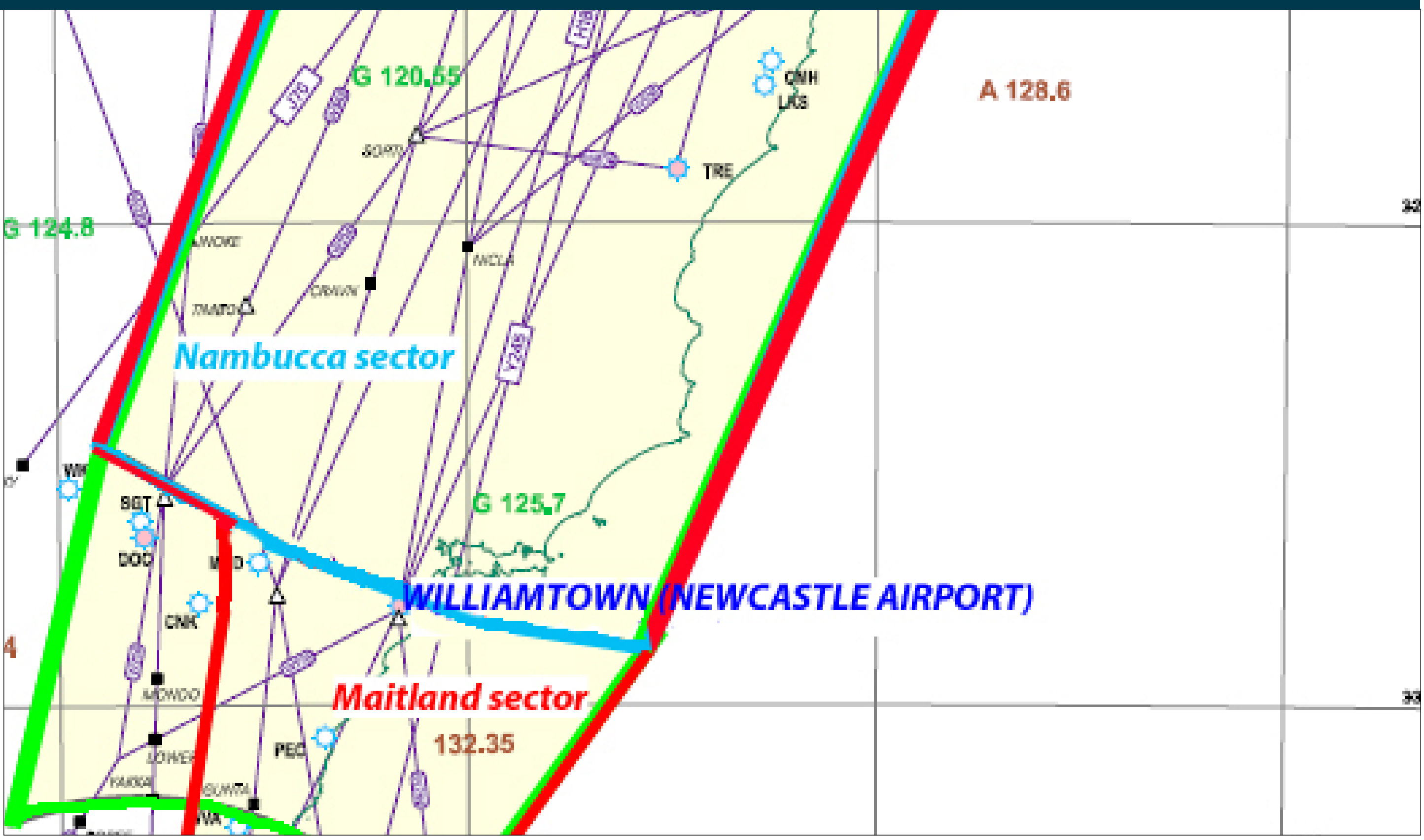
Australian Government
Australian Transport Safety Bureau

Loss of separation assurance involving Boeing 737-8BK VH-VUM

South of Williamtown to north of Grafton, New South Wales | 28 September 2012



Investigation

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Addendum

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Safety summary

What happened

On 28 September 2012, an en route air traffic controller acknowledged a Route Adherence Monitor (RAM) alert in respect of a Boeing Company 737-8BK aircraft, registered VH-VUM (VUM), on a scheduled passenger service between Sydney, New South Wales and Brisbane, Queensland. Believing that VUM was destined for Newcastle Airport under Department of Defence air traffic control jurisdiction, the controller erroneously inhibited the flight data record (FDR) for VUM. This action cancelled the RAM alert.

The inhibition of the FDR, in combination with the controller's altitude filter being set at a lower flight level than appropriate to the combined sectors under the controller's jurisdiction, meant that VUM's FDR registered as a 'not concerned' aircraft track. Subsequently, due to this 'not concerned' status, the controller did not see or interrogate VUM's FDR for the rest of the time it was under their jurisdiction. Similarly, the FDR did not attract the attention of two Inverell sector controllers after it entered and crossed their sector until they responded to a frequency change request from the flight crew of VUM.

There was no loss of separation with other aircraft for the resulting period that the aircraft operated without the active provision of ATC services and, during the course of the occurrence, two-way communications in controlled airspace remained available. However, maintenance of the minimum aircraft separation standards during this period was not assured. There was a loss of separation assurance.

What the ATSB found

High-reliability systems like air traffic control have many layers of controls to minimise risks associated with operational hazards. These controls were ineffective in this case as a result of a number of factors, including human perception and attention issues, the training of controllers with regard to 'not concerned' tracks, and the level of system protection against the potential impact of such tracks. Specifically, error-tolerant system designs that aid in the detection and recovery of inadvertently-inhibited tracks offer another defence against this type of occurrence.

Two safety issues were identified as a result of this investigation. The first relates to the provision of awareness training for en route controllers who are routinely exposed to 'not concerned' radar tracks, which can lead to a high level of expectancy that such tracks are not relevant for aircraft separation purposes. The second issue relates to the limited protections against a controller mistakenly inhibiting an aircraft and need for procedures to account for the limitations in the interoperability between the Australian Advanced Air Traffic System/Australian Defence Air Traffic System.

What's been done as a result

In response to the occurrence, Airservices has amended its air traffic controller ab-initio training exercises to include 'not concerned' track scenarios to ensure that training emphasised the importance of scanning 'not concerned' radar tracks. The scenarios will also be included in operational simulation training where appropriate. Furthermore, Airservices will use this occurrence to raise awareness of black tracks and the need to scan 'not concerned' tracks amongst its air traffic control staff.

In respect of equipment interoperability, Airservices and the Department of Defence are currently working towards implementing a harmonised joint civil military air traffic service system via the OneSky Program. Once implemented this system will increase air traffic management interoperability between both organisations.

Safety message

This occurrence highlights the fallibility of human attention/perception and the resulting risk of involved parties being 'primed' to the circumstances of an occurrence to the extent that they automatically (but incorrectly) perform actions that they perceived were correct. There is the potential for additional error-tolerant design improvements to complement existing air traffic system human machine interface risk controls to reduce the likelihood of such behaviour.

Humans can also experience difficulty detecting display targets that are subtle, unexpected and deemed of low information value. This occurrence showed a reduced awareness among controllers of the potential impact of black, 'not concerned' tracks in an en route airspace environment, which might be addressed by additional controller training or through an integrated air traffic management system.

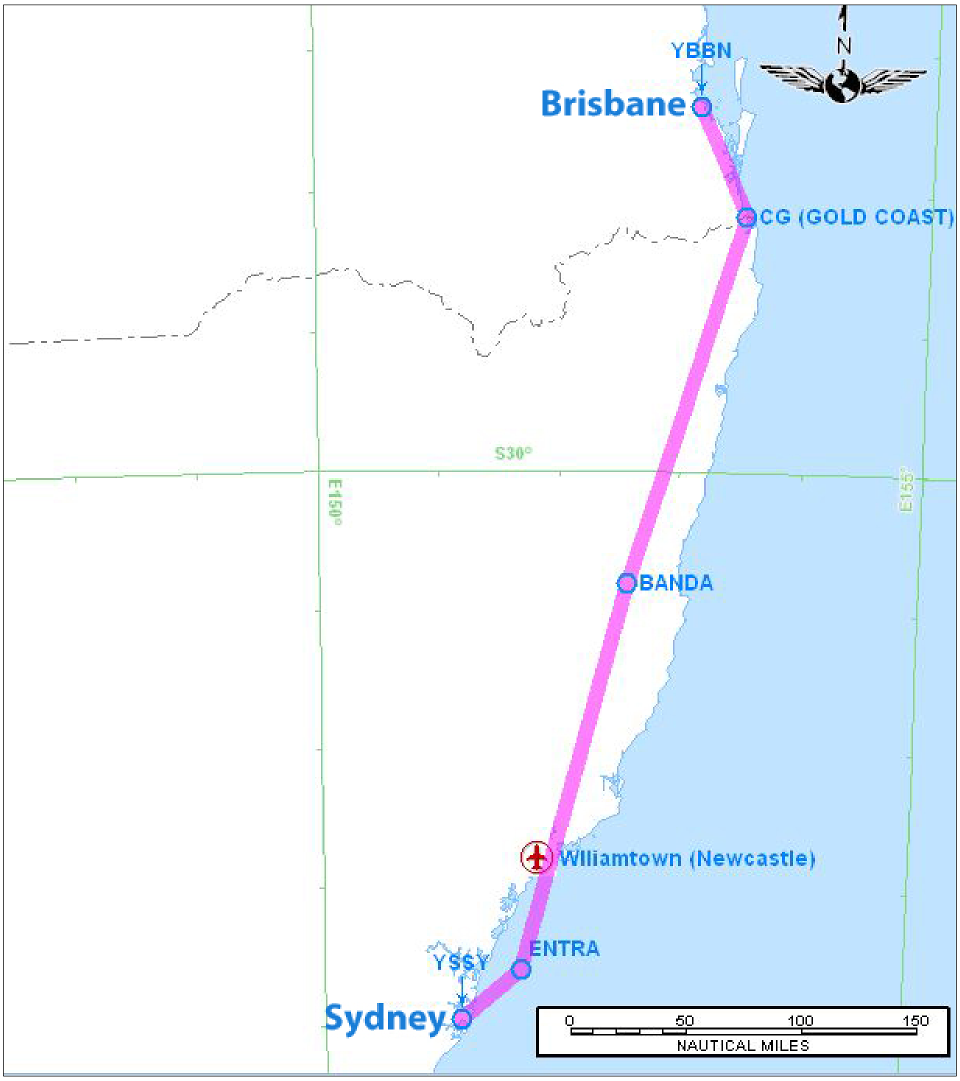
Contents

The occurrence

Departure from Sydney

On 28 September 2012, at 0751 Eastern Standard Time[1], a Boeing Company 737-8BK aircraft, registered VH-VUM (VUM), departed Sydney Airport, New South Wales (NSW) on a scheduled passenger service to Brisbane Airport, Queensland. The aircraft was flight planned to track via position ENTRA, to the north-east of Sydney, on climb to intermediate flight level (FL)[2] 280, before turning left and heading in a northerly direction towards Brisbane, cruising at FL 390 (Figure 1). All of the planned track was within air traffic control (ATC) radar coverage.

Figure 1: VH-VUM flight-planned track



Source: Jeppesen, modified by the ATSB

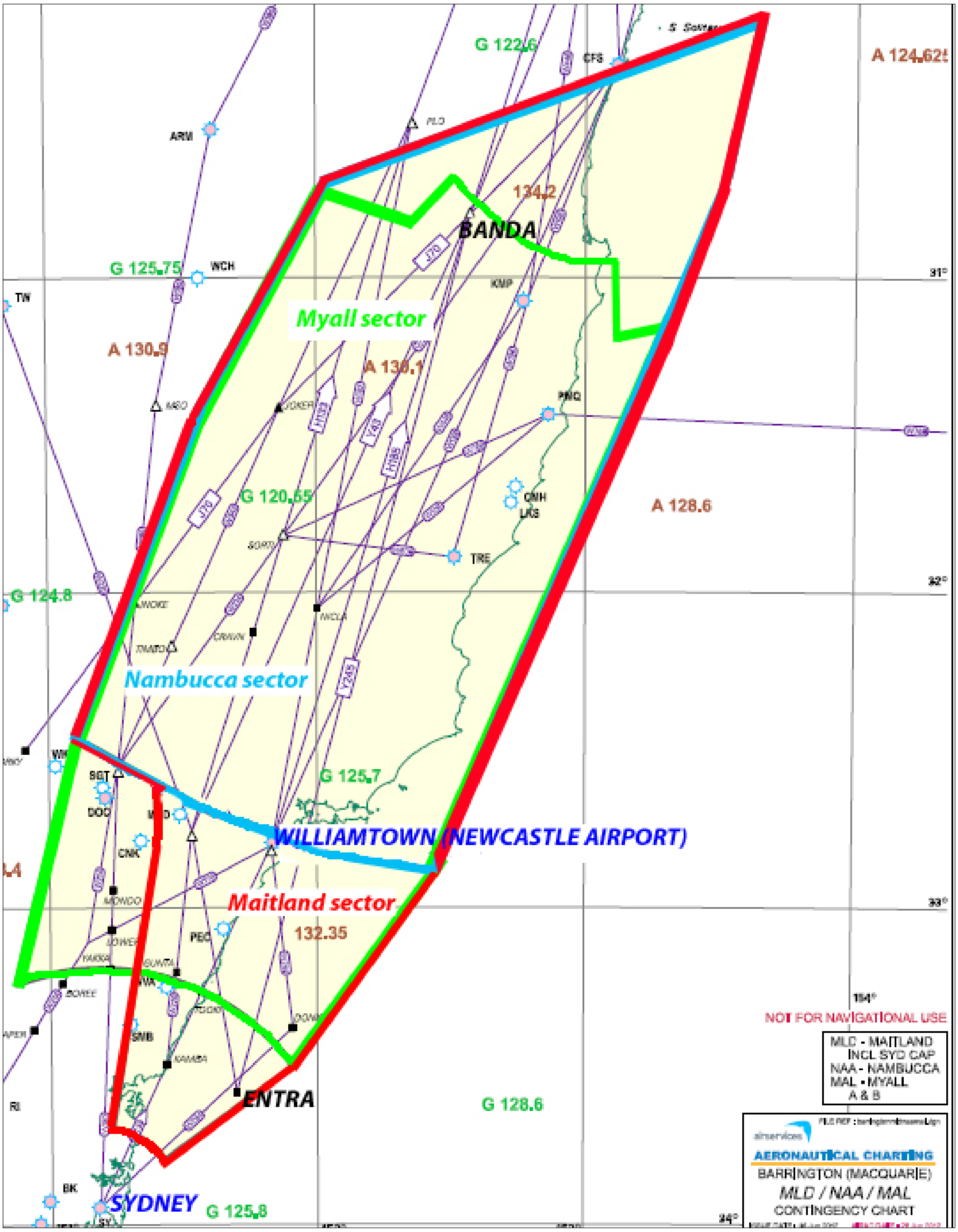
The provision of air traffic services for the flight was by Airservices Australia (Airservices) controllers. Soon after departing Sydney, the aircraft was in the Sydney Departures North (SDN) airspace. It then entered the Maitland (MLD), Nambucca (NAA), Inverell (INL) and Gold Coast

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

[2] At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 280 equates to 28,000 ft.

(GOL) sectors prior to commencing approach into Brisbane. MLD and NAA were within the Macquarie Group (Figure 2), which also included the Myall (MAL) sector, and INL and GOL were within the Byron Group to the north.

Figure 2: Macquarie Group airspace sectors

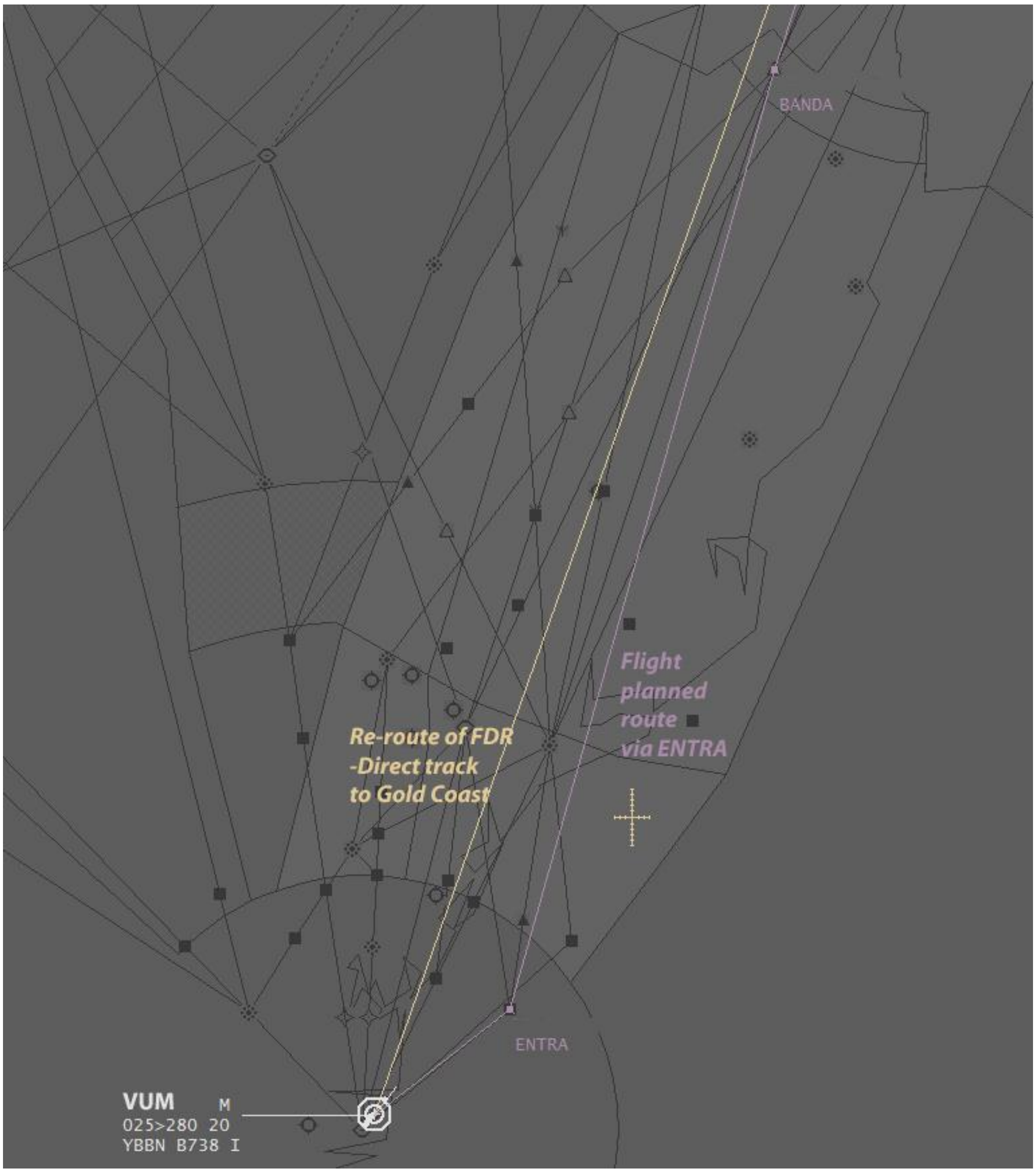


Source: Airservices Australia, modified by the ATSB

At the time of VUM's departure, the provision of air traffic services for the Macquarie Group was by two controllers at separate consoles using The Australian Advanced Air Traffic System (TAAATS). Controller 1 was responsible for the predominantly high-level airspace contained within the MLD and NAA sectors, which were combined onto one console. Positioned beside them was the MAL controller, who was responsible for the lower-level airspace.

At 0752:50, while VUM was still in Sydney airspace (Figure 3), Controller 1 changed the routing in the TAAATS flight data record (FDR) for the aircraft to show it tracking from its then position direct to the Gold Coast, in anticipation of the SDN controller issuing that tracking to the flight crew. This process, which was in accordance with documented coordination and standard operating procedures, facilitated an FDR update in the TAAATS en route partition to reflect the track shortening provided to aircraft departing Sydney and destined for Brisbane (see *Route Adherence Monitor* section for further information). The controller also added a 'C' prompt[3] to the aircraft's label[4] in TAAATS to show that there were no further coordination requirements for the aircraft.

Figure 3: Position of VUM at 0752:50



Source: Airservices Australia, modified by the ATSB

At 0755:30, the SDN controller cleared VUM's flight crew to track direct to the Gold Coast. The crew complied with this clearance soon after, taking the aircraft left of the flight-planned track to

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3 A Coordination or 'C' prompt is added to an aircraft's call sign label when all routine coordination relating to that aircraft is either completed or is not required. The prompt is removed from the display on completion of a successful jurisdiction transfer.

4 An aircraft 'label' (or Label Data Field) displays pertinent aircraft data for the controller's use, such as flight number, current altitude, final altitude, speed, destination, aircraft type and coordination information.

ENTRA and overhead Williamtown (Newcastle Airport),[5] NSW and position BANDA. VUM's final track was also to the right of the amended route in the FDR created by Controller 1 when the aircraft was still in Sydney airspace.

At that time, the aircraft was still in the SDN controller's jurisdiction, and was displayed with a green 'jurisdiction' track and label on that controller's air situation display (ASD). In addition, as VUM would enter the high-level airspace for which Controller 1 was responsible, TAAATS provided a blue 'announced' track symbol and label for the aircraft on Controller 1's ASD.

In contrast, as the aircraft would not enter the lower-level MAL airspace, a black 'not concerned' track was displayed on that controller's ASD. Moreover, as the altitude filter was set on that console to only display traffic at FL 145 and below, the associated black-label details for VUM would not have been displayed to the MAL controller.

At 0756:40, Controller 1 conducted a radar handoff to Department of Defence (DoD) controllers at Williamtown of two other passenger aircraft (an Airbus A320 and a turboprop) that were inbound to Newcastle Airport. The aircraft were transferred to Williamtown ATC shortly after. As part of this process, the controller added a 'C' prompt to the label for those aircraft to show that the coordination requirements were complete.

Combination of the Macquarie Group sectors

Combination of the sectors

At 0758:04, the MAL controller commenced a handover/takeover of control jurisdiction for the MAL sector to another controller (Controller 2), which was completed at 0758:45. Controller 2 assumed responsibility for the MAL sector and started to prepare for the transfer of the MLD and NAA sectors from Controller 1 to that console. This would result in all Macquarie Group sectors being under the jurisdiction of Controller 2.

The combining of sectors was commenced as the traffic levels were considered suitable for one controller to manage, and to facilitate rest and meal breaks for the controllers being relieved. As the altitude filter was still set on Controller 2's console for MAL, they used the 'Quicklook All' function in TAAATS to override the filter and display all traffic and associated labels within the ASD range, including for VUM, which was still in SDN airspace.

At 0758:38, the SDN controller instructed VUM's flight crew to transfer to one of Controller 1's frequencies. The flight crew acknowledged the instruction before contacting Controller 1, who assigned the crew further climb to FL 390, in accordance with the flight plan, and then updated the FDR. At that time, VUM was displayed as a jurisdiction track on Controller 1's ASD and a 'not concerned' track on Controller 2's ASD with an associated black label attached.

At 0758:48, Controller 1 inhibited the TAAATS FDRs for the A320 and turboprop passenger aircraft that were inbound to Newcastle Airport. These aircraft were now under the jurisdiction of the DoD ATC unit at Williamtown, which was not TAAATS-equipped. The inhibition function in TAAATS enabled Airservices controllers to inhibit the display of track and flight plan data, thereby reducing screen clutter resulting from flights that were no longer receiving air traffic services from these controllers.

Macquarie Group Local Instructions required FDRs for all aircraft landing at Newcastle Airport to be inhibited after the aircraft were established in Williamtown airspace. The colour of inhibited aircraft's tracks and labels changed to black and their cleared flight level was removed from the respective label. In addition to inhibiting the two aircraft, Controller 1 also removed the associated 'C' prompts, consistent with standard procedures for aircraft that had been transferred to another jurisdiction.

5 Williamtown is known as Newcastle Airport for scheduled passenger flights.

Handover of the MLD and NAA sectors to Controller 2

At 0800, Controller 1 initiated a handover of the high-level MLD and NAA sectors to Controller 2, who was combining all of the Macquarie Group sectors onto their MAL console. The combination of the high-level MLD/NAA sectors with the low-level MAL sector required the altitude filter on Controller 2's console to be reset to '999' to display aircraft at all altitudes. However, Controller 2 inadvertently omitted making this selection and the altitude filter remained set at FL 145. Because the 'Quicklook All' function was still on, all aircraft were still being displayed with their associated labels.

The handover/takeover included information on the position and assigned flight level of VUM, which was verbally acknowledged by Controller 2, and confirmation that the two passenger aircraft inbound to Newcastle Airport had been transferred to DoD ATC. At Controller 1's request, the Systems Supervisor transferred the MLD and NAA sectors and frequencies to Controller 2's console and as a result, VUM appeared as a jurisdiction track on Controller 2's ASD about 40 NM (74.1 km) north of Sydney, passing FL 201 on climb. The aircraft's direct track from that position to the Gold Coast took it directly overhead Williamtown.

During the handover/takeover, Controller 2 added a 'C' prompt on their console for several aircraft in the MLD/NAA sectors. This was necessary because 'C' prompts only applied to a specific console and did not transfer when a sector was transferred from one console to another. Accordingly, Controller 2 added a 'C' prompt for VUM at 0759:50. They also inadvertently added a 'C' prompt for the A320 that had already been transferred to DoD ATC at Williamtown. The A320's 'C' prompt was cancelled by Controller 2 at 0801.00.

Controller 2 verbally logged their acceptance of responsibility for the combined sectors at 0801:31 and commenced re-checking their traffic and console settings.

Inhibition of VUM's flight data record and loss of separation assurance

At 0801:48, about 17 seconds after Controller 2 verbally logged their acceptance of responsibility for the combined sectors, a Route Adherence Monitor (RAM) alert activated for VUM, drawing the controller's attention to the aircraft. The alert activated because the aircraft's track was not within the limits of the amended route in the aircraft's FDR set by Controller 1 at 0752:50. Such alerts were not uncommon, also occurring in situations where an aircraft had been transferred to DoD ATC Williamtown but had not yet been inhibited in TAAATS. In either case, this required the affected controller to amend the route again to clear the RAM.

Controller 2 immediately acknowledged the alert and, instead of amending the route, inhibited VUM's FDR using an available keyboard short cut. This resulted in VUM being displayed on Controller 2's ASD with an 'inhibited' black track and a limited label (without the cleared flight level) and the RAM alert being disabled.

Controller 2 later reported that they had observed VUM's position on receipt of the RAM and considered it to be that of an aircraft tracking for Newcastle Airport. Accordingly, the controller assumed that it was a Williamtown arrival and inhibited the FDR as required by Macquarie Group Local Instructions for such an arrival. They did not check the aircraft's call sign or other details prior to inhibiting the FDR. Following the inhibition, the controller removed the 'C' prompt from VUM's label on their ASD to reflect the aircraft's transfer to another jurisdiction (DoD ATC Williamtown).

There was a loss of separation assurance (LOSA)[6] when VUM's FDR was inhibited as there was no longer any assurance that ATC would positively separate VUM from other aircraft in controlled airspace. Controller separation plans would not consider VUM from that point, and no surveillance

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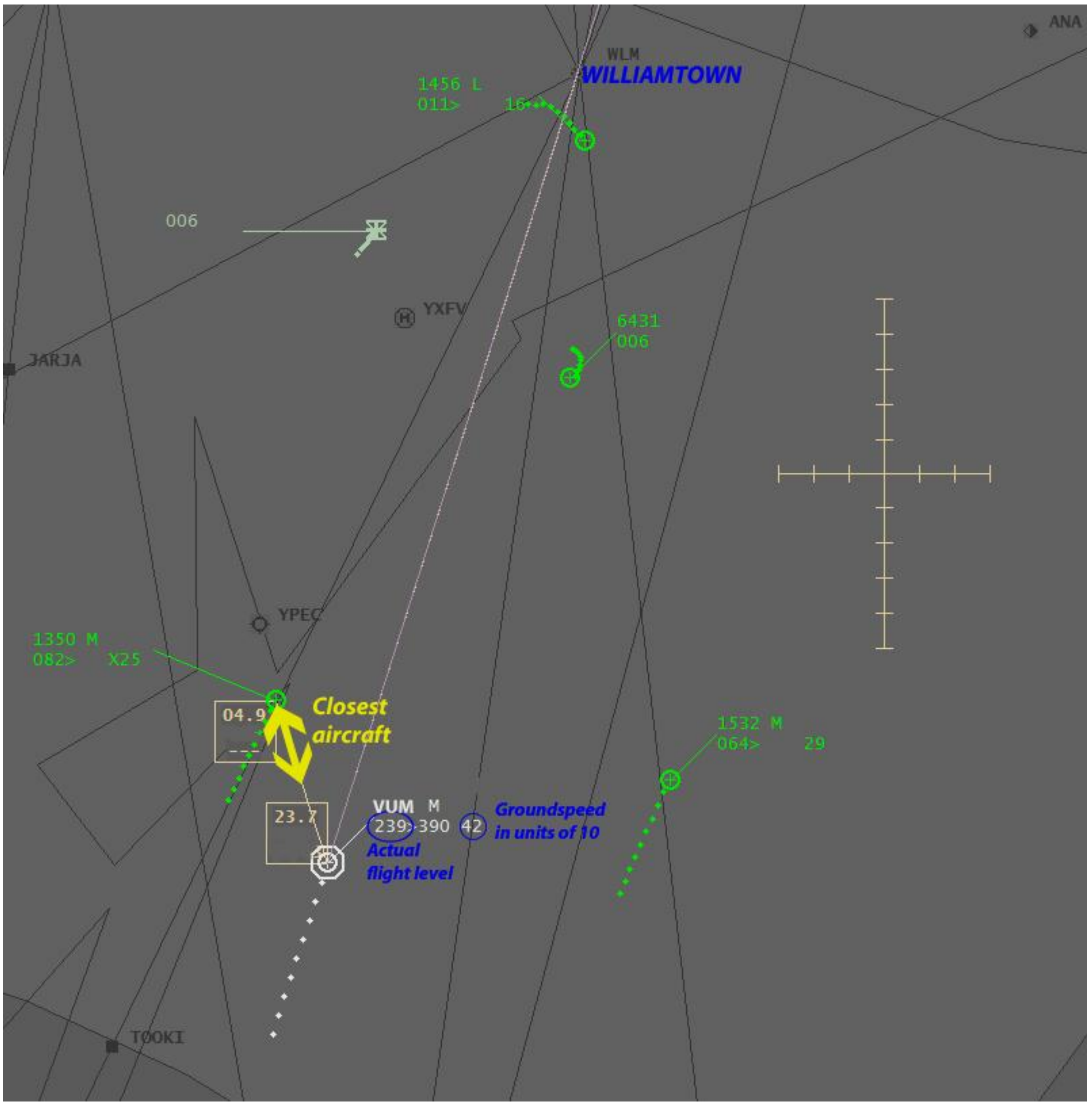
6 Loss of separation assurance describes a situation where a separation standard existed but planned separation was not provided or separation was inappropriately or inadequately planned.

control service was being provided to the flight crew. At the time, VUM was 23.7 NM (43.9 km) south of Newcastle Airport, passing FL 239 on climb with a ground speed of 420 kt. The nearest aircraft to VUM was the previously-inhibited turboprop aircraft about 4.9 NM (9 km) to the north-west and 15,700 ft below, with a ground speed of 250 kt (Figure 4).

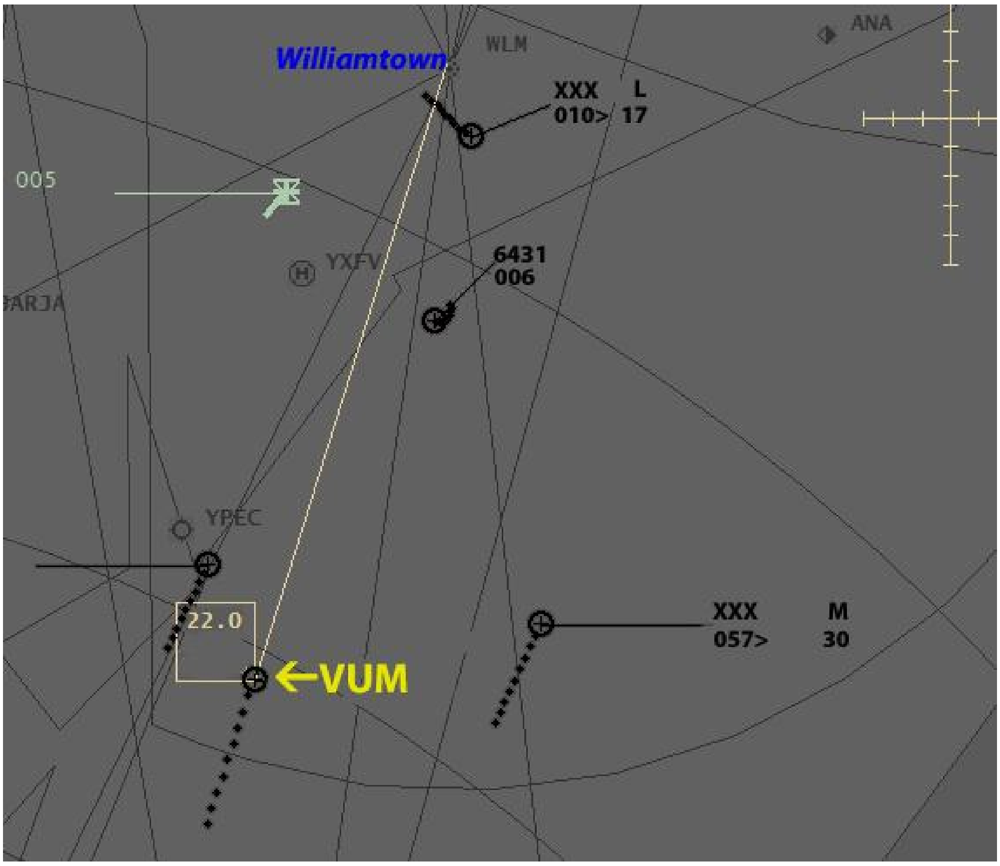
Figure 4: Position of VUM at the commencement of the LOSA (at 0801:50)



Source: Airservices Australia, modified by the ATSB

About 14 seconds after inhibiting VUM (0802:04), Controller 2 deselected the ‘Quicklook All’ function on their console, which was initially selected by Controller 1 prior to the handover/takeover to Controller 2 of the MLD and NAA sectors. De-selection of that function meant that the console altitude filter that was earlier incorrectly set at FL 145 was no longer overridden and only labels of uninhibited aircraft operating at or below FL145 remained displayed. As VUM was established above that level, its label was removed from Controller 2’s ASD, leaving only a black ‘not concerned’ track symbol. At that time, four other inhibited, black ‘not concerned’ track symbols were also displayed on Controller 2’s ASD, including the tracks for the A320 and turboprop aircraft that were inbound to Williamtown (Figure 5).

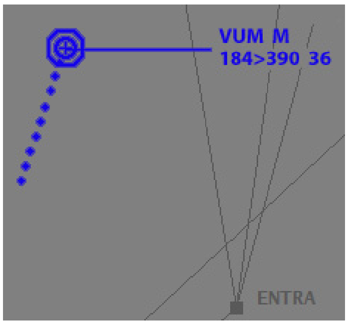
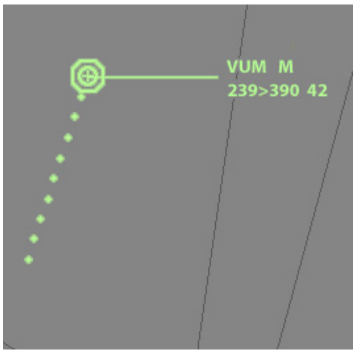
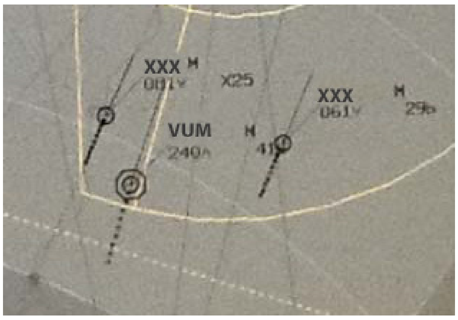
Figure 5: Position and display on de-selection of the 'Quicklook All' function (at 0802:04)



Source: Airservices Australia, modified by the ATSB

At 0812:47, Controller 2 reset the console altitude filter to display all levels and the black label for VUM (without the cleared flight level) was again displayed with the black 'not concerned' track symbol on their ASD. At that time, VUM was 63.1 NM (116.9 km) north of Williamtown and 62.3 NM (115.4 km) south of position BANDA, climbing through FL 378 with a ground speed of 510 kt (Figure 6). Up until this time the controller had not recognised that the aircraft was still in their airspace. Table 1 shows how each of the FDRs would have looked to the controller on Controller 1 and Controller 2's ASD at the time of the controller actions.

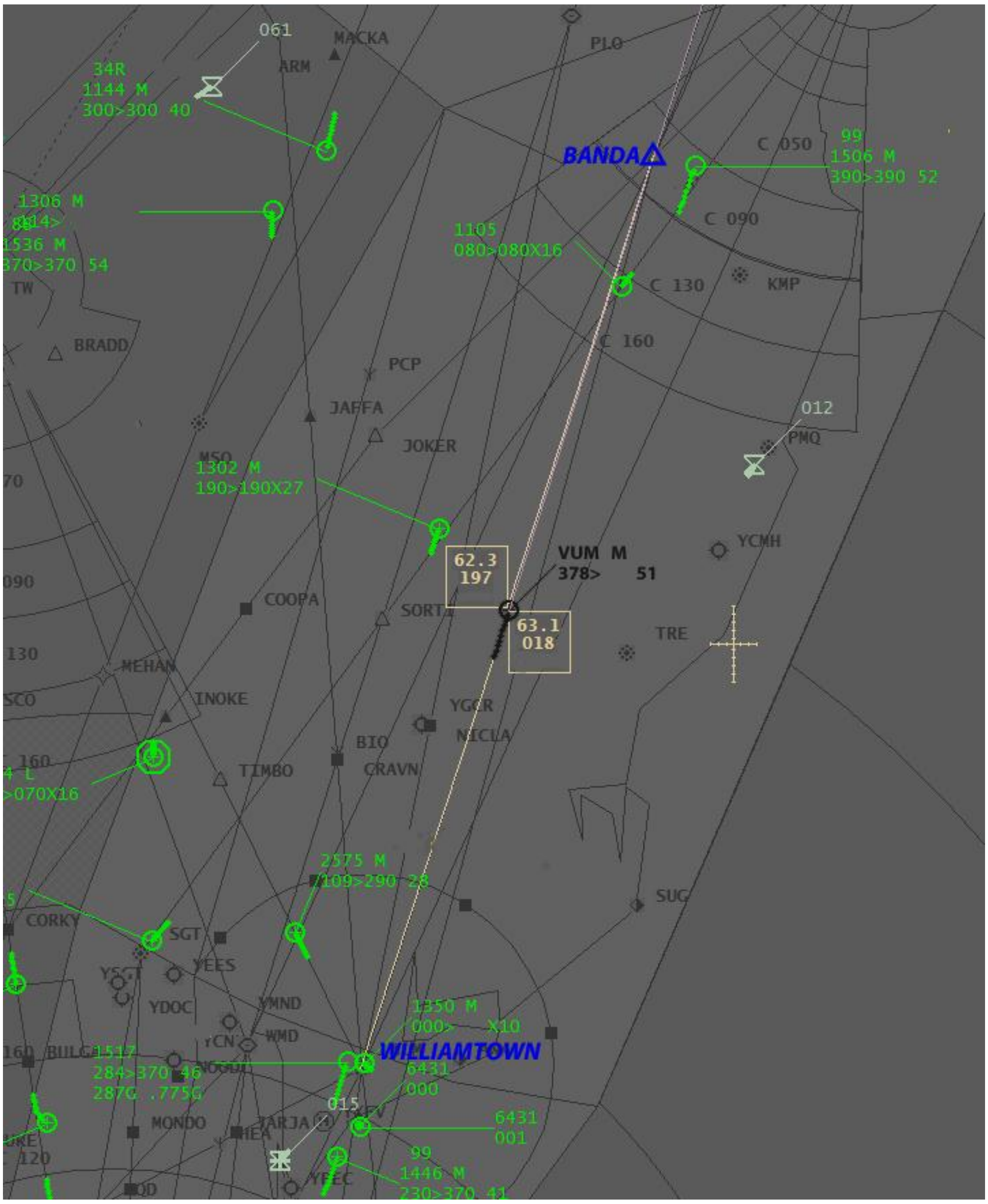
Table 1: Representations of the human machine interface display states at relevant times/activities

Time/activity	Track descriptor	HMI display[7]
0759:16 VUM's FDR as displayed on Controller 1's ASD controlling MLD and NAA sectors	Announced Track	
0801:31 Controller 2 verbally logs acceptance of responsibility for the combined MLD, NAA and MAL sectors	Jurisdiction Track	
0801:48 Controller 2 inhibits the FDR for VUM	Inhibited Tracks	

Source: Airservices Australia, modified by the ATSB

[7] Original images taken from the recorded TAAATS data of the occurrence.

Figure 6: Position and display of VUM (in black) at 0812:47



Source: Airservices Australia, modified by the ATSB

At about 0822:38, VUM departed the Macquarie Group airspace and entered the Byron Group's Inverell (INL) sector, which was under the jurisdiction of Controller 3. As the FDR for VUM was inhibited, the usual automatic system processing of the FDR and subsequent handoff and frequency transfer between controllers did not occur and the aircraft continued through the INL sector on Controller 2's frequency.

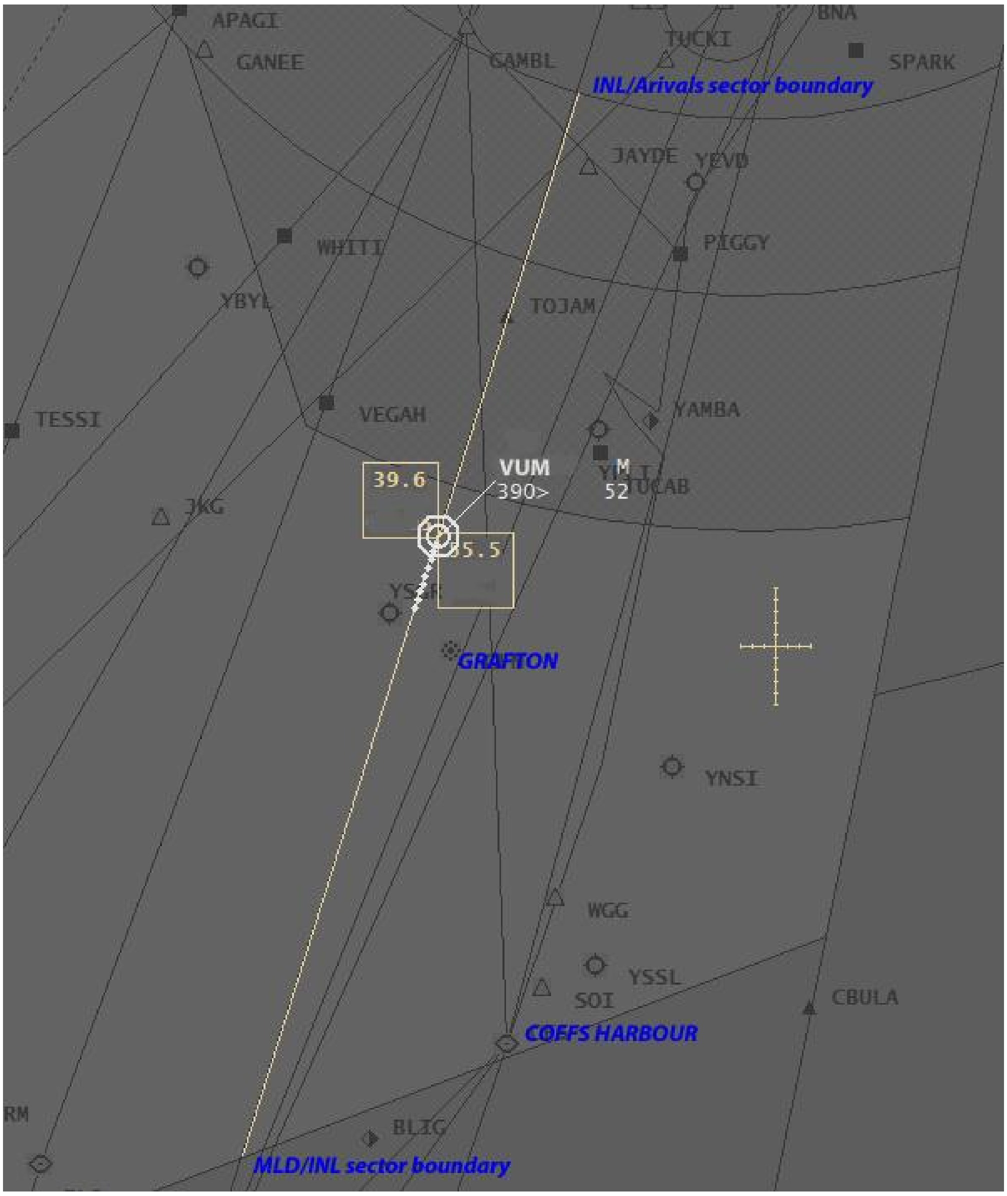
At 0826:25, a handover/takeover of the INL sector was conducted between Controller 3 and the subsequent Controller 4. Neither of these controllers detected that the aircraft, which had continued on track within the INL sector by about 33 NM (61.1 km), was in their airspace during their handover/takeover.

Identification of the inhibition of VUM's FDR

At 0828:58, VUM's flight crew made a transmission to Controller 2 querying if there was a frequency change applicable for them. After a brief pause, Controller 2 instructed the flight crew to transfer to Controller 4's frequency for the INL sector. At that time, VUM was about 55.5 NM

(102.8 km) north of the INL sector boundary and 39.6 NM (73.3 km) south of the northern arrivals sector boundary, maintaining FL 390, and had a ground speed of 520 kt (Figure 7).

Figure 7: Position of VUM at 0828:58



Source: Airservices Australia, modified by the ATSB

On receipt of the flight crew's initial transmission, Controller 4 scanned the green-coloured jurisdiction tracks on their ASD. As none of those tracks represented VUM, the controller advised the crew that they were on the incorrect frequency and instructed them to return to the previous frequency. An intercom exchange followed between Controller 2 and Controller 4, during which Controller 2 advised that VUM could be the aircraft located north of Coffs Harbour, which was within INL airspace. In the meantime, the flight crew called Controller 2 again, advising that they had been instructed to return to their frequency and requesting descent and a Standard Arrival Route Clearance for Brisbane.

At 0830:05, Controller 2 accepted jurisdiction for VUM in TAAATS, cancelling the inhibition of the aircraft's FDR and restoring normal processing and track display. At 0830:14, Controller 2 asked VUM's flight crew to advise their position, which was reported as 135 NM (250 km) from Brisbane at FL 390 (within the INL airspace). Over the intercom, Controller 4 agreed to accept VUM on their frequency and the two controllers expressed confusion to one another regarding the situation.

Controller 2 instructed the flight crew to return to the INL sector frequency and Controller 4 accepted jurisdiction of the aircraft track. The remainder of the flight was processed as normal and the LOSA was resolved.

VUM had operated in controlled airspace without the active provision of ATC services for about 27 minutes and over a distance of 225 NM (416.7 km). There was no loss of separation with other aircraft during this period and two-way communications remained available in controlled airspace. If the aircraft initiated communications (that is declared an emergency) the controllers would still have been able to respond to any requests from the crew.

Context

Personnel information

Controller 2

Controller 2 commenced air traffic control (ATC) en route training at the Airservices Australia (Airservices) Learning Academy in August 2007. In August 2008, Controller 2 commenced final field training on the Macquarie Group Maitland (MLD) and Nambucca (NAA) sectors, achieving their en route radar control ratings and endorsements for these sectors on 10 March 2010. After a period of about 2.5 years, they commenced training on the Myall (MAL) sector and were endorsed on that sector on 5 November 2011. As a result of holding these three endorsements, Controller 2 became a fully–endorsed Macquarie Group controller.

Controller 2 had two rostered days off immediately prior to the day of the occurrence and commenced duty at 0530 that day for an 8-hour shift. They reported being fit for duty on the day of the occurrence. No fatigue issues were identified following analysis of the controller's roster and reported sleep gained in the days leading up to 28 September 2012.

After a period that morning of controlling all of the Macquarie Group sectors, which were combined onto the MAL console, Controller 2 had a break, returning just prior to 0800. During their break, the MLD and NAA sectors were split off onto the adjoining console, under the jurisdiction of Controller 1. That de-combining of the sectors was normal practice on weekdays when Department of Defence (DoD) Williamtown ATC was active, and meant that Controller 2 initially resumed jurisdiction of the MAL sector only.

Controller 2 was aware that, following the handover/takeover for the MAL sector, they could expect the MLD and NAA sectors to be combined back onto the MAL console at some time during their shift. This depended on traffic levels being considered suitable for one controller to manage. They rated their workload after the subsequent re-combination that day as being about mid intensity.

Controller 3

Controller 3 commenced training at the Airservices Learning Academy early in 2010. In March 2011, the controller commenced final field training on the INL sector and achieved their first ATC endorsement on that sector on 5 July 2011. At the time of the occurrence, Controller 3 was undergoing training for endorsement on the Gold Coast (GOL) sector, which was the airspace located to the north of INL. The controller reported that during their GOL training period, which incorporated the period 6 to 29 September 2012, they were also working as an INL controller. This was reported to usually entail working the combined INL and GOL sectors under training.

The controller had not logged any duty hours on the de-combined INL position in August 2012. However, a period of 5 hours, which was the required number of hours each month to maintain recency on a sector, was completed on the INL position on 23 September 2012. Those were the first hours logged by the controller in the INL sector for the month. The controller next logged INL duty time on the day of the occurrence.

On 28 September 2012, Controller 3 was on a morning shift that commenced at 0545, following two rostered days off. They reported spending the majority of the shift training on GOL. However, when VUM entered the INL sector, Controller 3 was responsible for INL only and as such, were not, nor were required to be, under the supervision of an on-the-job training instructor. They reported that their workload was low during the period in which they were working on INL and at the time of the handover of VUM to Controller 4. No fatigue issues were identified following analysis of Controller 3's roster.

Controller 3 reported that they did not observe the inhibited track of VUM while INL was under their jurisdiction. They also did not recall seeing VUM in the Maestro traffic flow management system and considered that they would not have expected the aircraft to appear in the system as its FDR had been inhibited.

Controller 4

Controller 4 graduated from the Airservices Learning Academy around June 2012 and commenced the simulator component of the INL sector training course around July 2012. The controller received their INL endorsement 18 days before the occurrence, on 10 September 2012 and had completed 12 shifts as an endorsed controller prior to the occurrence.

Controller 4 completed an additional duty morning shift on 26 September and a rostered morning shift on 27 September 2012. On the day of the occurrence, Controller 4 was on a morning shift that commenced at 0630. No fatigue issues were identified following analysis of Controller 4's roster.

The handover/takeover with Controller 3 was reported by Controller 4 as comprehensive. The standardised checklist was reported followed but neither controller observed the black inhibited track and label for VUM.

Controller 4 reported that black tracks did not normally form part of their scan of the ASD as there was routinely traffic in the airspace sector below that was displayed as black tracks to the INL sector controller. The controller filtered such tracks from their scan as they were not in their airspace and therefore not of concern to them.

Air traffic control information

The Australian Advanced Air Traffic System human machine interface

The Australian Advanced Air Traffic System (TAAATS) human machine interface (HMI) supports the accomplishment of tasks being undertaken within the air traffic computer system. In the case of operations involving a DoD, non-TAAATS equipped unit, the indications in the air traffic computer system that coordination and handoff requirements have been completed are an integral situation awareness tool for controllers.

In that regard, TAAATS provided a number of methods for controllers to record information specific to an aircraft's operation and determine how that information was displayed on their ASD. A number of these methods, capabilities and alerts are discussed in the following sub-sections.

Console set-up

The Airservices National ATS (air traffic services) Procedures Manual (NAPM) documented the procedures for combining and de-combining TAAATS positions. The second step, after the relinquishing controller briefed the assuming controller, was for the assuming controller to 'adjust displays/maps to accommodate new airspace volume prior to assuming responsibility'. That requirement included checking and adjusting, as required, the altitude filters on the assuming controller's console.

Use of the 'C' prompt

Macquarie Group controllers were required to use a 'Coordination Prompt' (or 'C' prompt) on the aircraft's call sign label in TAAATS to indicate when coordination requirements were completed. In this case, the prompt also served as a reminder to coordinate inbound aircraft with DoD ATC Williamtown. A 'C' prompt on an aircraft's label would only be displayed on the ASD at the local console and was not visible to other controllers or on other ASDs.

Route Adherence Monitor

A Route Adherence Monitor (RAM) alerted controllers when an aircraft that was being provided with ATC surveillance services, and was associated with a coupled flight data record (FDR), deviated from the flight route held in the system for the aircraft.

The parameters for the activation of a RAM alert included an aircraft passing outside a radius of 8 NM (14.8 km) from a defined point and/or a width of 15 NM (27.8 km) from published and unpublished route corridors.

The Letter of Agreement between the Sydney Terminal Control Unit (TCU) and the Macquarie Group defined the direct tracking routes that Sydney Departures could issue to aircraft entering Macquarie Group sectors, including direct to the Gold Coast for aircraft with a destination of Brisbane. Airservices reported that the Maitland controller would affect the reroute of the associated FDR as soon as the aircraft was observed to be tracking direct to the Gold Coast, to aid with workload and situation awareness and to maintain the integrity of the FDR by reflecting the aircraft identity and subsequent clearance. In addition, it was reported that a delay in rerouting the FDR would affect the accuracy of the TAAATS assessment tools for the en route partition between Sydney TCU and the Macquarie Group, such as the time of passing function. The documentation did not specify when the Maitland controller should conduct the rerouting of the FDR.

Airservices reported that if the Maitland controller did not affect a reroute until the system handoff of jurisdiction, it was not uncommon for the FDR to generate a RAM through the limited cross boundary messaging between the Melbourne Flight Data Region (FDRG) TAAATS processors, which provided services for the Sydney TCU, and the Brisbane FDRG TAAATS processors, which provided services for the Macquarie Group.

Inhibition function

The TAAATS inhibition function was a feature that enabled controllers to change the display state and processing of FDRs for aircraft that were no longer under a controller's jurisdiction. When an FDR was inhibited, some system processing continued to occur but the flight data was not displayed to the controller. The flight progress strip was deleted and, for aircraft operating within surveillance coverage and within the altitude filters set at the controller's console, the aircraft's track, 'tail' of nine history dots and label were displayed in black, with the cleared flight level removed from the label. The track would not automatically hand-off between airspace sectors and it was not included in some TAAATS alert functions, including RAM. Once an FDR was inhibited, its state could still be changed as required.

When an aircraft was operating within surveillance coverage but at an altitude outside those displayed on a TAAATS console, whether inhibited or not, only a black track and a 'tail' of nine black history dots would be displayed. Such tracks were termed 'not-concerned' tracks but referred to colloquially by controllers as black tracks. Controller 2 reported that it was normal for a controller in a low-level airspace sector such as MAL to see multiple black tracks for aircraft operating outside that airspace volume.

The NAPM allowed controllers to inhibit an FDR provided that:

a. the aircraft is no longer receiving a traffic service from a TAAATS sector or unit

b. the controller inhibiting the track does not anticipate any further involvement with the aircraft

c. inhibiting the FDR has no adverse effect on the situation awareness of another TAAATS Controller.

In addition, NAPM stated:

> Do not inhibit a track eligible for inhibition until it has left the area of responsibility of the inhibiting sector or unit and the aircraft has transferred to the next frequency.

Macquarie Group Local Instructions for arrivals at Newcastle Airport required controllers to clear the aircraft's label data field in TAAATS and then inhibit the FDR after the aircraft was established within Williamtown airspace. The intent was for this to enhance controller situation awareness and reduce ASD clutter.

In addition, if FDRs for aircraft operating into Williamtown were not inhibited, TAAATS would continue to process those aircraft's FDRs. As a result, alerts, such as RAMs, would result at Macquarie Group consoles when DoD Williamtown ATC changed the tracking of those aircraft once under their jurisdiction. Such nuisance alerts had the potential to distract Macquarie Group controllers. A similar procedure was in place within the Byron Group when coordinating inbound aircraft with DoD ATC at Amberley in Queensland.

An FDR can be inhibited manually by either using a keyboard short cut or by a second, somewhat more involved procedure. A flight can similarly be manually de-inhibited to re-enable control and display the aircraft's label and flight data.

Controllers are also able to display a list of inhibited aircraft at each control position by selecting the 'Inhibited Window'. There was no documented requirement for the Macquarie or Byron Group controllers to display this window and it was not used by Controllers 2, 3 or 4 on 28 September 2012.

MAESTRO system

A sequencing tool was available in TAAATS to assist controllers sequence arriving aircraft at some major capital city airports. Termed MAESTRO, this system calculated the optimum arrival time at affected runway threshold(s) for each aircraft in the arrival sequence onto single or multiple runways. MAESTRO then generated and displayed the sequence to affected control positions.

An inhibited aircraft could be processed by the available traffic flow management facilities, including MAESTRO, if its destination airport was linked to the MAESTRO system. In the case of VUM, when the FDR was inhibited, the aircraft still appeared in the MAESTRO window on the INL sector controller's ASD as part of the arrival sequence into Brisbane via the Gold Coast.

Short Term Conflict Alert

The Short Term Conflict Alert (STCA) function determined all of the surveillance track pairs that were deemed by the system to be separated by less than the minimum air traffic separation requirements and alerted the respective controller. The alerts were computed using a three-dimensional forecast and, in en route airspace, activated when separation reduced below 4.1 NM (7.6 km). A STCA alert provided for a controller warning time of 60 seconds.

An inhibited surveillance track, with a coupled flight plan that was in an inhibited state, became a 'target track' in TAAATS and remained eligible for STCA processing under certain conditions. In the case of VUM, STCA processing was in place for the duration of its flight, both when under controller jurisdiction and when it was inhibited.

Airspace

Macquarie Group

The Macquarie Group was part of the East Coast Services North airspace and comprised the MLD, NAA and MAL sectors (Figure 2).

The Macquarie Group Local Instructions detailed the default settings in TAAATS for each sector, including the altitude/level settings. The default display levels for MAL were from the surface to FL145 and from the surface to '999' for MLD, which would display all altitudes. An aircraft's label setting could be selected as:

- 'normal', to show the aircraft's call sign, assigned and actual altitudes and ground speed
- 'extended', to also display the aircraft's type, destination and category.

No specific label setting was stipulated in the local instructions.

The local instructions also contained a standard handover/takeover checklist for use by Macquarie Group controllers. That checklist required that ‘facilities/frequencies/equipment’ be covered during a handover/takeover and inferred that both external operational facilities and equipment, such as airports and radars, and local physical facilities and equipment, such as the console and display settings, be considered.

Williamtown

The primary function of the airport facility at Williamtown was as a military base. The DoD facilitated the use by a number of civil aviation operators of the civil terminal and associated facilities, which was known as Newcastle Airport.

The DoD was responsible for the provision of air traffic control services to all aircraft in DoD Williamtown airspace. The ATC computer system used by DoD Williamtown ATC in support of these services was the Australian Defence Air Traffic System (ADATS). TAAATS and ADATS were not integrated and operated as ‘stand-alone’ systems.

The standard assignable level for Macquarie Group controllers to assign aircraft on descent into Williamtown was 9,000 ft, which had to be verbally coordinated with the military controllers.

Inverell sector

Inverell (INL) was a high-level sector in the Byron Group, which was part of the East Coast Services North airspace. The INL control position was mainly responsible for providing air traffic services to aircraft operating between major airports such as Brisbane and Sydney. Arrival services were also provided into the Brisbane and Gold Coast Airports, including the issue of standard arrival route clearances for those arrivals as required.

Controller training

Group simulator training

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

Each group had a number of group training specialists (GTS), who were responsible for the provision of the theory and simulator components of ab initio, endorsement, ongoing, remedial and some refresher training modules. GTSs also maintained their group’s training documentation. The positions were often rotated amongst suitably-qualified group controllers. While the position had previously been staffed as a full-time position for 6-month periods on a rotational basis, at the time of the occurrence, the Byron GTS role was filled on an as required basis.

It was reported that the simulator training courses for the Byron Group required significant updating as they had not been substantially changed for 10 years due to resource limitations. The calibre of trainee from the Learning Academy was reported to have not changed. However, the job requirements were believed to have become more complex and it was considered by some that operational simulator training needed to be improved to meet the level of job complexity.

Flight data record inhibition

A review of the training syllabus from the Airservices Learning Academy determined that trainees were not specifically instructed to scan for ‘not concerned’ tracks. The aim at that stage of a controller’s training was to teach basic ATC practices and processes.

Similarly, there was no requirement in final field training for the high-level airspace sectors of INL or Gold Coast (GOL) to consider ‘not concerned’ tracks as part of their scan. Moreover, during a controller’s simulator training, the consideration of ‘not concerned’ tracks was only covered in the context of providing traffic information for aircraft operations at a non-controlled aerodrome and outside controlled airspace. The controllers interviewed for this investigation stated that they could not recall any other training involving black 'not concerned' tracks and only one could recall training in the non-controlled aerodrome/airspace context.

At the time of this occurrence, the Byron Group lesson plans for the INL and GOL simulator training programs were maintained by the group. There was a feeling in this group that possibly the simulator training courses could incorporate appropriate training in respect of 'not concerned' tracks and the inhibition function; however, they would need to be properly designed and implemented to get the same training effect across the trainee cohort.

Related occurrence

Loss of separation at Darwin Airport, Northern Territory on 2 October 2012[8]

At 1345 Central Standard Time[9] on 2 October 2012, a loss of separation occurred between a Boeing 717 aircraft, registered VH-NXQ (NXQ), operating a scheduled passenger service from Alice Springs to Darwin, Northern Territory, and a Boeing 737, registered VH-VXM (VXM), operating a scheduled passenger service from Darwin to Melbourne, Victoria. The aircraft were under the jurisdiction of DoD ATC at the time of the occurrence.

The traffic confliction was detected by NXQ's flight crew and they did not initiate their descent from 10,000 ft. Concurrent with the activation of an Australian Defence Air Traffic System (ADATS) predicated conflict alert, the Approach Supervisor identified the conflict and directed the controller to commence separation recovery procedures. The controller instructed VXM's flight crew to stop their climb at 9,000 ft. At that stage the aircraft was displaying 8,400 ft on the controller's display and climbing. NXQ's flight crew advised the controller of conflicting traffic below them and the controller instructed them to stop descent.

Separation between the aircraft reduced to about 900 ft vertically as NXQ passed directly overhead VXM on a crossing track. The required separation standards were either 1,000 ft vertical separation or 3 NM (5.56 km) radar separation.

The ATSB determined that the call sign label for NXQ was assigned to another aircraft in ADATS and displayed on the controller's radar display. The other aircraft was overflying Darwin and not on that controller's frequency, or under their jurisdiction. The actual radar return for NXQ was displayed on the controller's display as an unlabelled track and not observed by Darwin Approach personnel until the activation of the predicated conflict alert.

A number of safety issues were identified by the ATSB, including system and equipment limitations, an ineffective risk assessment and review process for new equipment implementation, and the non-provision of refresher training in compromised separation recovery techniques.

Similar to the occurrence involving VUM on 28 September 2012, the Darwin approach controllers were regularly exposed (in the ADATS environment) to green, or limited data block radar returns and expected these returns to have little relevance to them in terms of aircraft separation requirements. Further, DoD refresher training for these controllers did not emphasise the importance of scanning the green radar returns. In response to this safety issue, the DoD reviewed their radar control training programs and increased the time spent training on scanning green codes and all unidentified aircraft.

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8 ATSB investigation AO-2012-131, available at www.atsb.gov.au.

9 Central Standard Time (EST) was Coordinated Universal Time (UTC) + 9.5 hours.

Safety analysis

Introduction

The loss of separation assurance (LOSA) that commenced near Newcastle Airport (Williamtown) on 28 September 2012 involved the incorrect inhibition of the Australian Advanced Air Traffic System (TAAATS) flight data record associated with Boeing 737, registered VH-VUM (VUM). VUM operated in controlled airspace without the active provision of air traffic control (ATC) services for a period of about 27 minutes and a distance of 225 NM (416.7 km). There was no loss of separation with other aircraft during this period and TAAATS-based and aircraft alerting systems remained as active defences against the risk of collision with another aircraft.

Two key aspects of the occurrence were the inhibition of the aircraft's flight data record (FDR) and that the three involved controllers did not identify that the displayed black 'not concerned' track was representative of the position of VUM and relevant to their jurisdiction of their respective sectors. There were no reports of previous similar occurrences in Australian airspace since TAAATS became operational.

High-reliability systems such as ATC have many layers of risk controls to minimise risks associated with operational hazards. The existing controls to minimise the likelihood of this occurrence were rendered ineffective in this case by many factors. These included human factors considerations such as perception and attention, controller training in the identification of relevant 'not concerned' tracks in TAAATS and the level of system protections. Specifically, error-tolerant system designs that aid in the detection and recovery of inadvertently-inhibited tracks represent key risk controls against a repeat of this type of occurrence.

Inhibition of the flight data record

Within a short period of time, Controller 2 assumed responsibility for the low-level Myall (MAL) sector and the higher-level combined sectors of Maitland (MLD) and Nambucca (NAA) in handover/takeovers from two different controllers. Situation awareness is influenced by an individual's levels of concentration or attention. An individual's capacity for taking in and assimilating new information is contingent on their work conditions, interruptions, distractions and levels of stimulus (Flin, O'Conner and Crichton, 2008). Due to the rapid succession of handovers and combination of the three airspace sectors, Controller 2 may still have been familiarising themselves with the traffic picture of the combined airspace at the time of their action to inhibit the FDR for VUM. However, controllers are required to have a complete traffic picture and the correct console set-up before accepting control jurisdiction.

During the handover/takeover of the combined sectors, Controller 2 was advised that Controller 1 had coordinated the two aircraft that were inbound to Newcastle Airport and that the TAAATS Human Machine Interface (HMI) display for those aircraft was up to date. The activation of a Route Adherence Monitor (RAM) alert relating to VUM and the position of the aircraft at the time led Controller 2 to believe that the aircraft was inbound to Newcastle Airport and that the removal of the 'C' prompt from the aircraft's label and inhibition of its FDR had yet to be actioned.

However, the information presented in TAAATS for VUM at the time was correct. It displayed to the controller that no coordination was required and that the aircraft was climbing and accelerating rather than descending and slowing. Also, the aircraft's flight number provided an indication that it would not terminate at Newcastle Airport. The RAM and associated HMI display was an opportunity for Controller 2 to reassess the information presented for its validity. Instead Controller 2, facilitated by the expectancy set up in the handover regarding the two aircraft that were inbound to Newcastle Airport, interpreted the information displayed for VUM as representing another aircraft destined for Newcastle Airport and automatically inhibited the FDR.

Automatic thoughts and behaviours occur efficiently without the need for conscious guidance or monitoring. Research has shown that most thoughts and behaviours tend to be automatic or have automatic components in order to allow fast processing of information and the performance of well-known tasks (for example, driving a car to work) (Wheatley and Wegner, 2001). Much automatic behaviour has quite conscious beginnings, of which an individual is fully aware. Examples include getting into a car to go to work or commencing a shower. Yet because an individual has completed the act so often, it does not require any further thought once the act has been consciously launched. These behaviours are often acquired skills – actions that become automatic only after significant repetition. Once the action is well-learned, the behaviour becomes automatic in the sense that it does not require constant conscious monitoring.

In terms of conscious automaticity, Controller 2 automatically inhibited VUM's FDR on receipt of the RAM alert and in the belief that the aircraft was on approach to Newcastle Airport and under the jurisdiction of military controllers. The availability of the keyboard shortcut facilitated the automatic behaviour as Controller 2 had routinely inhibited such aircraft by this means on numerous previous occasions. This automatic behaviour precluded Controller 2 from checking VUM's other details, such as its cleared flight level, airspeed and flight number call sign. These details may have alerted the controller to the aircraft's actual tracking.

Altitude filter setting

The combination of the MLD and NAA high-level sectors with the lower-level MAL sector on Controller 2's console required the controller to reset their altitude filter to flight level (FL) '999', rather than the previously-set FL 145 when only the MAL sector was in the controller's jurisdiction. This action would have ensured the display of all aircraft at all altitudes.

Instead, the 'Quicklook All' function, which was initially selected by Controller 2 early in the handover sequence, remained active and displayed traffic at all levels. This likely contributed to Controller 2's subsequent delay in resetting the console altitude filter to display aircraft at all levels, as it was not obvious that the filter remained incorrectly set. As such, when the 'Quicklook All' function was deselected, all label information was removed and only the black 'not concerned' track symbol and nine history dots remained.

The representation of VUM at that time as a 'not concerned' track with no label information attached may have reinforced Controller 2's belief that the aircraft was not within their jurisdiction airspace. However, the extended history dot trail provided an indication that the track was fast moving and operating at a speed likely to be a jet aircraft in the cruise. A jet aircraft conducting an approach into Williamtown would be operating at a slower speed and the associated history dots would be more closely spaced.

When Controller 2 reset the console altitude filters 12 minutes later, VUM's black label, with the flight number call sign displayed but minus the cleared flight level, was again displayed on their air situation display. By this time VUM was positioned well to the north of Williamtown and there was an opportunity for Controller 2 to have identified that the 'not concerned' track was associated with a fast moving aircraft tracking northbound with a flight number call sign. This was unusual and might have been expected to have been investigated further.

Non-identification of relevant 'not concerned' tracks

Controller 2 did not detect the inhibited FDR for VUM as it passed through and exited their jurisdiction airspace. Subsequently Controller 3 and Controller 4, who were responsible for the Inverell sector in the Byron Group, also did not detect the inhibited FDR for VUM until the flight crew queried whether a frequency change was applicable. Similarly, neither Inverell controller identified that VUM was in their airspace from the display window of the MAESTRO flow management system. All three controllers stated that their workload was of low to medium intensity at the time and that they were not distracted or interrupted during the time that VUM's FDR was within their respective airspaces.

The inability to see that which has not been attended to has been shown to be affected by a number of different factors (Wickens, 2001, 2009; Wickens and others, 2009). Human attention is *guided* by two factors: expectancy – an individual will look where they expect to find information - and relevance – an individual will look to information sources relevant to the important tasks and goals they need to carry out. At the same time, an individual's attention is *attracted* by the salient events in their environment – a flashing light, a highlighted checklist item or a prominent line on the pavement. Lastly, the *allocation* of attention is modulated by the effort required to move attention from one location to another and the perceived value to an individual of this effort.

The key factor is expectancy. It is well-demonstrated that people are more likely to detect targets when expected and less likely to detect targets that are not expected (Wickens and McCarley, 2008). This occurs even when the targets are salient, potentially important and in an area to which the person is looking, a phenomenon known as 'inattentional blindness' (Chabris and Simon, 2010).

The three controllers in this occurrence did not expect a black track to be associated with an incorrectly-inhibited FDR, or to be representative of an aircraft operating in their jurisdiction airspace. Therefore, the track was not considered important and lacked saliency. Without expectancy and saliency, attention was not allocated to the black 'not concerned' track as its information value was believed to be small, and the controllers needed to allocate information search effort to their jurisdiction tracks. A plausible risk mitigation strategy under these conditions is the provision of training to controllers to increase awareness that 'not concerned' tracks may have information value and should be included in their scan.

Training/guidance for scanning for black 'not concerned' tracks

Visual scanning involves the periodic sampling of information sources (such as aircraft tracks on a visual display) to build and maintain a mental model of the environment (such as a sector's air traffic). New research on visual perception is questioning how much an individual visually captures instantaneously and how much they remember. It is believed that, due to limitations of the visual system, an individual will have a just-in-time or virtual perception system. It appears that an individual will see and take in a lot of information before recognising what the object is that they are looking at, but they are only attending to a few things at a time. An object is only fully perceived and recognised once focused attention is brought to bear on it.

To identify differences such as the subtle cues that were available to Controller 2 in VUM's FDR label, an individual needs to create a coherent picture of the situation so that they recognise that the object to which they are attending is the same object they originally perceived, only changed. For this, perceptual constancy is required so the observer's visual system motion detectors pick up the change and direct their attention to it (Wickens and McCarley, 2008; Rensink, 2010).

Importantly, research has shown that an expert's (or very experienced individual's) scanning abilities are more effective than those of a novice (or inexperienced individual). Put simply, this is due to the ability of the expert to build a richer mental model from the initial perceptual picture. Indeed, the mental model has been shown to be a critical component of expertise. In trials of scanning training techniques for novices, it was shown that providing a more knowledge-driven scanning strategy that involved a more elaborate narrative description of the information sources and workload management, improved the individual's mental model. This improvement was more effective for scanning than imposing stimulus-driven strategies such as mimicking the scans of experts or reducing dwell time on certain information sources so the novices could spend more time attending to other areas (Wickens and McCarley, 2008).

In terms of the three controllers scanning any black 'not concerned' tracks for the rare event of a wrongly-inhibited FDR, researchers have shown that differences exist between unexpected events and 'truly surprising' events in terms of visual scanning (Wickens and McCarley, 2008). Their studies, which involved pilots monitoring cockpit displays for traffic and conflict avoidance, found that as long as individuals were prepared for the existence of infrequent events, their detection was not particularly inhibited. The individuals studied appeared able to 'optimally' calibrate their attention allocation strategies, noticing rare, but nevertheless possible events in a timely fashion.

Controllers would benefit from initial and refresher training to promote awareness of unexpected, rare but possible events, such as the incorrect or inadvertent inhibition of an FDR associated with a scheduled passenger service aircraft. It might be expected that this awareness would, in general, result in a controller addressing errant inhibitions. Although no formal awareness training of the consequences of an incorrectly or inadvertently inhibited FDR was in place at the time of the LOSA involving VUM, the Department of Defence (DoD) has taken this action in response to a similar occurrence at Darwin Airport, Northern Territory on 2 October 2012 (see AO-2012-131, available at atsb.gov.au).

System protections for inhibited flight data records

The design of the TAAATS HMI incorporates many important and necessary design principles that align with human factors best practice. Guidelines for incorporating ATC automation into new air traffic management (ATM) systems (which includes the HMI) highlighted three high-level objectives for these systems: usability, operational suitability and workforce acceptance (International Civil Aviation Organization, 2000; Mejdal and McCauley, 2001).

The ability for controllers to inhibit tracks and filter out altitude levels that were not part of their sector were considered necessary design principles that allowed de-cluttering of the HMI display and thus easier identification of specific items in a visual display. The use of colour provided a known usability outcome in that inhibited tracks were black on a dull-grey background, allowing for the other coloured tracks to visually stand out (Wickens and McCarley, 2008). The use of colour in ATC displays to distinguish between jurisdiction and other aircraft is common and is very effective in reducing controller workload. Although it has many advantages, increased difficulty identifying relationships between aircraft within jurisdiction and non-jurisdiction airspaces can result (Xing, 2006).

The ability to activate the inhibition function via a keyboard shortcut was consistent with the significant human factors objective for ATC automation of transparency of underlying operations, especially with regards internal software operations. If an operation can be performed naturally or intuitively without the need to pay conscious attention to underlying computational structures, then it meets the higher-level objectives of ATM system usability and operational suitability.

However, this abbreviated task is also open to conscious automaticity, as once the action is consciously launched, there is little requirement to conduct further conscious examination of the action. This increases the risk of unintended user error. In this respect, error-tolerant designs that allow for recovery from user error anticipate possible user errors in data or command entry and include capabilities to 'trap' them before they spread through the system. Error-tolerant designs would routinely query the user at critical choice points (for example, with the query 'Are you sure you want to inhibit this track?') or automatically process tracks and alert users if an inhibited track with certain altitude and speed properties moves from one volume of airspace to the next. Although recovery from error would be simpler and usability enhanced under such design criteria, at the time of the LOSA involving VUM, neither capability was available in TAAATS.

At the time of this report, air traffic services in Australia were delivered by Airservices Australia (Airservices) and the DoD, using two different air traffic management computer systems with a limited level of integration. System limitation and reliability issues may be addressed in the future by the proposal by Airservices and the DoD to develop and implement one air traffic management system that will be used by both organisations to provide air traffic services. A project to develop a joint operational concept and national solution to replace or enhance current Australian ATC systems has already been commenced. Known as OneSKY Australia, this project aims to plan, develop and implement a new air traffic management platform, facilitating the harmonisation of future civil and military air traffic management infrastructure and operations to achieve benefits and efficiencies for military and civilian airspace users as well as for the DoD and Airservices.

Summary

This very low probability occurrence took place despite the current risk controls and resulted from a number of factors in three key areas:

- The human factors aspects of attention and perception were instrumental in that the controllers were suitably primed by the circumstances of the occurrence to automatically perform actions that they perceived were correct. They also did not detect a target in their display environment that was subtle, unexpected and deemed of low information value.
- There was low awareness among the controllers of the potential impact of black 'not concerned' tracks in an en route airspace environment. Emphasis on that possibility through training can provide controllers with the ability to better deal with the situation should it arise again.
- The existing TAAATS HMI risk controls provided a tried and tested means to alleviate known ergonomic issues of clutter and clarity. Unfortunately, in this instance, these controls facilitated the controller's automated but incorrect behaviour to inhibit VUM. This situation was exacerbated by the limited protections afforded the controller when considering inhibited tracks at the intersection of the TAAATS and ADATS systems. There is the potential for additional error-tolerant design improvements to complement the existing risk controls.

Findings

From the evidence available, the following findings are made with respect to the loss of separation assurance involving Boeing Company 737-8BK aircraft, registered VH-VUM (VUM), travelling on a scheduled passenger service between Sydney, New South Wales and Brisbane, Queensland on 28 September 2012. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

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

Contributing factors

- Controller 2 automatically, but erroneously, inhibited VH-VUM’s flight data record in the Australian Advanced Air Traffic System after misinterpreting a system alert as being associated with the aircraft re-positioning for approach to Newcastle Airport (Williamtown).
- A delay in resetting the altitude filters for the combined Maitland and Nambucca sectors to the correct values resulted in the label display for VH-VUM’s inhibited flight data record not being displayed to Controller 2 for a period of time.
- The black track and label information associated with the inhibited flight data record for VH -VUM was not recognised by the involved controllers as being unusual or indicative of traffic within their airspace jurisdiction until the flight crew queried the need for a frequency change.
- **Controllers were routinely exposed to ‘not concerned’ radar tracks that were generally inconsequential in the en route environment, leading to a high level of expectancy that such tracks were not relevant for aircraft separation purposes. Training did not emphasise the importance of scanning ‘not concerned’ radar tracks in jurisdiction airspace. [Safety issue]**
- **The limited interoperability between The Australian Advanced Air Traffic System and Australian Defence Air Traffic System increased the risk of error due to the need for a number of manual interventions or processes to facilitate the coordination and processing of traffic. [Safety Issue]**

Other key findings

- A discrepancy between the actual tracking of VH-VUM and the aircraft's flight data record (FDR) in The Australian Advanced Air Traffic System resulted in a Route Adherence Monitor alert south of Williamtown, when the aircraft’s radar track exceeded the system parameters of the FDR track.
- VH-VUM operated in controlled airspace without the active provision of air traffic control services for a period of about 27 minutes and over a distance of 225 NM (416.7 km). There was no loss of separation with other aircraft during this period.

Safety issues and actions

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

All of the directly involved parties were provided with a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Controller training for black 'not concerned' track awareness

Number:	AO-2012-132-SI-01
Issue owner:	Airservices Australia
Operation affected:	Aviation – Air traffic services
Who it affects:	All Airservices Australia en route air traffic controllers providing surveillance services

Safety issue description:

Controllers were routinely exposed to 'not concerned' radar tracks that were generally inconsequential in the en route environment, leading to a high level of expectancy that such tracks were not relevant for aircraft separation purposes. Training did not emphasise the importance of scanning 'not concerned' radar tracks in jurisdiction airspace.

Proactive safety action taken by Airservices Australia

Action number: AO-2012-132-NSA-047

On 12 February 2015, Airservices Australia (Airservices) advised that:

> In response to the occurrence, Airservices has amended its air traffic controller Abinitio training exercises to include 'not concerned' (black) track scenarios to ensure that training emphasised the importance of scanning 'not concerned' radar tracks. The scenarios will also be included in operational simulation training where appropriate.
>
> Furthermore, Airservices advises that the safety issue (AO-2012-132-SI-01) will be used to raise awareness of black tracks amongst air traffic control staff.

Current status of the safety issue:

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the safety action, when fully implemented, will reduce the risk associated with this safety issue.

Limited system features for protection against inhibited tracks

Number:	AO-2012-132-SI-02
Issue owner:	Airservices Australia
Operation affected:	Aviation – Air traffic services
Who it affects:	All Airservices Australia en route air traffic controllers providing surveillance services

Safety issue description:

The limited interoperability between The Australian Advanced Air Traffic System and Australian Defence Air Traffic System increased the risk of error due to the need for a number of manual interventions or processes to facilitate the coordination and processing of traffic.

Proactive safety action taken by Airservices

Action number: AO-2012-132-NSA-048

On 12 February 2015, Airservices advised the following:

> Airservices and the Department of Defence are currently working towards implementing a harmonised joint civil military air traffic service system via the OneSky Program. Once implemented, the new harmonised air traffic service system will increase the interoperability between both organisations and address the identified safety issue.

Current status of the safety issue:

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the safety action, when fully implemented, will reduce the risk associated with this safety issue.

General details

Occurrence details

Date and time:	28 September 2012 – 0802 EST	
Occurrence category:	Incident	
Primary occurrence type:	Loss of separation assurance	
Location:	41 km south-south-west of Williamtown, New South Wales	
	Latitude: S 32° 47.70'	Longitude: E 151° 50.07'

Aircraft details

Manufacturer and model:	The Boeing Company 737-8BK
Registration:	VH-VUM
Serial number:	29675
Type of operation:	Air Transport High Capacity
Damage:	None

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- involved Airservices Australia (Airservices) air traffic controllers
- relevant Airservices line manager, check and standards supervisor, group training specialist and systems specialist
- Airservices
- the operator of VH-VUM.

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Submissions

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

A draft of this report was provided to the involved air traffic controllers, Airservices, the aircraft operator and the Civil Aviation Safety Authority.

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

Australian Transport Safety Bureau

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

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

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation

Loss of separation assurance involving Boeing 737-8BK VH-VUM, From south of Williamtown to north of Grafton, NSW, 28 September 2012

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