Australian Government
Australian Transport Safety Bureau

Aviation Short Investigation Bulletin

Issue 10

Investigation

ATSB Transport Safety Report
Aviation Short Investigations
AB-2012-065
Final

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ATSB TRANSPORT SAFETY REPORT

Aviation Level 5 Investigations
AB-2012-065
Final

Aviation Short Investigation Bulletin

Issue 10

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INTRODUCTION

About the ATSB

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; and 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.

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.

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.

About this Bulletin

The ATSB receives around 15,000 notifications of aviation occurrences each year; 8,000 of which are accidents, serious incidents and incidents. It is from the information provided in these notifications that the ATSB makes a decision on whether or not to investigate. While further information is sought in some cases to assist in making those decisions, resource constraints dictate that a significant amount of professional judgement needs to be exercised.

There are times when more detailed information about the circumstances of the occurrence would have allowed the ATSB to make a more informed decision both about whether to investigate at all and, if so, what necessary resources were required (investigation level). In addition, further publicly available information on accidents and serious incidents would increase safety awareness in the industry and enable improved research activities and analysis of safety trends, leading to more targeted safety education.

To enable this, the Chief Commissioner has established a small team to manage and process these factual investigations, the Level 5 Investigation Team. The primary objective of the team is to undertake limited-scope, fact-gathering investigations, which result in a short summary report. The summary report is a compilation of the information the ATSB has gathered, sourced from individuals or organisations involved in the occurrences, on the circumstances surrounding the occurrence and what safety action may have been taken or identified as a result of the occurrence. In addition, the ATSB may include an ***ATSB Comment*** that is a safety message directed to the broader aviation community.

The summary reports detailed herein were compiled from information provided to the ATSB by individuals or organisations involved in an accident or serious incident.

JET AIRCRAFT

AO-2012-008: VH-VUJ / VH-VZS, Loss of separation assurance

Date and time:	8 January 2012, 2140 ESuT	
Location:	47 NM (87 km) S of Tamworth Airport, New South Wales	
Occurrence category:	Incident	
Occurrence type:	Loss of separation assurance	
Aircraft registration:	VH-VUJ and VH-VZS	
Aircraft manufacturer and model:	VH-VUJ: Boeing Company 737-8FE VH-VZS: Boeing Company 737-838	
Type of operation:	Air transport –high capacity	
Persons on board:	VH-VUJ: Crew –6	Passengers –169
	VH-VZS: Crew - 6	Passengers - 117
Injuries:	Crew – Nil	Passengers – Nil
Damage to aircraft:	Nil	

FACTUAL INFORMATION

On 8 January 2012, at 2140:54 Eastern Daylight-saving time[1], a loss of separation assurance (LOSA)[2] occurred between a Boeing Company B737-8FE, registered VH-VUJ (VUJ) and a Boeing Company B737-838, registered VH-VZS (VZS), near Tamworth Airport, New South Wales (NSW). There was no infringement of separation standards.

Both aircraft were conducting scheduled passenger services, with VUJ operating from Sydney, NSW to Brisbane, Queensland and VZS operating from Brisbane to Sydney.

At 2110:17, the occurrence controller (controller) assumed responsibility for 2 control sectors. At that time, radar surveillance data indicated that VZS was in a holding pattern at flight level (FL) 330 in another controller's sector to the north. Holding was due to traffic management requirements resulting from adverse weather enroute to, and in the vicinity of Sydney.

Due to extensive weather diversions during that afternoon and evening, many aircraft were not operating at conforming levels prescribed in the Tables of Cruising Levels[3] in the Australian Aeronautical Information Publication (AIP). VZS was one of those aircraft.

In accordance with AIP, air traffic control (ATC) could only assign cruising levels not conforming to the tables when traffic or other operational circumstances required. Pilots were also only able to request non-conforming levels when the pilot in command determined it to be essential to the safety of the flight, and its occupants. Adverse weather and the deviations necessary to avoid it could be considered to meet those requirements.

At 2124:24, the controller instructed the northern sector controller to take VZS out of the holding pattern at FL 330 and continue tracking the aircraft on its flight planned route for Sydney. At that time, VUJ was about 37 NM (68.5 km) to the north-west of Sydney, passing 18,400 ft on climb.

At 2129:35, the controller received coordination from a southern sector controller on VUJ. That aircraft wasthen about 58 NM (107.4 km) north-west of Sydney, on a heading of 350° to divert around weather, and had been assigned an amended conforming level of FL 300 to assure

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

[2] A separation standard existed; however, planned separation was not provided or separation was inappropriately or inadequately planned.

[3] The altitude or flight level assigned to, or selected by the flight crew, for flight from top of climb to top of descent.

vertical separation with a southbound aircraft operating at FL 310.

At 2130:56, the flight crew of VUJ contacted the controller and advised that they would require continued tracking on a heading of 350° for another 45 NM (83.3 km). At that time, the aircraft was about 64 NM (118.5 km) to the north-west of Sydney, passing FL 280 on climb to FL 300. The controller approved the diversion and advised that higher flight levels would be available in 45 NM (83.3 km). Shortly after, the flight crew requested a heading of 340° for weather deviation, which the controller approved.

At 2131:44, the flight crew of VZS contacted the controller and requested a weather deviation up to 10 NM (18.5 km) right of their flight planned route, which was approved, after issuing the crew with a standard arrival route clearance for Sydney. At that time, VZS was about 208 NM (385.2 km) north of Sydney, maintaining FL 330. In addition to VUJ and VZS, the controller had 2 other aircraft on frequency.

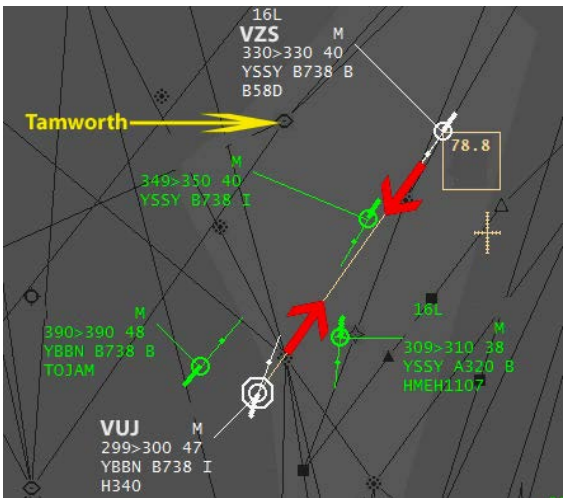
The controller then issued onwards tracking to the flight crew of VUJ for forward planning when their aircraft was clear of the weather, and coordinated holding and weather deviation requirements with the flight crew of VZS, for their arrival into Sydney, before dealing with the requirements of the other aircraft on frequency. The controller made numerous transmissions, in addition to coordination with adjoining sector controllers, about aircraft weather diversions.

At 2137:47, the flight crew of VUJ reported that their aircraft was clear of the weather, they were tracking direct to position TOJAM[4], and requested climb to a higher level. The controller advised that further climb would be available once VUJ was clear of other traffic. At that time, there were a total of 5 aircraft on the controller's sector frequency.

The controller did not update the label display to indicate the aircraft's direct tracking until a later time, due to high workload.

The radar surveillance data indicated that as VUJ was cleared to track direct to TOJAM, there was 78.5 NM (145.4 km) between VZS and VUJ and the aircraft were vertically separated by 3,000 ft. As a result of the weather diversions, however, the aircraft were now on reciprocal tracks (Figure 1).

Figure 1: Position of the aircraft at 2137:47



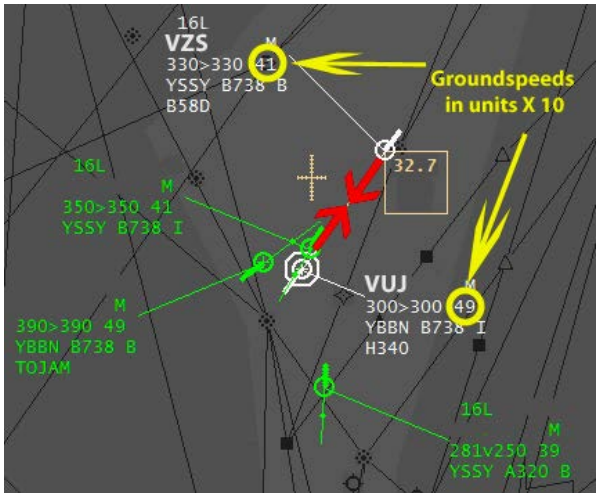
Note: Each graduation on the scale marker is 1 NM (1.85 km)

About 2 minutes later, the flight crew of VZS advised the controller that they would require another weather deviation, further down their route. There were then numerous transmissions between the crew and the controller to determine the likely position at which the deviation would be required and the effect on the timings for their arrival slot into Sydney.

Immediately after, at 2140:54, the controller instructed the flight crew of VUJ to climb to FL 330, which they acknowledged. At this point, there was a loss of separation assurance (LOSA), since VUJ and VZS were now assigned the same flight level, although the required separation standards of either 1,000 ft vertical or 5 NM (9.26 km) radar separation had not been infringed. At the time the climb instruction was issued, there was 32.7 NM (60.6 km) between the aircraft. (Figure 2).

[4] TOJAM was an Instrument Flight Rules waypoint.

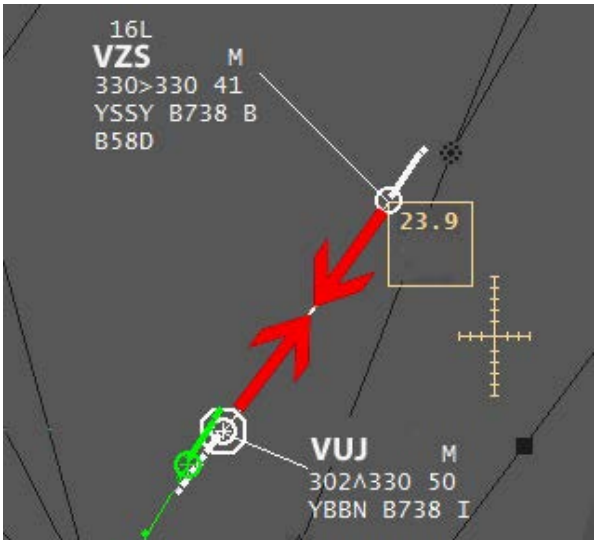
Figure 2: Position of the aircraft at 2140:54



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

At 2141:30, the flight crew of VUJ requested a heading of 040° for weather avoidance, which the controller approved, with an onwards clearance of direct to TOJAM once the aircraft was clear of the weather. At that time, there was 23.9 NM (44.3 km) and 2,800 ft between the aircraft, as VUJ passed 30,200 ft on climb to FL 330 and VZS was maintaining FL 330 (Figure 3).

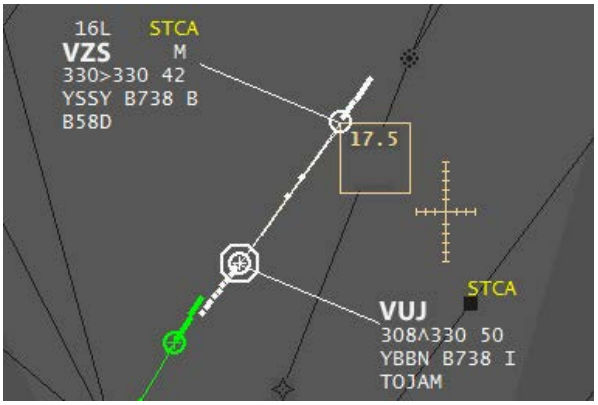
Figure 3: Proximity of the aircraft at 2141:30



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

At about 2141:51, as the controller was completing a transmission to the flight crew of VUJ, the Australian Advanced Air Traffic System (TAAATS) Short Term Conflict Alert (STCA)[5] activated, presenting the controller with both visual and aural alerts. At that time, there was 17.5 NM (32.4 km) and 2,200 ft between the aircraft, with a closing groundspeed of 920 kts (Figure 4).

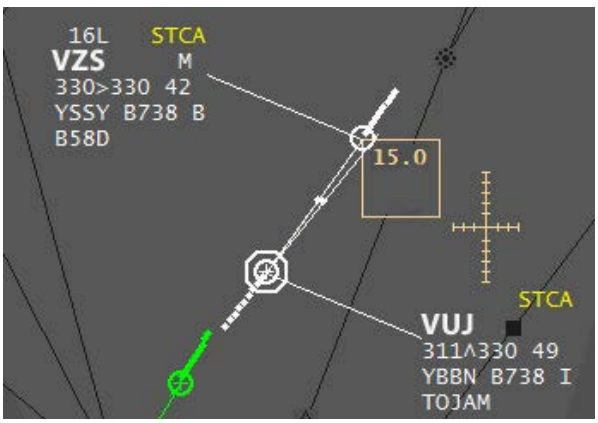
Figure 4: Proximity of the aircraft at 2141:51



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

Three seconds later, at 2141:54, the controller instructed the flight crew of VZS to turn right immediately by 30°, which they acknowledged. The controller then instructed the flight crew of VUJ to maintain FL 310 and turn further right onto a heading of 070°. That crew acknowledged the heading and reported descending to FL 310. At 2142:04, when the control instructions were issued for VUJ, that aircraft was passing FL 311 on climb, and there was 15 NM (27.8 km) and 1,900 ft between VUJ and VZS (Figure 5).

Figure 5: Proximity of the aircraft at 2142:04

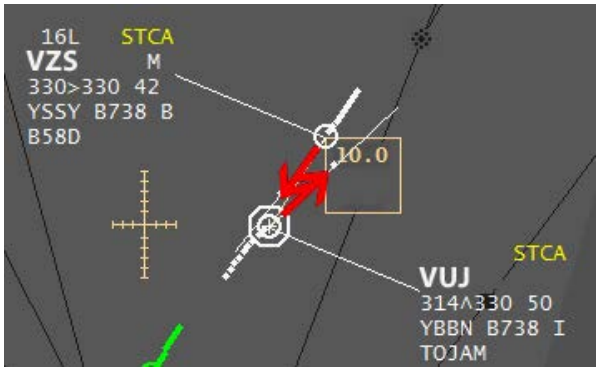


Note: Each graduation on the scale marker is 1 NM (1.85 km)

At 2142:21, there was 10 NM (18.5 km) and 1,600 ft between the aircraft. As the flight crew of VUJ required time to arrest their aircraft's climb before being able to descend back to FL 310, the aircraft reached FL 314 before descending (Figure 6).

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

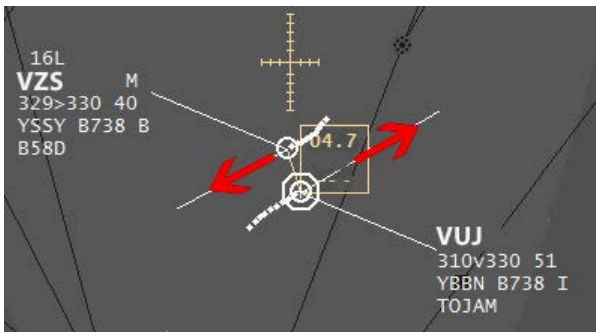
Figure 6: Proximity of the aircraft at 2142:21



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

At 2142:55, the aircraft passed abeam one another, 4.7 NM (8.7 km) and 1,900 ft apart. A breakdown of separation was avoided as the vertical separation standard of 1,000 ft had been maintained (Figure 7).

Figure 7: Proximity of the aircraft at 1042:55



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

Air traffic control

The air traffic controller involved in the occurrence had over 38 years experience in air traffic control, including about 13 years of experience on the airspace sector on which the incident occurred. The controller reported feeling mentally fatigued, following a very busy shift of continual high and complex workload, including multiple weather diversions and holding. Prior to the occurrence, it had been over 2 hours since their last break away from the console, and there remained about 1 hour before the end of the shift. To enable another person to have a break, the controller had decided to continue working, as the shift was close to completion.

The controller was aware that the flight crew of VUJ needed a higher level and was trying to assist, but had not identified that the assignment of FL 330 to VUJ conflicted with VZS, on the reciprocal track, until the STCA activation.

The compromised separation recovery techniques utilised by the controller were effective and prevented a breakdown of separation, following the LOSA.

The controller had completed compromised separation recovery (CSR) training about 1 year earlier and considered that their reaction to the STCA and subsequent control instruction to maintain separation were a result of ATC experience and CSR training.

SAFETY ACTION

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Airservices Australia

Airservices Australia (Airservices) advised that they are committed to continual safety improvement and reduction of occurrences of a similar nature, as demonstrated through the following key initiatives:

- By the end of June 2012, mandated completion of compromised separation recovery refresher training by controllers,
- Conduct sessions with operational air traffic controllers, Academy air traffic control instructors and safety investigators on the importance of separation assurance techniques, drawing on lessons learnt from previous occurrences.
- Renovation of their Fatigue Risk Management System to address the impact of fatigue on performance (implementation for air traffic control to be completed by September 2012).
- Implementation of a Normal Operations Safety Survey (NOSS) during the period of July 2012 to the end of June 2013, that will provide:

  The methodology and measures for assessing normal ATC operations, with an approach that recognises that controllers routinely handle threats in the operational environment and safely manage whatever human errors might occur. The data and

findings from the NOSS can be used to guide safety efforts and monitor trends.

SAFETY MESSAGE

This incident highlights the need for awareness of the effects of high workload and sustained task complexity on performance, and the importance of taking regular breaks, and monitoring performance during such periods.

While the use of conforming levels is not always possible due to operational circumstances such as weather, the utilisation of conforming levels by both flight crew and ATC, whenever possible, provides an integral system defence against the loss of vertical separation between aircraft on reciprocal tracks.

In this incident, the air traffic controller attributed their prompt and effective resolution of the detected conflict to experience and to having received compromised separation recovery training. Those actions highlight the benefit and importance of regular, appropriate training in providing an integral defence for the management of such situations.

TURBOPROP AIRCRAFT

AO-2011-162: VH-VSV / VH-TQG, Breakdown of separation

Date and time:	9 December 2012, 14:47 EDT	
Location:	9km SW Sydney Airport	
Occurrence category:	Incident	
Occurrence type:	Breakdown of separation	
Aircraft registration:	VH-VSV / VH-TQG	
Aircraft manufacturer and model:	VH-VSV – S.O.C.A.T.A. Groupe Aerospatiale TBM 700 VH-TQG – De Havilland Canada DHC-8	
Type of operation:	VH-VSV – Private VH-TQG – Air transport – Low capacity	
Persons on board:	VH-VSV: Crew – 1	Passengers – 1
Injuries:	VH-VSV: Crew –Nil	Passengers –Nil
Damage to aircraft:	Nil	

FACTUAL INFORMATION

On 9 December 2011 at about 1447 Eastern Daylight-saving Time[1], a S.O.C.A.T.A. Groupe Aerospatiale TBM 700 aircraft, registered VH-VSV (VSV), departed Bankstown airport, New South Wales for a private flight to Merimbula, NSW. On board the aircraft were a pilot and one passenger.

The flight was operated as a private medical transfer flight and had originated in Wagga Wagga, NSW, before picking up the passenger in Merimbula and flying to Bankstown. The planned route for the incident flight was to depart Bankstown under Instrument Flight Rules (IFR) and return to Merimbula with the passenger.

The pilot recalled that, while he was taxiing for departure, the Bankstown Tower air traffic controller (ATC) had informed him that there would be significant delays in obtaining a clearance into controlled airspace due to airspace congestion and the use of runway 07 at Sydney Airport. The pilot decided to accept a visual departure with the intention of tracking clear of the Bankstown control zone before requesting a clearance into controlled airspace.

The pilot recalled that, during taxi, he was given a clearance to depart the Bankstown control zone on an upwind departure from runway 11 left. The pilot believed that he read back the clearance to depart upwind to Bankstown Tower ATC, but did not write it down.

Prior to departure, the pilot referred to his map and formulated a plan to climb to 1,500 ft AMSL on runway heading then turn right at 3 NM to intercept the planned outbound track. The pilot determined that Sydney controlled airspace began 3 NM from the Bankstown aerodrome reference point based on an estimate made by looking at the visual terminal chart. The pilot believed that if he climbed to 1,500 ft and extended upwind for 3 NM, he would be clear of the circuit area and able to turn right, contrary to circuit direction[2].

When 4.3 NM from Bankstown Airport and about 1.3 NM past the point where the pilot had intended to commence a turn, the Bankstown Tower ATC advised that VSV had penetrated Sydney airspace. The pilot had penetrated controlled airspace without a clearance by 2.3 NM.

At that time, the pilot observed a DHC-8[3] aircraft turning onto final approach for runway 07 at Sydney

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

[2] Normal circuit direction on runway 11 left at Bankstown is a left hand circuit.

[3] Registered VH-TQG

airport. A breakdown of separation[4] occurred with the two aircraft coming within 1.2 NM at the same altitude (Figure 1) before horizontal separation reduced to 1.1 NM with 100 ft vertical separation. Bankstown ATC instructed the pilot of VSV to turn left. The pilot requested further direction and ATC responded with the instruction to track direct to Bankstown.

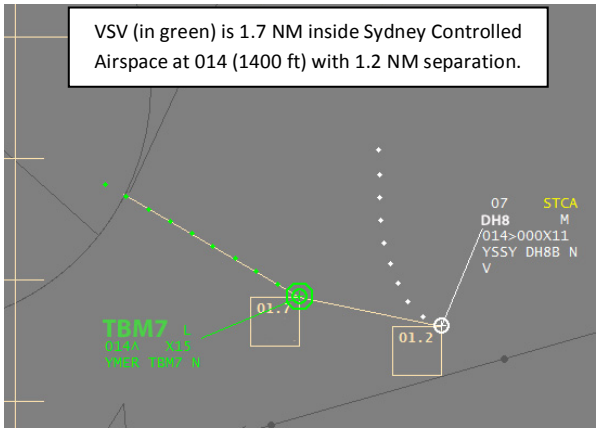
The pilot then asked for confirmation of his departure instructions and was informed by Bankstown ATC that he had been issued a clearance to depart downwind from runway 11 left, not upwind as he had flown.

Take off clearance

A review of the Bankstown Tower ATC tapes showed that the Aerodrome Controller (ADC) issued a clearance for takeoff on runway left (runway direction was omitted) followed by a left turn onto downwind on climb to 1,500 ft. The pilot read back the clearance to depart from runway left (runway direction was omitted), on the downwind leg at 1,500 ft. The pilot did not read back the instruction to turn left and this omission was not corrected by the ADC.

The Manual of Air Traffic Services (MATS) states that Air Traffic Controllers should obtain a readback of key elements following Air Traffic Control clearances, including direction of turn.

Figure 1: Position of VSV and conflicting traffic



[4] An occurrence in which two or more aircraft come into such close proximity that a threat to the safety of the aircraft exists, or may exist, in airspace where the aircraft is subject to an air traffic separation standard.

Airspace

Bankstown Airport and Procedures

Bankstown control zone[5] operated as class D[6] airspace whenever the tower was active. Departures into class G[7] airspace from runway 11 left at Bankstown were to be conducted by extending a leg of the left hand circuit, as issued in the departure clearance, and climbing to 1,500 ft until clear of the control zone.

It was usual for departures from runway 11 left to be conducted by extending either the crosswind or downwind leg of the circuit, as cleared by the tower. It was not possible to extend the upwind leg of the circuit from runway 11 left and enter class G airspace.

Sydney Airspace

Sydney controlled airspace starts 2 NM from the Bankstown aerodrome reference point, along the extended centreline of runway 11 left. The pilot commented that this information was difficult to obtain and was only printed on the Bankstown standard instrument departure (SID) plate. The pilot commented that it would be useful for the information to be available in the ERSA.

Circuit procedures

The pilot believed he could turn contrary to circuit direction once he had reached 3 NM. That procedure was applicable to operations in non-towered aerodromes; however, departure from an aerodrome in Class D airspace should always be conducted in accordance with the circuit direction unless instructed otherwise by the tower.

Pilot experience

The pilot had about 2,500 hours total flight time and about 80 hours on the TBM 700. All of the flying had

[5] Airspace surrounding the airport, extending laterally up to 3 nm (not in a uniform shape) and vertically from the surface to 1,500 ft.

[6] Class D airspace is classified as controlled airspace and is in the terminal control zones of medium sized airports.

[7] Class G airspace is classified as uncontrolled airspace and operations may be conducted without a clearance.

been conducted for private flights. The pilot had owned the aircraft for a few months and reported that he was still adjusting to the aircraft and its instrumentation.

Bankstown experience

The pilot had flown into Bankstown about three times in the past 12 months. On all of the previous flights out of Bankstown, he had been given a visual departure and a clearance into controlled airspace.

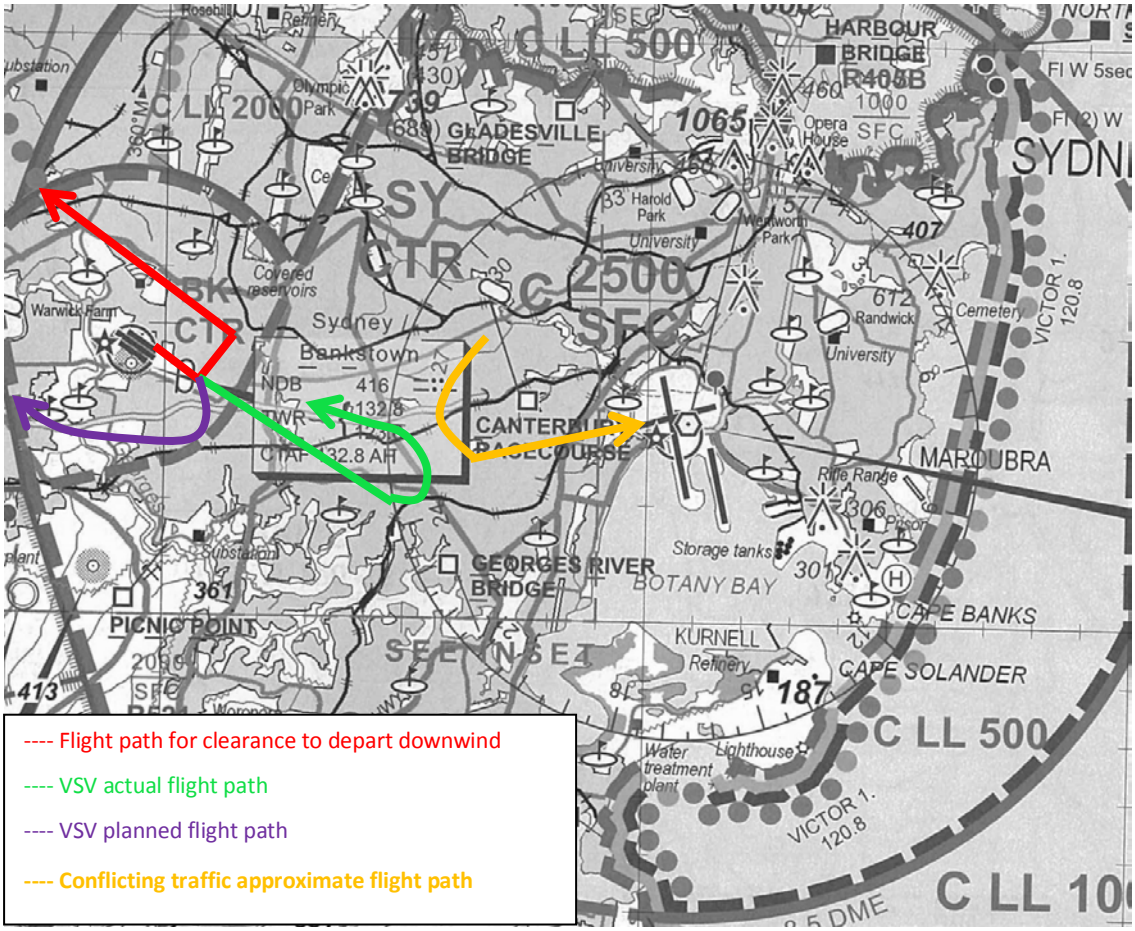
SAFETY MESSAGE

This incident highlights the following key points to consider when operating at unfamiliar aerodromes;

- It is easy to make an error adhering to a clearance when operating in an unfamiliar aerodrome. Familiar clearances are easier to process as the pilot has an existing mental model and expectation of what the clearance will be. Therefore, it may be prudent to write down unfamiliar clearances to ensure you have recalled the details correctly.
- The use of correct phraseology is vital. It is the responsibility of both the pilot and the controller to ensure that clearances and readbacks are complete and correct and that any omissions or discrepancies are clarified.
- Pre-flight planning is essential to ensure a safe flight. All relevant documents should be reviewed prior to departure. CASA published Visual Pilot Guides for Archerfield, Jandakot, Melbourne, Parafield and Sydney, including Bankstown, that provide detailed assistance for operating in these areas.
- It is important to clarify a clearance if any ambiguity exists. An upwind departure from runway 11 left would result in the aircraft having to enter controlled airspace.

The Sydney Basin Visual Pilot Guide, published by CASA, recommends that if you are unfamiliar with the airport you should use the phrase "unfamiliar with Bankstown" on first contact with the tower so they can offer additional assistance.

Figure 2: Clearance, planned and approximate flight path for VH-VSV and the conflicting traffic



AO-2012-018: VH-ZZI and VH-MWO, Breakdown of Separation

Date and time:	25 January 2012, 1310 WST
Location:	near Broome Aerodrome, Western Australia
Occurrence category:	Serious incident
Occurrence type:	Breakdown of Separation
Aircraft registration:	VH-ZZI and VH-MWO
Aircraft manufacturer and model:	VH-ZZI: Bombardier Inc DHC-8-202 VH-MWO: Pilatus Aircraft Ltd PC-12/45
Type of operation:	VH-ZZI: Aerial Work VH-MWO: Aerial Work
Persons on board:	VH-ZZI: Crew – 2 Passengers – 2 VH-MWO: Crew – 1 Passengers – 1
Injuries:	Crew –Nil Passengers – Nil
Damage to aircraft:	Nil

FACTUAL INFORMATION

At 1300 Western Standard Time[1] on 25 January 2012, a Pilatus Aircraft Ltd PC-12/45 (PC12) registered VH-MWO (MWO), departed Broome Airport, Western Australia, under the instrument flight rules for the Lombadina authorised landing area (ALA), about 174 km north-north-east of Broome.

Due to procedural separation[2] requirements in place at the time, Broome Tower[3] re-cleared MWO from a direct track to Lombadina on the 022° bearing to depart on an amended 340° bearing from the Broome non-directional beacon (NDB)[4], on climb to an altitude of 4,000 ft above mean sea level (AMSL) (Figure 1).

MWO was Automatic Dependent Surveillance - Broadcast (ADS-B)[5] equipped. A review of the ADS-B recorded data indicated that at 1304 the aircraft had tracked close to the 340° bearing before deviating to the east. 30 seconds later and about 2 NM north of the runway, MWO turned onto a north-easterly heading.

At 1305, the flight crew of a Bombardier Inc. DHC-8-202 (Dash 8), registered VH-ZZI (ZZI), contacted Broome Tower and reported inbound on the 013 Broome NDB bearing with an estimated arrival time of 1316. ZZI was cleared to descend to an altitude of 7,000 ft AMSL.

At 1306, the pilot of MWO reported being established on the 340° bearing: however, the ADS-B data showed the aircraft on about the 037° bearing at 6.4 NM. At 1308, ZZI was cleared to

1 Western Standard Time (WST) was Coordinated Universal Time (UTC) + 8 hours.

2 Used when the information derived from an Air Traffic Service surveillance system (for example radar) is not used for the provision of air traffic control services, and involving the use of vertical, time, distance or lateral separation standards.

3 Broome Tower provided a Class D air traffic service. Class D airspace was controlled airspace where IFR aircraft were separated from other IFR aircraft.

4 A non-directional (radio) beacon (NDB) is a radio transmitter at a known location, used as a navigational aid. The signal transmitted does not include inherent directional information.

5 ADS-B – Global system to compensate for lack of radar coverage over oceans and remote areas, involving automatic regular polling of navaids of each aircraft so that ATC can always monitor its position and ensure safe operation. Satellites appear to be essential for implementation.

descend to 6,000 ft and MWO was cleared to climb to flight level (FL) 150[6].

At 1309, the crew of ZZI advised Broome Tower that the aircraft was maintaining 6,500 ft due to a Traffic Collision Avoidance System (TCAS)[7], traffic alert (TA)[8] for traffic in their 12 o'clock[9] position. The ADS-B data confirmed that MWO was at about the 019° bearing at 16.2 NM at that time.

Less than 30 seconds later, at 17 NM from Broome, the crew of ZZI reported that they had descended in response to a TCAS Resolution Advisory (RA)[10]. Shortly afterwards, they reported the traffic had been sighted and was visually clear.

At that point, the pilot of MWO observed the traffic on his TCAS display, but it had passed. The pilot of MWO did not hear an aural TCAS alert.

ZZI was re-issued a descent clearance and landed at Broome without further incident. MWO was re-issued a clearance to climb to FL150 and cleared to track direct to Lombadina.

Both aircraft were operating under Instrument Flight Rules (IFR)[11] and were within airspace controlled by Broome Tower.

Proximity

The Pilot in Command (PIC) of ZZI reported that he first became aware of the traffic when he observed a TCAS TA about 10 NM ahead at his 12 o'clock about 2,000 ft below and climbing.

The first officer sighted the PC-12 at about 1 NM at 12 o'clock. A 'descend' TCAS RA was received and the first officer subsequently reported that the PC-12 passed about 200 to 300 ft to the right and slightly above ZZI.

At the time of the incident, the pilot of MWO reported he was in cloud and did not see the other aircraft. He only became aware of the aircraft after the TCAS traffic radio transmission, when it was about 2 to 3 NM behind, on a reciprocal track, below and descending.

Pilot comment – VH-MWO

The pilot of MWO reported that he had landed at Broome on the previous flight with the GPS[12] and DME[13] selected as the two active navigation aids in the aircraft's Electronic Flight Instrumentation System (EFIS)[14]. Prior to departure he had not updated the navigation aid selection, thus the ADF[15] was not selected.

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6 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.

7 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.

8 Traffic Collision Avoidance System Traffic Advisory, when a TA is issued, pilots are instructed to initiate a visual search for the traffic causing the TA.

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

10 Traffic Collision Avoidance System Resolution Advisory. When an RA is issued pilots are expected to respond immediately to the RA unless doing so would jeopardize the safe operation of the flight.

11 Instrument flight rules permit an aircraft to operate in instrument meteorological conditions (IMC), which have much lower weather minimums than visual flight rules. Procedures and training are significantly more complex as a pilot must demonstrate competency in IMC conditions, while controlling the aircraft solely by reference to instruments. IFR-capable aircraft have greater equipment and maintenance requirements.

12 The Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites.

13 Distance Measuring Equipment (DME) uses the signal from an aircraft to a ground-based transponder station to calculate the aircraft's distance from the ground station.

14 An Electronic Flight Instrumentation System (EFIS) replaces traditional flight instruments with a full-colour display and is reprogrammable to operate in different modes.

15 The NDB and its associated automatic direction finding equipment (ADF) was primarily a short distance navigational aid. The ground station (NDB)

When issued with the amended outbound tracking requirements, the pilot selected the Broome NDB on the GPS, then selected the GPS to Omni-bearing selector (OBS)[16] mode, dialled up 340° and selected direct to Broome. The result was that the EFIS displayed the aircraft's bearing to the Broome NDB.

Once airborne, the pilot realised that he had incorrectly planned his landing point as Lombadina, when it should have been One Arm Point (ALA), about 28 km east of Lombadina. While passing about 3,000 or 4,000 ft AMSL, the pilot programmed One Arm Point into the GPS. The pilot did not realise he had deviated from his cleared track until he observed ZZI on his TCAS display.

The pilot later considered that it was when he programmed One Arm Point into the GPS that the GPS began tracking with reference to the Broome / One Arm Point track, and not via the Broome NDB as was his intent.

Surveillance equipment

There was no radar coverage in the area. Although the Broome ADS-B ground station was operational, Broome Tower was not equipped to display ADS-B data and had operated as a procedural Class D Tower since November 2010.

Aeronautical Information Publication

The Aeronautical Information Publication (AIP) ENR 1.1 – 36 *Track Keeping* stated that 'tolerances are applied to tracks to assess containment areas for the purposes of ensuring navigational integrity, separation from other aircraft, terrain and obstacle clearances, and avoidance of specified airspaces.

radiates a signal in all directions around the transmitter, and the aircraft receiver (ADF), when tuned to this signal, determines the direction from which the signal is being radiated. By monitoring the direction indicated by the ADF instrument the aircraft will fly over the NDB or maintain a specified bearing away from it.

[16] Omni-bearing selector (OBS) – a knob turned to the required bearing, which appears in a three-digit window display, the left/right needle thereafter showing the difference from the required heading.

SAFETY ACTION

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Operator of MWO

As a result of this occurrence, the operator of MWO has advised the ATSB that they have taken the following safety action:

TCAS audio level

The operator of MWO took immediate steps to check all aircraft in its fleet to ensure that the audio level of the TCAS could be heard above engine noise and radio traffic. Reconfiguring of the TCAS computer was only required in MWO, where the audio level of the TCAS voice call out in the pilot's headset was increased.

SAFETY MESSAGE

The flight crew of ZZI's compliance with the TCAS RA provided vertical separation with MWO, ensuring that the aircraft remained separated.

This occurrence highlights that where radar or other surveillance is not available, and to ensure safety within a procedural environment, both air traffic controllers and pilots need to understand each other's requirements and limitations. In such an environment, accurate position and level reporting is essential for effective controller coordination.

The Civil Aviation Safety Authority (CASA) produced Civil Aviation Advisory Publication (CAAP) 5.59-1(0) in October 2008, titled *Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management*. Though intended to support the then newly effective Day Visual Flight Rules (VFR) Syllabuses (Aeroplanes) Issue 4 and (Helicopters) Issue 3, CAAP 5.59-1(0) is a useful aid as a refresher.

The incident was resolved due to the Dash 8 flight crew's prompt compliance with the TCAS RA alert. The need to comply with such alerts was highlighted in the mid-air collision between a Tupolev TU154M

and a Boeing 757 near Ueberlingen, Germany on 1 July 2002.

The following documents provide additional information:

- Aeronautical Information Publication www.airservicesaustralia.com/aip/aip.asp
- CAAP 5.59-1(1) – Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management (October 2008) casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_91054
- Safety Behaviours – Human Factors for Pilots skybrary.aero/index.php/Portal:Safety_Behaviours_-_Guide_for_Pilots

The investigation report into the mid-air collision between a Tupolev TU154M and a Boeing 757 near Ueberlingen is available at: www.bfu-web.de/cln_007/nn_226462/EN/Publications/Investigation_20Report/2002/Report__02__AX001-1-2___C3_9Cberlingen__Report,templateId=raw,property=publicationFile.pdf/Report_02_AX001-1-2_%C3%9Cberlingen_Report.pdf

Figure 1: Cleared track inbound for ZZI (solid green line) and outbound for MWO (solid red line), and MWO's actual track (broken red line) derived from ADS-B data

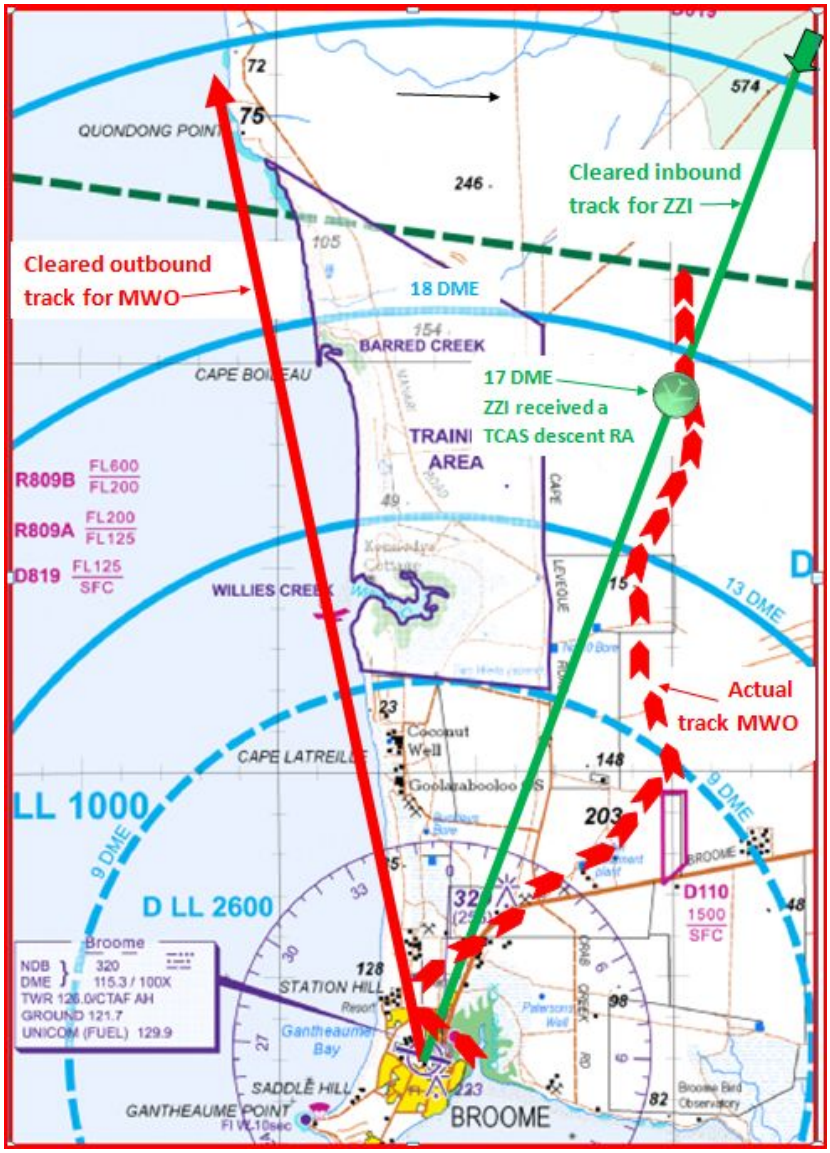

Image and ADS-B data courtesy of Airservices Australia.

AO-2012-043: VH-ZLH / VH-PGX, Runway incursion

Date and time:	23 March 2012, 1400 EDT
Location:	Taree Aerodrome, New South Wales
Occurrence category:	Serious incident
Occurrence type:	Airspace
Aircraft registration:	VH-ZLH and VH-PGX
Aircraft manufacturer and model:	VH-ZLH: SAAB Aircraft Co 340B VH-PGX: Van's RV-10
Type of operation:	VH-ZLH: Air transport – low capacity VH-PGX: Private
Persons on board:	VH-ZLH: Crew – 3 Passengers – 5 VH-PGX: Crew – 1 Passengers – 3
Injuries:	Crew – Nil Passengers – Nil
Damage to aircraft:	Nil

FACTUAL INFORMATION

Shortly before 1400 Eastern Daylight-saving Time (EDT)[1] on 23 March 2012, a Van's RV-10 aircraft, registered VH-PGX (PGX), taxied for runway 22 at Taree Aerodrome, New South Wales (Figure 1). Prior to entering the runway, the pilot of PGX broadcast[2] his intentions on the Taree Common Traffic Advisory Frequency (CTAF)[3]. He heard no other transmissions on the CTAF.

At the end of runway 22, after completing his before-take-off checks, the pilot broadcast 'rolling runway 22 Taree'. At about 50 kts, the front seat passenger pointed out an aircraft approaching the runway holding point. The pilot acknowledged this and, given that he was almost airborne, anticipated the other aircraft would hold at the holding point. The pilot had still not heard any broadcasts on the CTAF.

As PGX became airborne at about 65 kts, the pilot observed the other aircraft enter the runway and turn right for the threshold of runway 04. The pilot reported that PGX became airborne between a quarter and a third of the way down the runway. As PGX was already airborne, the pilot decided the safest option was to continue the take-off. PGX passed directly overhead the other aircraft at about 300 ft.

The other aircraft was subsequently identified as a Regional Express SAAB Aircraft Co 340B registered VH-ZLH (ZLH), conducting a scheduled passenger service to Grafton, NSW. Following the incident, the captain of ZLH established contact with PGX and the crew of neither aircraft experienced problems communicating with the other.

Taree Aerodrome

Taree aerodrome was a non-towered certified aerodrome, and radio carriage was required for all aircraft operating at the aerodrome. Civil Aviation Regulation (CAR) 166C requires a pilot to make broadcasts whenever it is reasonably necessary to do so to avoid a collision, or the risk of collision with another aircraft in the vicinity of the Taree

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

2 'Broadcast' means a radio broadcast from an aircraft on the appropriate frequency to provide advisory traffic information to other aircraft.

3 Common Traffic Advisory Frequency (CTAF), the name given to the radio frequency used for aircraft-to-aircraft communication at aerodromes without a control tower.

aerodrome. A number of standard broadcasts are recommended, but none are mandatory.

Taree aerodrome is not equipped with an Aerodrome Frequency Response Unit (AFRU)[4]. To confirm the flight crew's selection of the correct frequency and the serviceability of the aircraft's radio, the operator of ZLH had established a procedure whereby the ground staff listened out for, and responded to, the aircraft's initial CTAF broadcast.

Visibility along the runway at Taree was good, with a dip at the northern end not obscuring the view from the holding point. The weather was fine with visibility in excess of 10 km and no low cloud.

The Chief Flying Instructor (CFI) of a Taree-based flying training school reported that he sometimes listened to CTAF broadcasts on a hand-held radio, primarily to monitor students, but shielding within the office area meant that to hear all transmission the CFI must leave the office building. On the day of the incident the radio was on, but as the CFI was in his office he did not hear all the CTAF broadcasts related to the incident. However, he reported that he heard one broadcast from PGX, and the ground crew's response to ZLH.

PIC of VH-PGX recollection of events

PGX was painted white with orange and blue stripes along the fuselage and wings. The wing and tail tips were also orange.

The pilot of PGX taxied for runway 22 as that was the runway closest aligned to the wind – reported by the Bureau of Meteorology at 1400 as 300° at 11 kts.

Prior to entering the runway, the pilot of PGX had switched on the aircraft's transponder, landing lights and wing-tip strobes lights. Though PGX was fitted with 'wig-wags'[5], the pilot had not selected them on.

Prior to the incident, the pilot of PGX had not heard any CTAF broadcasts.

Crew of VH-ZLH recollection of events

Normally when on the ground at Taree, the operator's aircraft were parked facing north with a view of the general aviation apron and taxiing aircraft. Due to the presence of another aircraft undergoing maintenance in front of the terminal, on the day of the incident, ZLH was parked facing south.

The first officer conducted an external check of the aircraft prior to departure. During his walk-around he did not notice any aircraft moving or starting up.

Having observed no other traffic and having heard no CTAF broadcasts, the flight crew of ZLH taxied for runway 04. Runway 04 had the shortest taxi distance and was the most closely aligned with their planned departure track to the north northwest. The first officer had made a CTAF broadcast of their intentions and received a confirmation response from ground staff in line with company procedure.

As ZLH approached the holding point, the first officer broadcast on the CTAF that ZLH was entering the runway. Both the first officer and the captain then conducted a visual scan of the runway and its approach paths and each verbalised 'runway clear' in line with company procedure.

The flight crew of ZLH had not selected the aircraft's Traffic Collision Avoidance System (TCAS)[6] on as the multi-function screen normally reserved for that function was being used for the electronic checklist. Though not normally used while on the ground, the first officer reported that the TCAS generally displayed other aircraft while on the ground.

Neither flight crew had heard the CTAF broadcasts made by the pilot of PGX, nor saw PGX airborne above the runway.

The flight crew first became aware of PGX when the captain saw a shadow moving along the left of his

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4 The operation of the AFRU provides additional safety enhancements by confirming the operation of the aircraft's transmitter and received, the volume setting, and that the pilot has selected the correct frequency for use at that aerodrome.

5 'Wig-wags' alternately flash the wing-tip landing lights to improve aircraft visibility.

6 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.

aircraft, then both flight crew observed an aircraft passing directly overhead.

The captain reported that he may not have sighted PGX due either to glare from the sun or a lack of contrast between PGX and a line of trees beyond that end of the runway.

Recorded transmissions

CTAF broadcasts at Taree were not recorded, however the Port Macquarie CTAF was recorded and the two locations share a common frequency.

A review of the Port Macquarie CTAF recordings indicated that the radios in both PGX and ZLH were working. However, due to the distance and geographic shielding between Port Macquarie and Taree, and the power output of the radios involved, the Port Macquarie CTAF recordings provided only a limited number of broadcasts in relation to this incident.

ATSB Comment

The pilots of the two aircraft reported their radios were serviceable and that the correct frequency was used for all required CTAF broadcasts. It was not clear why the pilots had not heard the reported broadcasts made prior to the incident.

SAFETY ACTION

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety actions in response to this occurrence.

Operator of ZLH

As a result of this occurrence, Regional Express advised the ATSB that they are taking the following safety action:

Non-AFRU radio procedures

The operator of ZLH determined that the operating crew and ground staff followed existing published procedures designed for CTAF aerodromes without an AFRU. However, these procedures have been bolstered with additional text to include operations into and out of aerodromes without serviceable AFRU.

SAFETY MESSAGE

When operating outside controlled airspace, it is the pilot's responsibility to maintain separation with other aircraft both in the air and on the ground. For this, it is important that pilots utilise both alerted and un-alerted see-and-avoid principles.

In alerted see-and-avoid in uncontrolled airspace, a pilot is assisted in sighting conflicting traffic by broadcasts from other aircraft. Un-alerted see-and-avoid relies entirely on the ability of the pilot to sight other aircraft.

The physical limitations of the human eye are such that even the most careful visual search may not guarantee that traffic will be sighted due to:

a. a significant proportion of the view being masked by the blind spot in the eye, or

b. the eyes focusing at an inappropriate distance due to the effect of obstructions or to empty field myopia[7].

The contrast between an aircraft and its background can be significantly reduced by atmospheric effects, even in conditions of good visibility.

An on-board collision avoidance system can provide a significant safety benefit outside controlled airspace and at uncontrolled aerodromes. TCAS should not be reserved for use airborne as the safety benefit on the ground could also pay dividends. The use of all available means to increase the visibility of an aircraft should also be made – the use of wig-wags included.

Pilots should never assume that not hearing other CTAF broadcasts means an absence of CTAF traffic. The Civil Aviation Safety Authority (CASA) have published a number of Civil Aviation Advisory Publications (CAAPs) dealing with operations at non-towered aerodromes and the importance of not relying solely on radio broadcasts for traffic advice.

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[7] Empty field myopia where, in the absence of visual cues, the eyes focus at a resting distance of around half a metre.

The following publications provide information on the importance of correct radio use and the limitations of see-and-avoid.

- Civil Aviation Advisory Publication 166-1(0) – Operations in the vicinity of non-towered (non-controlled) aerodromes www.casa.gov.au/wcmswr/_assets/main/download/caaps/ops/166-1.pdf
- Civil Aviation Advisory Publication 166-2(0) – Pilots' responsibility for collision avoidance in the vicinity of non-towered (non-controlled) aerodromes using 'see-and-avoid' www.casa.gov.au/wcmswr/_assets/main/download/caaps/ops/166-2.pdf
- Civil Aviation Advisory Publication 5-59(1) – Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management www.casa.gov.au/wcmswr/_assets/main/download/caaps/ops/5_59_1.pdf
- Limitations of the see-and-avoid principle (1991) www.atsb.gov.au/media/32918/limit_see_avoid.pdf
- A pilot's guide to staying safe in the vicinity of non-towered aerodromes (AR-2008-004(1)) www.atsb.gov.au/media/2097901/ar2008044(1).pdf
- Pilots' role in collision avoidance (Federal Aviation Administration Advisory Circular AC 90-48C) www.rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/list/AC%2090-48C/$FILE/AC90-48c.pdf
- ATSB Report 200700231: Runway incursion - Port Macquarie Airport, 5 January 2007, Bombardier Inc. DHC-8-315, VH-TQZ, Piper Aircraft Corp. PA-28R-201, VH-TBB www.atsb.gov.au/publications/investigation_reports/2007/aair/aair200700231.aspx

Figure 1: Take-off path of PGX (solid blue line) and taxi path of ZLH (broken green line)

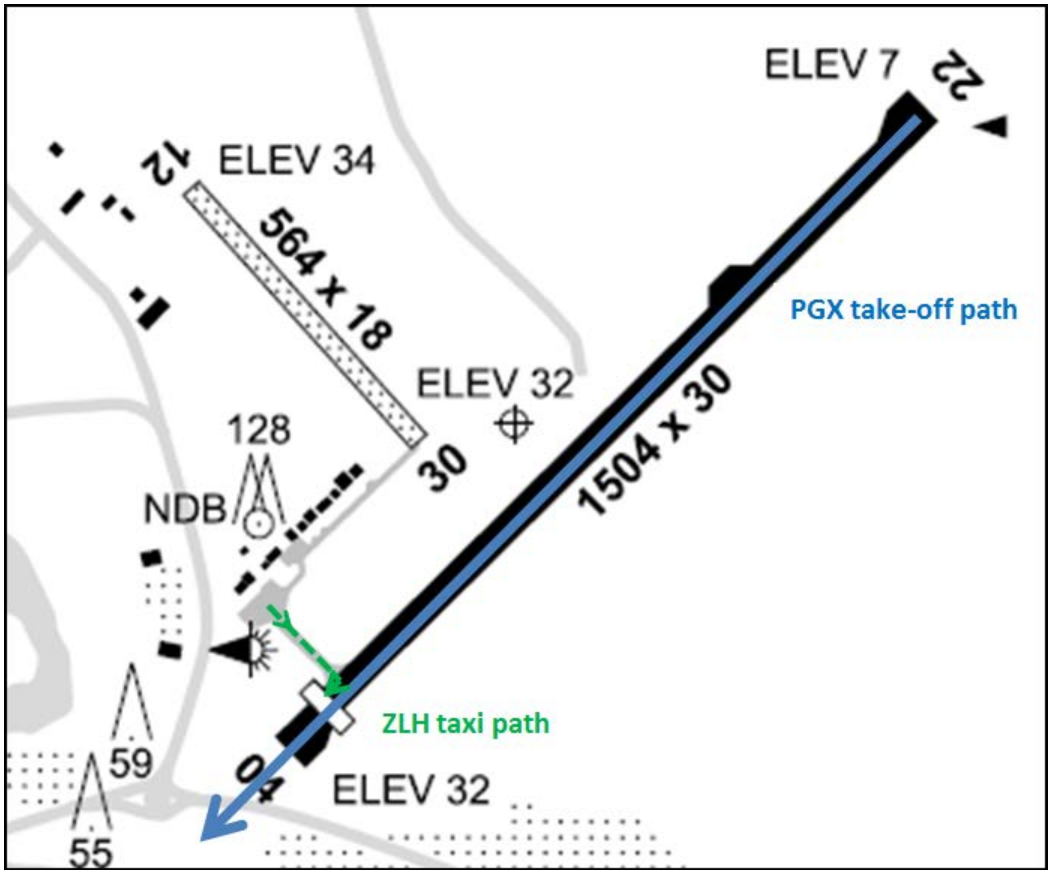


Image courtesy of Airservices Australia.

PISTON AIRCRAFT

AO-2012-002: VH-MMG, Runway Undershoot

Date and time:	25 December 2011, 1045 EDT	
Location:	Warnervale, New South Wales	
Occurrence category:	Serious incident	
Occurrence type:	Runway undershoot	
Aircraft registration:	VH-MMG	
Aircraft manufacturer and model:	Cirrus Aircraft Company SR22	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 2
Injuries:	Crew – Nil	Passengers –Nil
Damage to aircraft:	Minor	

FACTUAL INFORMATION

At about 0950 Eastern Daylight-saving Time[1] on 25 December 2011, a Cirrus Aircraft Company SR22 aircraft, registered VH-MMG (MMG), with the pilot and two passengers onboard, departed Warnervale aerodrome, New South Wales on a private, scenic flight. On returning to Warnervale from the north and joining the circuit, the pilot's primary flight display (PFD) indicted that there was a northerly wind of 12 kts, which would require a landing from the south on runway 02.

The pilot flew downwind at 1,000 ft above ground level (AGL) and 100 kts with flaps set to 50%. On turning to approach runway 02, the aircraft speed was reduced to 90 kts with the flaps extended to 60%. On final approach, the pilot reduced aircraft speed to 80 kts with flaps fully extended.

As there was a long open area of low scrub on the approach to runway 02, the pilot adopted a shallower approach than he would have if landing from the north where trees were present. The pilot calculated that with the headwind of 12 kts, an indicted airspeed of 80 kts and flaps full down, he would be able to land just inside the bitumen runway threshold. The pilot had a habit of utilising the full length of the bitumen runway for landing, to minimise brake usage and wear.

At about 1045, on approaching the runway 02 threshold, at approximately 30 ft AGL and with no indication from the PFD of varying headwinds, the stall warning audible alert sounded. The pilot immediately applied full engine power, but the aircraft continued to descend rapidly landing on the wet ground short of the bitumen runway. The aircraft continued forward, collapsing the nose landing gear, before coming to rest (Figure 1).

The aircraft sustained damage to the propeller, nose landing gear and lower engine cowl. All of the occupants exited the aircraft safely with no injuries reported. On exiting the aircraft, the pilot noticed that the windsock indicated gusting wind from zero to about 12 kts. The pilot reasoned the stall warning was the result of a sudden loss of headwind. He also realised that his approach had been too shallow, as if completing a short field landing.

Aircraft stall characteristics

The pilot's operating handbook (POH) for the aircraft stated that stall characteristics are conventional and that the stall warning sounds between 5 and 10 kts before the stall. Power-on stalls are marked by a high sink rate at full aft stick. The POH also specified the stall speeds associated with different percentages of flap extension.

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

Pilot information

The pilot held a private pilot (Aeroplane) Licence with a total of 195.7 hours of flying experience and a total of 73.3 hours on the Cirrus SR-22. His previous flying experience was on Cessna 152 and 172 aircraft.

Previous approaches

The pilot estimated that he had landed MMG about 100 times at Warnervale aerodrome, with about 25% of those landings being on runway 02 using the same shallow approach.

SAFETY ACTION

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Aircraft Pilot / Owner

As a result of this occurrence, the pilot has advised the ATSB of the following safety actions:

Approach profile

The pilot advised that in the future, he would be adopting a steeper approach to runway 02. He would also increase the approach airspeed dependent on the strength of headwinds.

SAFETY MESSAGE

This incident demonstrates the importance of establishing wind direction and strength using all available references, including those on the ground while on approach. Ground references, such as windsocks could better position the pilot to adjust the aircraft approach profile and airspeed to suit the weather conditions.

The incident also highlights the unexpected nature of wind gusts and the need to identify an appropriate touchdown point on the runway that provides an adequate safety margin. The following CASA publication provides guidance for operations in the vicinity of non-towered (non-controlled) aerodromes. Determining wind speed, direction and strength are contained in sections 4.6.3 and 7.2.3.

CAAP 166-1(0)
www.casa.gov.au/wcmswr/_assets/main/download/caaps/ops/166-1.pdf

Final approach

The objective of a good final approach is to descend at an angle and airspeed that will enable the aircraft to reach the desired touchdown point.

The following FAA publication, chapter 8, provides additional information on approaches and landings.
www.faa.gov/library/manuals/aircraft/airplane_handbook/media/faa-h-8083-3a-4of7.pdf

Aircraft owners and pilots associations

As aircraft handling characteristics can vary from one type to another, it is important that pilots are fully aware of their aircraft's limitations and handling peculiarities. Aircraft owner and pilot associations are often dedicated to specific manufacturers and provide a valuable resource of safety information that could contribute to a pilot's knowledge of error avoidance. Aircraft owners and pilots are encouraged to obtain appropriate association membership, although membership in itself is no guarantee of safety.

For example, the Cirrus owners and pilots association (COPA) website contains a number of resources that outline the benefits of belonging to COPA. These include a safety gallery that lists the resources available and a lessons learned page compiled from Cirrus accident data.

- COPA.
  www.cirruspilots.org

- COPA safety gallery.
  www.cirruspilots.org/media/g/copa_safety/default.aspx?Sort=PostDate&PageIndex=1

Figure 1: VH-MMG after landing at Warnervale Aerodrome

Image courtesy of the aircraft owner.

AO-2012-003: VH-ZAP, Collision with terrain

Date and time:	1 January 2012, 0900 EDT	
Location:	40 km south of Forbes, New South Wales	
Occurrence category:	Accident	
Occurrence type:	Collision with terrain	
Aircraft registration:	VH-ZAP	
Aircraft manufacturer and model:	Cessna Aircraft Company A188B/A1	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers –Nil
Injuries:	Crew – Minor	Passengers –Nil
Damage to aircraft:	Serious	

FACTUAL INFORMATION

On 1 January 2012, at about 0900 Eastern Daylight-savings Time[1], a Cessna Aircraft Company A188B/A1 (C188) aircraft, registered VH-ZAP (ZAP), was conducting aerial work about 40 km south of Forbes, New South Wales (NSW). The aerial work consisted of the application of chemical herbicide. The pilot reported that he was on the 14th chemical load having previously refuelled the aircraft once. The pilot had commenced spraying a new paddock which was of a similar, north-south orientation to the previous one with a hill to the north. The wind had shifted and was reportedly coming from the north.

In the previous paddock, the pilot's practice had been to approach the hill and turn to the left flying over open ground, before making a right turn and overflying the hill.

During the accident run, as he approached the hill, ZAP was affected by a downdraught[2], resulting in a high sink rate.

The pilot attempted to jettison the chemical spray load, but was unfamiliar with the configuration of the emergency dump control[3] in ZAP and could not release the load in time.

Approaching a heavy clump of trees at speed, the pilot noticed a small clearing. In an attempt to slow the aircraft down, the pilot dropped the left wing into the tree line. The wing separated and the aircraft struck the ground. The pilot exited before a large post-impact fire engulfed the aircraft. The pilot sustained injuries to his neck, arm and pelvis. He was transported by a medical helicopter to Orange Hospital, NSW. The pilot reported that the aircraft seat belt had limited the extent of his injuries.

The aircraft was seriously damaged with only sections of the right wing, right landing gear and tail surfaces remaining undamaged by the post-impact fire (Figure 1).

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

2 Bulk downward movement of air such as commonly found on lee side of mountain or caused by descending body of cool air.

3 The emergency dump control was used to empty the entire contents of the aircraft hopper in an emergency in order to lighten the aircraft.

Figure 1: Photo of wreckage

Photo courtesy of Mr David Tod.

Figure 2: VH-ZAP file photo

Photo courtesy of Brenden at Avphotos.net.

Emergency equipment

The aircraft (Figure 2) was equipped with an emergency dump control system. The system consisted of an emergency dump gate which was controlled by a flow control handle located in the cockpit. Pushing the handle forward jettisoned the contents of the hopper.

The emergency dump control system on ZAP contained a safety pin to prevent inadvertent dumping of the hopper contents on the ground or during ferry flights. The pilot reported that the pin was in the UNLOCKED position during the pre-flight checks but it may have fallen back into the LOCK position during taxiing or takeoff on the bumpy airstrip.

The pilot reported that he was unfamiliar with the cockpit configuration, in particular with the operation of the emergency dump control system, in ZAP as it differed from the system on another C188 aircraft that the pilot owned and operated.

SAFETY MESSAGE

This accident highlights the risks associated with executing a turn, when in close proximity to the ground. Such manoeuvres require heightened pilot vigilance regarding controlling the aircraft. In addition, pilots must be prepared to immediately identify the situation and act to control the aircraft.

Standardized equipment configuration in agricultural aircraft is not common even within an aircraft type. Therefore, before flying an aircraft for the first time, pilots should ensure they are aware of what equipment variations there are from previous similar aircraft flown and the location and operation of the emergency equipment installed.

The Aerial Agricultural Association of Australia website has valuable information for pilots concerning wind anomalies and may be found at www.aerialag.com.au.

AO-2012-014: VH-HYC and VH-TAK, Aircraft proximity event

Date and time:	23 January 2012, 1001 EDT		
Location:	1 NM N of Parramatta, New South Wales		
Occurrence category:	Serious incident		
Occurrence type:	Airprox		
Aircraft registration:	VH-HYC and VH-TAK		
Aircraft manufacturer and model:	VH-HYC:	Robinson Helicopter Company R44 Raven II	
	VH-TAK:	Piper Aircraft Company PA-28-161	
Type of operation:	VH-HYC:	Aerial work	
	VH-TAK:	Flying training - dual	
Persons on board:	VH-HYC:	Crew – 1	Passengers – Nil
	VH-TAK:	Crew – 1	Passengers – 1
Injuries:	Crew – Nil		Passengers – Nil
Damage to aircraft:	Nil		

FACTUAL INFORMATION

Sequence of events

Robinson R44 II, VH-HYC

On 23 January 2012, at about 0854 Eastern Daylight-saving Time[1], a Robinson Helicopter Company R44 Raven II helicopter, registered VH-HYC (HYC), departed the Parramatta helicopter landing site (HLS), New South Wales on a routine gas pipeline inspection flight.

After conducting operations to the north-west of Bankstown Airport, the pilot tracked to the north-east of the airport to commence aerial work near Homebush. At 0946:01 the pilot broadcast a call on the Sydney Centre frequency[2] to advise that he would be operating between Homebush and Parramatta at 1,000 ft for the next 20 minutes.

Following that inspection, the helicopter tracked towards Parramatta to commence an inspection between Parramatta and Castle Hill.

When approaching Parramatta from the east, the pilot broadcast a call on the Sydney Centre[3] frequency at 0957:05, to advise traffic within the Bankstown lane of entry (LOE)[4] that he would be operating between Parramatta and Castle Hill, not above 1,500 ft, until 1020 (Figure 4). The pilot received a response from another helicopter tracking north in the LOE. The pilot of HYC advised that he was overhead the Parramatta Central Business District at 1,300 ft and reported visually sighting the other helicopter.

When overhead Parramatta, the pilot looked for traffic departing Bankstown for the LOE. With no

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

2 The helicopter was equipped with two very high frequency (VHF) communication systems (COMM 1 and COMM 2). The Sydney Centre frequency of 124.55 was selected on COMM 1 while the 120.8 frequency was selected on COMM 2. The pilot was monitoring traffic operating in restricted area R405 on the 120.8 frequency.

3 The Sydney Centre frequency of 124.55 was selected on COMM 1 while the Bankstown Tower frequency of 132.8 was selected on COMM 2.

4 The Bankstown LOE is a narrow corridor between the Sydney control zone (CTR) to the east and Richmond CTR to the west. There is no requirement for pilots to broadcast their intentions when operating in the LOE.

traffic sighted, he commenced a right turn to the north.

Piper PA-28-161, VH-TAK

At about 0945, a Piper Aircraft Corporation PA-28-161, registered VH-TAK (TAK), departed Bankstown, New South Wales on a training flight. On board the aircraft were the flight instructor and student pilot.

After departing runway 11 Left, the aircraft was turned onto crosswind at about 500 ft and soon after, commenced tracking towards Parramatta for the LOE, on climb to 1,500 ft.

Shortly after, the instructor observed a helicopter in his 2 o'clock[5] position. He focused on ensuring sufficient separation was maintained with the helicopter, which he reported was not HYC.

When at Parramatta, they commenced tracking towards Pennant Hills. The instructor reported that the Bankstown Tower frequency was selected on COMM 1; he could not recall what frequency was selected on COMM 2.

The incident

When 1 NM (1.85 km) north of Parramatta, at about 1001, the pilot of HYC observed TAK pass overhead, about 20 ft above. In response, the pilot of HYC immediately lowered the collective and commenced a descending right turn.

The instructor of TAK reported that he did not observe HYC until after passing, at which time he believed the vertical separation was 100 ft.

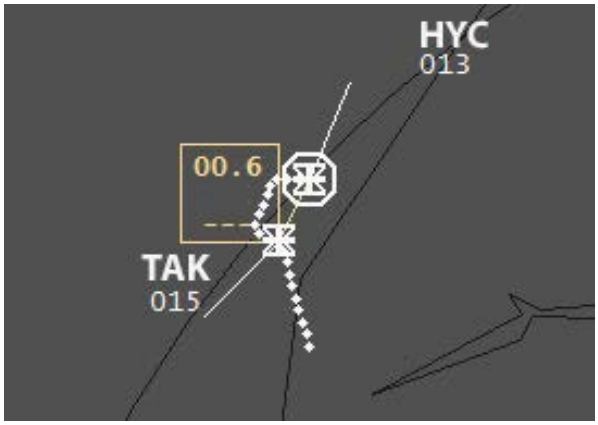
The pilot of HYC reported that he attempted to contact TAK on Sydney Centre on two occasions, but no response was received.

Soon after, the pilot of TAK changed his radio settings from the Bankstown Tower to Sydney Centre frequency.

Both flights continued without further incident. At the time of the occurrence, the aircraft were operating in uncontrolled airspace and were not subject to air traffic control services.

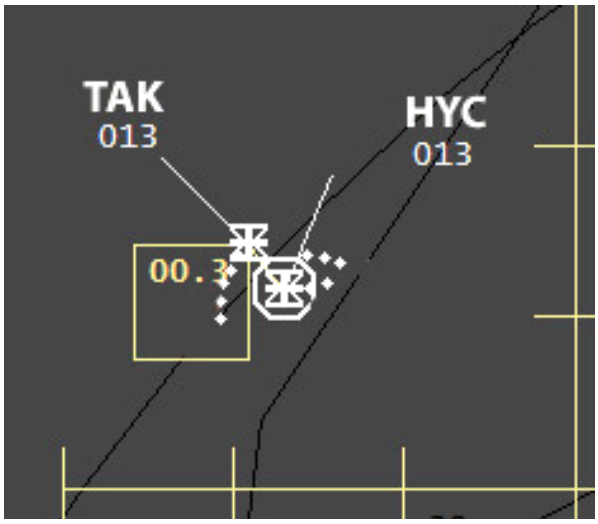
A review of Airservices Australia radar surveillance data indicated that at 0959:01, the distance between HYC and TAK reduced to 0.6 NM (1.1 km) laterally and 200 ft vertically (Figure 1).

Figure 1: Proximity of the aircraft at 0959:01



At 0959:37, separation between the aircraft reduced further, when both aircraft were operating at the same altitude of 1,300 ft and there was 0.3 NM (560 m) between them (Figure 2).

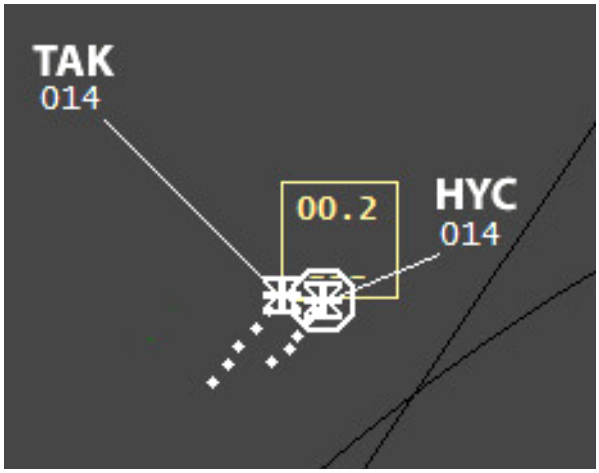
Figure 2: Proximity of the aircraft at 0959:37



Both aircraft then tracked in a north-easterly direction. At 1001:30, the aircraft were at their closest position, with both operating at 1,400 ft, 0.2 NM (370 m) apart (Figure 3).

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

Figure 3: Proximity of the aircraft at 1001:30



From that point, the tracks of the aircraft diverged.

Communications

The pilot of HYC reported that he had Sydney Centre selected on COMM 1 and Bankstown Tower selected on COMM 2; however, the volume on COMM 2 was turned down to a low 'murmur'. He stated that his normal practice was to turn the volume up when operating to the south of Parramatta, so that he could listen for traffic departing Bankstown for the LOE. But when operating to the north of Parramatta, he turned the volume down as he had no need to monitor Bankstown Tower when operating in the LOE. The pilot reported that he did not hear any broadcasts from TAK.

The En Route Supplement Australia (ERSA) stated that aircraft departing Bankstown into Class G (non-controlled) airspace shall change frequency when 3 NM from the Bankstown control zone (CTR) boundary. The pilot of TAK reported that, at the time of the incident he had Bankstown Tower selected on COMM 1 and could not recall what was selected on COMM 2. He further stated that he normally changed from Bankstown Tower to Sydney Centre when at Parramatta, as this was about 3 NM from the CTR boundary.

Pilots comments

The pilot of HYC reported that he had on previous occasions noted that the Bankstown Airport automatic terminal information service (ATIS) had advised of aircraft conducting aerial work within the Bankstown CTR. Both the pilot of HYC and the operator of TAK suggested that pilots intending to conduct aerial work within the LOE could notify Bankstown air traffic control, who could then pass that information on to known aircraft operating within the vicinity, either via the ATIS or by direct communication.

The pilot of TAK also recognised that, as the aircraft was equipped with two communications systems, it may have been advantageous to monitor Sydney Centre on COMM 2.

SAFETY MESSAGE

Radio communication is the primary tool of alerted see-and-avoid; it allows for the communication of information to the pilot from the ground (air traffic control) or from other aircraft[6]. The effective use of such is particularly crucial in Class G airspace, where aircraft separation is the pilot's responsibility.

The Civil Aviation Safety Authority's Sydney Basin Visual Pilot Guide (VPG) 2010, which incorporates Bankstown, encourages pilots to monitor the tower frequency when operating in proximity to the CTR boundary, even though it is not mandatory to do so.

Conversely, it may be beneficial for pilots of aircraft departing the CTR to also monitor the surrounding area frequency (such as Sydney Centre).

This incident highlights the advantages of utilising dual communication systems, if fitted, to enhance traffic awareness. It further emphasises the benefits of notifying the appropriate air traffic control authority if intending to conduct aerial work within a known area of high traffic levels, such as the Bankstown LOE.

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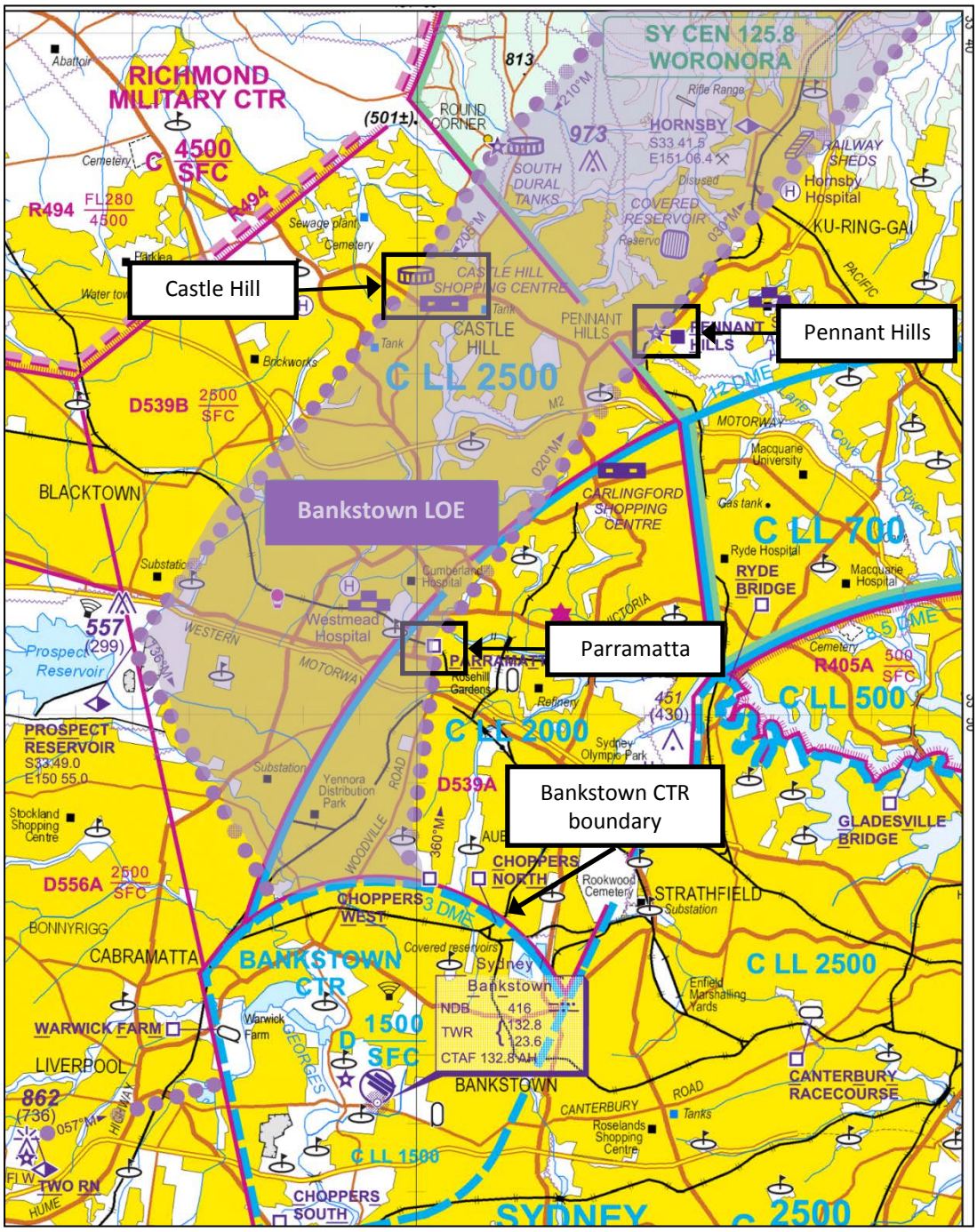
6 Civil Aviation Advisory Publication CAAP 166-2(0) *Pilot's responsibility for collision avoidance in the vicinity of non-towered (non-controlled) aerodromes using 'see-and-avoid'*.

Figure 4: Bankstown lane of entry



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HELICOPTERS

AO-2012-016: VH-FUJ, Partial Power Loss

Date and time:	25 January 2012, 1600 EDT	
Location:	19 km 080 M Long Hill (ALA), Tasmania	
Occurrence category:	Accident	
Occurrence type:	Partial power loss	
Aircraft registration:	VH-FUJ	
Aircraft manufacturer and model:	Schweitzer Helicopter Company 300C	
Type of operation:	Aerial Work	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage to aircraft:	Serious	

FACTUAL INFORMATION

On 25 January 2012, at about 1600 Eastern Daylight-saving Time[1], a Schweitzer helicopter company 300C helicopter (300C), registered VH-FUJ (FUJ), departed an agricultural property located near Scottsdale, for Devonport, Tasmania. The pilot was returning to his home base at the conclusion of the day's aerial spraying activities. The pilot was the only person on board the helicopter.

About 20 NM to the south-east of Devonport, while flying over heavily timbered country, the pilot noticed a bright flash on the ground to his left and commenced a left turn to investigate. The left turn was commenced at about 300 to 500 ft above ground level (AGL). Failing to identify the source of the flash, the pilot commenced a second left turn descending to about 100ft AGL.

Part way through the second turn the pilot heard what he described as "a loud groaning noise" accompanied by an unusual vibration. The pilot immediately lowered the collective, opened the throttle and pushed forward on the cyclic to increase airspeed to about 50 kts. However, the pilot was unable to arrest the descent and the helicopter impacted the tree canopy before coming to rest on the ground between several large trees (Figure 1).

The pilot was wearing a helicopter safety helmet and was uninjured. He immediately exited the helicopter and described seeing "steam or smoke" coming from the helicopter.

The pilot made his way to a small clearing and called his employer on a mobile phone to notify him of the accident. The pilot's employer arrived shortly after in another helicopter to pick him up. On becoming airborne in the second helicopter, the pilot noticed that the wreckage and surrounding bush were on fire and notified the local fire brigade (Figure 2).

The helicopter was seriously damaged by the fire and the cause of the partial power loss was not determined.

Figure 1: VH-FUJ

Image courtesy of the insurer

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

Weather

The pilot reported the weather as clear and hot with a light wind from the north.

Pilot information

The pilot held a Commercial Pilot (Helicopter) Licence and a Private Pilot (Aeroplane) Licence with a total of 1013 hours total time on helicopters with 340 hours on the 300C.

Figure 2: Accident site

Image Courtesy of the Insurer

Pilot comment

The pilot reported impact damage to both sides of his helmet. The pilot stated that he was of the opinion that, "the helmet saved my life."

SAFETY MESSAGE

Helicopter safety helmets

This accident highlights the value of pilots wearing helicopter safety helmets.

A study conducted by the US Army concluded that head injuries occur in approximately 70 per cent of helicopter accidents and further that a pilot is six times more likely to suffer a fatal injury in an accident without a helmet[2]. A helmet with the visor down will significantly reduce facial and eye injuries resulting from secondary collisions[3].

The Transportation Safety Board of Canada (TSB) advises that the effects of non-fatal head injuries can range from momentary confusion and inability to concentrate, to a full loss of consciousness. This effectively incapacitates a pilot and compromises a pilot's ability to quickly escape from a helicopter and assist passengers in an emergency evacuation[4].

The following publications provide further information on Helicopter Safety Helmets:

- Helicopter Safety Helmets- A Hard S(h)ell;

  www.tc.gc.ca/eng/civilaviation/publications/tp185-2-10-flightops-3719.htm

- Low Usage of Head Protection by Helicopter Pilots;

  www.tc.gc.ca/eng/civilaviation/publications/tp185-2-10-flightops-3719.htm

[2] Injury in U.S Army Helicopter Crashes October 1979-September 1985 (1989) *The Journal of Trauma*, 29(4), 415-423

[3] Helicopter Safety (1998) *Flight Safety Foundation* Vol 24

[4] TSB Investigation A09A0016

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Investigation

ATSB Transport Safety Report
Aviation Short Investigation Bulletin Issue 10
AB-2012-065
Final