Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY BULLETIN
Aviation Level 5 Investigations AB-2010-020
Final

Level 5 Factual Investigations:
1 December 2009 to 30 March 2010

Issue 1

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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.

The summary reports detailed herein were compiled from information provided to the ATSB by individuals or organisations involved in an accident or serious incident between the period 1 December 2009 and 30 March 2010.

AO-2009-055: VH-LAB, Pilot incapacitation

Date and time:	31 August 2009, 1344 EST
Location:	37 km south of Bindook VOR[3], New South Wales
Occurrence category:	Serious incident
Occurrence type:	Pilot incapacitation
Aircraft registration:	VH-LAB
Aircraft manufacturer and model:	Beech Aircraft Corporation B200T
Type of operation:	Aerial Work – fire-scanning
Persons on board:	Crew – 2 Passengers – Nil
Injuries:	Crew – Nil Passengers – Nil
Damage to aircraft:	Nil

SYNOPSIS

On 31 August 2009 at 1344 Eastern Standard Time,[1] the pilot of a Beech Aircraft Corporation B200T, registered VH-LAB, suffered a seizure and was rendered unconscious, while the aircraft was descending from flight level (FL) 200[2] to FL150 inbound to the Bindook VOR.[3] The aircraft was being flown using the aircraft's autopilot coupled to the Global Positioning System (GPS). The aircraft crewman attended to the pilot and notified Air Traffic Control (ATC) of the occurrence.

In the ensuing 20 minutes, the pilot gradually regained consciousness and at 1418 initiated and successfully completed an approach and landing at Bankstown airport.[4]

It was later determined that the pilot had a previously undiscovered medical condition that was the likely cause of the in-flight seizure.

FACTUAL INFORMATION

On 31 August 2009, at about 1120, a Beech Aircraft Corporation B200T, registered VH-LAB (Figure 1), departed Bankstown Airport (Bankstown), New South Wales (NSW) on a fire reconnaissance flight in the south-eastern region of NSW. On board the aircraft were one pilot[5] and one crewman[6]. The crew was tasked with conducting an infrared fire-mapping reconnaissance flight (fire-scanning) at FL200, on fires in the Eurobodalla and Shoalhaven regions. This was the third consecutive day of fire-scanning operations conducted by this crew in the same aircraft.

The fire-scanning flight was completed to the west of Nowra at about 1330. The pilot advised ATC of the intention to return to Bankstown and was cleared by ATC to the Bindook VOR (BIK) at FL200. At 1341, the pilot requested descent to FL150, which was granted with a clearance requirement

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

2 Flight Level (FL) is a level of constant atmospheric pressure related to a datum of 1013.25 hectopascals, expressed in hundreds of feet. Therefore, FL200 indicates 20,000 ft.

3 Very High Frequency Omnidirectional Radio Range. A system that provides bearing information to an aircraft.

4 Bankstown airport is 85 km east-north-east of Bindook VOR.

5 The pilot held an Air Transport Pilot (Aeroplane) Licence with a current Class 1 medical certificate.

6 The crewman was trained to operate the line-scanning equipment on board the aircraft and had accrued significant experience in airborne fire-scanning operations.

to be at FL150 by 18 km south-east of BIK. The pilot reported leaving FL200 at 1342.

At 1344, the pilot was instructed by ATC to change frequencies. The pilot did not respond, although there was a garbled transmission from an unknown source shortly after the ATC instruction. ATC made numerous transmissions to the aircraft over the next 2 minutes without response from the pilot.

As the aircraft commenced descent, the crewman was completing tasks associated with the fire-scanning operations. When the pilot did not respond to the transmission from ATC, the crewman queried the pilot on the aircraft's intercom. The pilot again did not respond, so the crewman turned towards the pilot and observed that the pilot was suffering what appeared to be a seizure. Shortly thereafter, the pilot slumped forwards, unconscious. The crewman moved the pilot back from the aircraft's flight controls and checked the autopilot and instruments to ensure that the aircraft was under control and pressurized[7]. At 1349, the crewman occupied the right pilot's seat and declared an emergency, advising ATC that the pilot was unconscious.

The aircraft continued to track on autopilot via preloaded GPS waypoints to overhead Bankstown at FL150, while the crewman attended to the pilot and sought advice from the aircraft operator and ATC. The pilot slowly regained consciousness, but was unresponsive and appeared unaware of his surroundings. After flying overhead Bankstown at 1405, the aircraft commenced tracking towards the south. Over the next 5 minutes, the pilot regained sufficient awareness such that at 1410, in response to an ATC request that the aircraft track to the west, the pilot disengaged the GPS from the autopilot and engaged manual heading onto the requested track. At 1415, the crewman reported that the pilot had recovered sufficiently to perform an approach and landing at Bankstown. At 1418, ATC issued the pilot with frequency change instructions for the approach. The pilot complied and conducted a successful approach and landing into Bankstown.

Immediately after landing and shutting down the aircraft, the pilot was transported to hospital and admitted for observation and tests. The pilot was released from hospital that evening.

Aircraft information

There was no evidence that the aircraft pressurisation, air systems, or any other equipment on board the aircraft contributed to the occurrence.

Meteorological information

The weather conditions were clear and sunny for the flight. At 1415 at BIK, the sun was at an azimuth of 316° true and an elevation of 36°.[8] At the time of the occurrence, the aircraft was heading approximately 325° magnetic inbound to BIK, descending in a wings level attitude. It was considered unlikely that the pilot's seizure was induced by the strobe or flicker vertigo effect[9] of the sun passing through the aircraft's propeller arc when viewed from the pilot's seat.

Medical information

The pilot's aviation medical records indicated that there was no evidence of a medical condition and/or medication which may have contributed to the occurrence. There was also no evidence that the pilot had consumed spoiled food or liquids on the day of the occurrence. However, the pilot stated that he had suffered a brief but very intense headache on the way into work that morning. It was later determined that the pilot had a previously-undetected medical condition that was the likely cause of the in-flight seizure.

7 The crewman had sufficient familiarity with the aircraft to make these assessments.

8 Data provided by Geoscience Australia see http://www.ga.gov.au/bin/astro/sunmoonposn.

9 Flicker vertigo is caused by light flickering at frequencies from four to 20 times per second, such as when a propeller aircraft is heading towards the sun at low revolutions per minute (RPM); and can produce nausea, dizziness, or unconsciousness in susceptible individuals.

Figure 1: VH-LAB

Source: Wikipedia

ATSB COMMENT

Research published by the ATSB has shown that the chances of pilot incapacitation associated with a fitting episode or seizure is rare; however, such events do happen. Between 1975 and 2006, there were 98 reported crew incapacitation occurrences for medical or physiological reasons, including 16 that resulted in accidents. Flight crew should be aware of any potential medical or physiological conditions that may affect their fitness for flight and consider seeking professional medical advice before commencing duty where such a condition exists.

The following ATSB publication (available at www.atsb.gov.au) provides some useful information on pilot incapacitation occurrences:

- Newman, D. G. (2007). Pilot incapacitation: Analysis of medical conditions affecting pilots involved in accidents and incidents 1 January 1975 to 31 March 2006. (Aviation Research and Analysis Report B2006/0170). ATSB: Canberra, ACT.

AO-2009-059: VH-TJW / VH-NXO, Ground handling event

Date and time:	20 September 2009, 1630 WST
Location:	Perth Airport, Western Australia
Occurrence category:	Incident
Occurrence type:	Ground operations
Aircraft registration:	VH-TJW and VH-NXO
Aircraft manufacturer and model:	VH-TJW: Boeing Co. 737-400 VH-NXO: Boeing Co. 717-200
Type of operation:	High capacity air transport
Persons on board:	VH-TJW: Crew – 6 Passengers - Unknown VH-NXO: Crew – 6 Passengers - 81
Injuries:	Crew – Nil Passengers – Nil
Damage to aircraft:	Nil

SYNOPSIS

On 20 September 2009, at about 1630 Western Standard Time[1], a Boeing Company 737-400 (737) aircraft, had been pushed back from the domestic terminal onto the taxiway at Perth Airport, Western Australia (WA), when a technical fault was experienced. The aircraft remained in position to allow the flight crew to examine the fault. At the same time, a Boeing Company 717-200 (717) aircraft, located in an adjacent bay, requested a pushback clearance from the surface movement controller (SMC)[2]. The SMC advised the 717 flight crew to contact their ground crew to discuss suitable pushback options. The 717 was pushed back with the aircraft kept as close to the terminal as possible. A clearance marshaller was located next to the left wing of the 717.

The flight crew of the 737 and the ground engineer for the 717 estimated that the wing of the 717 and the nose of the 737 were 11 m apart. However, the ground engineer for the 737 reported that the distance between the two aircraft was within 1 m and that as a result, he and another ground engineer with him may have been placed within the inlet and exhaust hazard area of the 717.

It was not possible to reconcile the differing accounts of aircraft proximity. However, the incident highlights the potential dangers associated with ground operations around jet aircraft and the need for particular care and attention when dealing with dynamic traffic situations.

FACTUAL INFORMATION

On 20 September 2009, at about 1630 WST[1], a Boeing Company 737-400 (737) aircraft, registered VH-TJW, was being prepared for departure at bay 9 of the domestic terminal at Perth Airport, WA. At the same time, a Boeing Company 717-200 (717) aircraft, registered VH-NXO, was also being prepared for departure in the adjacent bay, number 10. The 737 was pushed back by an aircraft tug onto taxiway Golf, with the nose of the aircraft being stopped on a towbar disconnect marker, which was painted onto the taxiway (Figure 1). Shortly after the tug was disconnected from the 737, the aircraft's traffic alert and collision avoidance system failed. The aircraft remained positioned at the towbar disconnect marker while the ground engineers and flight crew sought to resolve the fault.

At around the same time, the flight crew of the 717, located in bay 10, requested a pushback

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1 The 24-hour clock is used in this report to describe the local time of day, Western Standard Time, as particular events occurred. Western Standard Time was UTC + 8 hours.

2 The SMC is responsible for controlling aircraft on the surface of the aerodrome, with the exception of the runways and aprons.

clearance from SMC. The SMC cleared the 717 for pushback pending the taxiing of the 737. After about 4 minutes, the SMC noted that the 737 had not commenced taxiing. The SMC contacted the flight crew who advised they were experiencing a technical fault. In response, the SMC suggested that the 737 remain in its current position to allow the 717 to pushback. The flight crew of the 737 replied that the 717 could push back with its tail to the east. The SMC then advised the flight crew of the 717 to discuss possible pushback options with their ground crew.

Based on the message received from the SMC, the flight crew of the 717 gave clearance to their ground engineer to push back if there was sufficient room to do so.

The 717 ground engineer and tug driver discussed the possibility of pushing the aircraft back safely. As there were no aircraft in bays 8 or 9, they decided that they could conduct the pushback, pointing the aircraft's tail to the west, if the aircraft was kept as close to the terminal as possible. A clearance marshaller was positioned on the left wing of the 717 and the tug commenced the pushback. During the pushback the flight crew of the 717 reportedly started one engine.

The flight crew of the 737 and the ground engineer for the 717 estimated that the clearance between the wing of the 717 and the 737 during the pushback was about 11 m.

The tug disconnected from the 717 and the flight crew obtained a clearance to taxi. The flight crew then started the other engine and taxied to the east. As there was another 717 located in bay 11, the 717 reportedly had to taxi up toward the taxi line to ensure there was sufficient clearance from the aircraft in bay 11.

The ground engineer for the 737 had some concerns about the clearance between the aircraft and stated that he believed the distance between the 717 and 737 was only 1 m when the 717 was disconnected from the tug. The ground engineer also stated that he felt uncomfortable being so close to the aircraft and was concerned that he and another ground engineer who was with him, may have been placed in the inlet and exhaust danger zone of the 717, particularly when the 717 taxied away.

Neither of the ground engineers located near the 737 was injured in the occurrence.

Figure 1: Overview of parking bays and taxiway

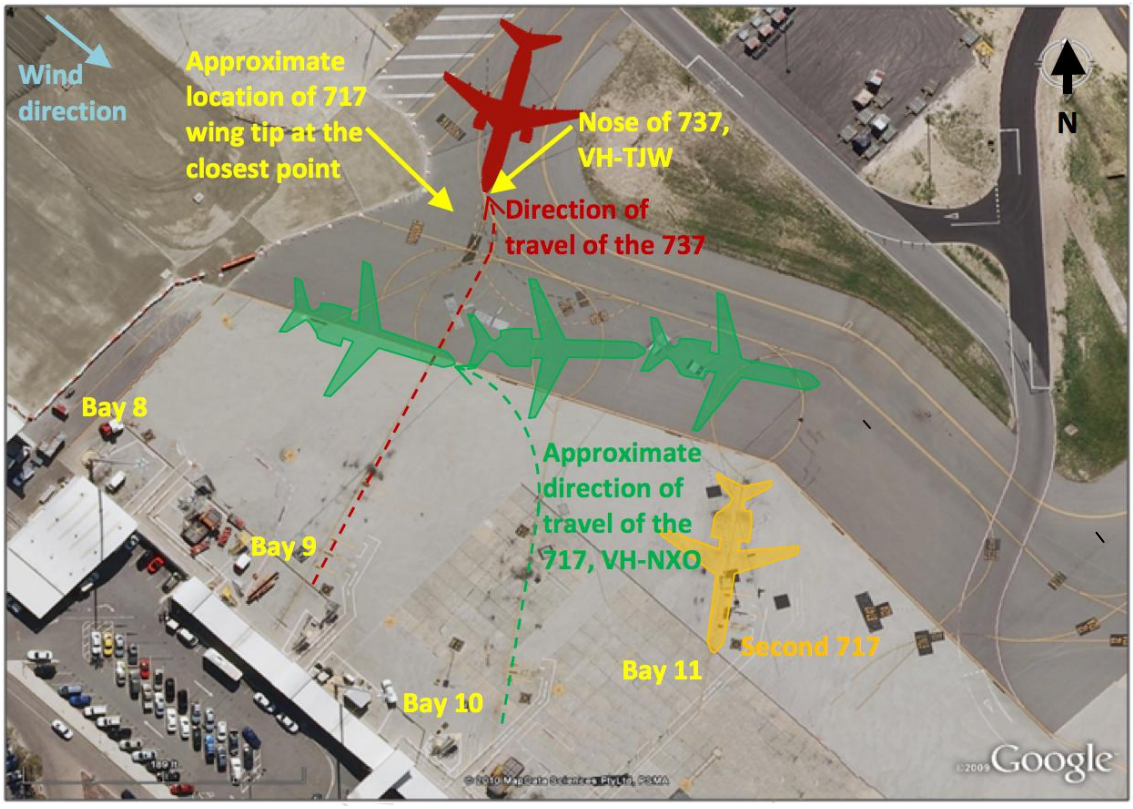


Image courtesy of Google Earth

Boeing 717 engine hazard areas

A turbine engine's inlet and exhaust areas provide a significant hazard to ground personnel. During operation, a turbine engine creates a low-pressure area around the inlet, which leads to large quantities of air surrounding the inlet being sucked into the engine. Therefore, it is necessary for ground personnel to remain a safe distance from the front of the engine. For the 717 this is a radius of 4.35 m from the centre of each engine, within the span of the wing (Figure 2).

Correspondingly, air exits the engine exhaust at a very high speed. For the 717 (two engine operations), air can be travelling at 240 km/h up to 16 m directly behind the engine when the engines are operating with ground idle thrust. The jet exhaust hazard area was localised to 9 m either side of the aircraft centreline.

Wind will affect the direction of the jet exhaust. At the time of the occurrence, the wind was blowing between 12 and 20 kts from the west-north-west. As the 737 was located north of the 717, the wind would not have directed the exhaust towards the 737.

ATSB COMMENT

While it is not possible to reconcile the differing accounts of aircraft proximity, the incident highlights the potential dangers associated with ground operations around jet aircraft and the need for particular care and attention when dealing with dynamic traffic situations.

Figure 2: Boeing 717 engine hazard area and entry corridor, for normal and thrust reverser engine operation

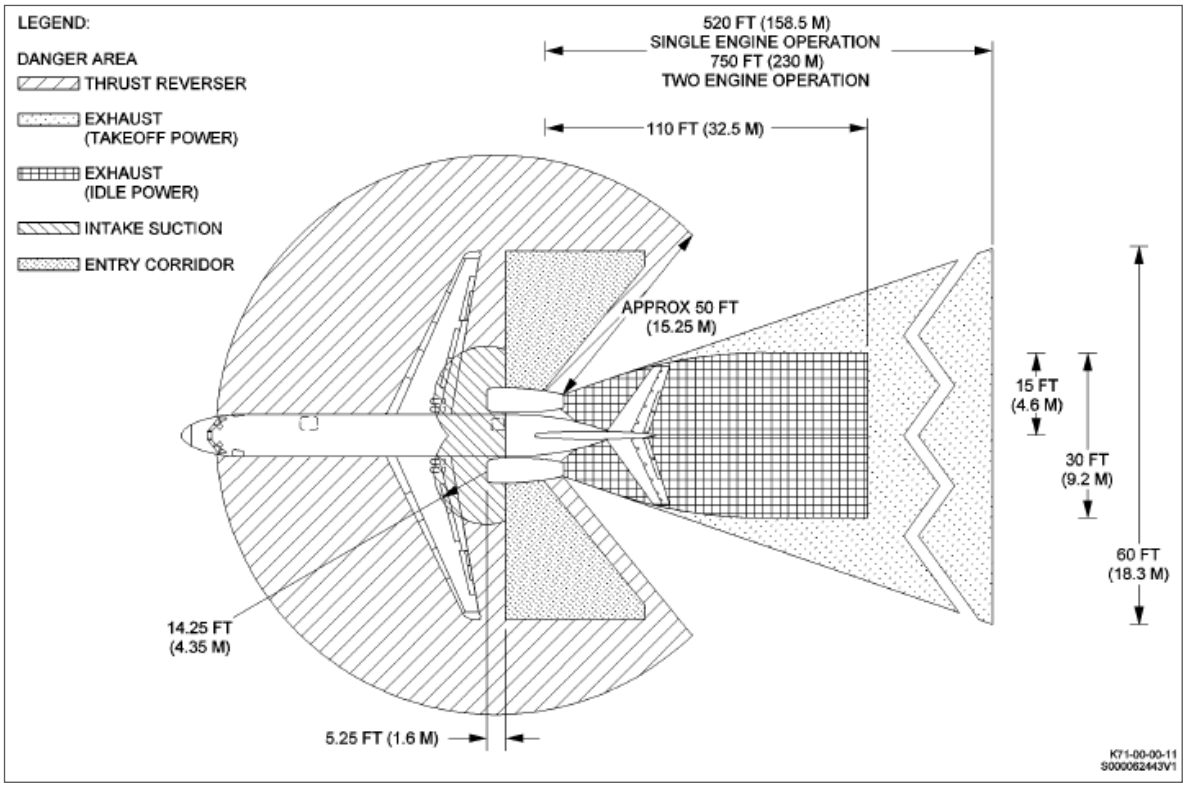


Diagram courtesy of Boeing

AO-2009-076: VH-LIQ, Total power loss

Date and time:	8 December 2009, 1645 EDT
Location:	56 km SE Tamworth Aerodrome, New South Wales
Occurrence category:	Accident
Occurrence type:	Total power loss
Aircraft registration:	VH-LIQ
Aircraft manufacturer and model:	Bell Helicopter Company TH-1F Iroquois
Type of operation:	Aerial work – fire-fighting
Persons on board:	Crew – 2 Passengers – Nil
Injuries:	Crew – 1 (minor) Passengers – Nil
Damage to aircraft:	Serious damage

SYNOPSIS

On 8 December 2009, at about 1645 Eastern Daylight-saving Time[1], a Bell Helicopter Company TH-1F, registered VH-LIQ, was conducting aerial fire-fighting operations south-east of Tamworth, New South Wales (NSW). On approach to a water source, the pilot in command (PIC) noted a loss of engine power. The PIC reported that he lowered the collective[2] and rolled the throttle on; however, the engine continued to spool down. The PIC manoeuvred the helicopter to a cleared area and carried out an emergency landing. The helicopter landed heavily and sustained serious damage. The PIC sustained a fractured nose, while the other occupant (second pilot) was uninjured.

At the time of writing this report, the reason for the total power loss was unknown.

Figure 1: VH-LIQ at the accident site

Photograph courtesy of Mark Ogden

FACTUAL INFORMATION

On 8 December 2009, at about 1430, a Bell Helicopter Company TH-1F (Iroquois), registered VH-LIQ (Figure 1), departed Nundle, NSW to conduct aerial fire-fighting operations. The helicopter was equipped with a 1,300 L Bambi bucket[3] on a 30 m long line. There were two people onboard the helicopter; the PIC and a second pilot[4]. The helicopter had been refuelled prior to departure and was reported to have had full fuel.

At about 1645, the helicopter had conducted about 12 water deliveries and was on approach to a small dam preparing to refill the bucket. The helicopter was approaching the dam from the

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time, as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

2 The collective lever is the pilot control in helicopters that simultaneously directly affects the pitch of all main rotor blades, irrespective of their azimuth position. It is the primary control of a helicopter's altitude or vertical velocity.

3 A collapsible bucket suspended on cables and used by helicopters to deliver water for aerial fire-fighting.

4 The second pilot, was performing a monitoring role and reportedly did not manipulate the flight controls during the accident flight.

south-west and was reportedly travelling at about 30 kts indicated airspeed and 10 kts groundspeed, at a height of about 150 ft above ground level. The PIC reported that as he was positioning the bucket over the dam, he noted a low engine revolutions per minute (RPM) indication.

In response, the PIC reported that he lowered the collective and rolled the throttle on. He then noted a master caution, RPM warning, and warning siren and realised that the engine had failed. The second pilot also reported hearing the engine spool down.

The PIC found a suitable clearing and conducted an emergency landing. He flared the aircraft and cushioned the impact using the collective. The helicopter landed heavily, reportedly yawing left and rolling slightly right. The helicopter sustained serious damage (Figure 2).

After landing, the crew reported a strong fuel smell and noticed fuel leaking from the helicopter. The crew shut down the helicopter and exited when the main rotor blades had ceased rotating. The second pilot noted that the collective was fully up after the impact.

Injuries

The second pilot was secured in a four point harness and braced for impact; he did not receive any injuries. The PIC was secured in a lap belt and had his shoulder harness loosely fitted, to allow him to lean forward and observe the bucket on the long line. The PIC suffered a fractured nose in the impact. Both pilots were wearing helmets.

Aircraft information

The Bell Helicopter Company TH-1F helicopter was manufactured in the United States in 1966. The total time in service was 12,165.7 hours. The most recent maintenance was a 100-hourly inspection performed 87.5 hours prior to the accident. The helicopter was equipped with a General Electric T58-GE-8 gas turbine engine. The engine had a total time in service of 6,925 hours and had accumulated 757.5 hours since its last overhaul.

The aircraft was registered in the restricted category and therefore not permitted to carry passengers.

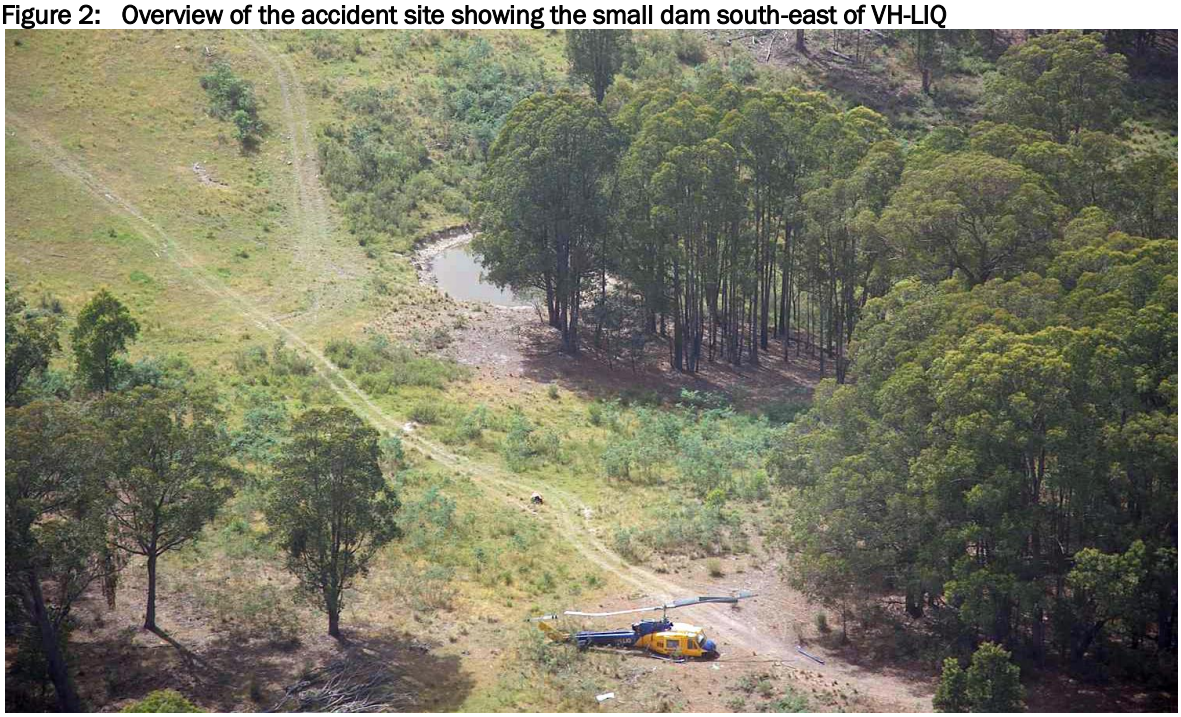
Engine examination

The engine control system was examined by an aviation consultant on behalf of the NSW Rural Fire Service and was reported to have been rigged correctly, with only impact damage observed.

A Licensed Aircraft Maintenance Engineer (LAME) employed by the operator conducted tests on the engine. These indicated that there was unlikely to be a failure within the fuel control unit and that fuel flow between the fuel feed and the flow divider was normal.

The operator removed the engine from the wreckage and sent it to Canada for a full engine tear down and inspection. At the time of publication of this report, the results of this inspection were not known. If further information becomes available relating to the engine failure, the ATSB will update this report.

Figure 2: Overview of the accident site showing the small dam south-east of VH-LIQ



Photograph courtesy of Mark Ogden

AO-2009-078: VH-XFU, Depressurisation

Date and time:	15 December 2009, 1457 WST
Location:	296 km NE of Perth Airport, Western Australia
Occurrence category:	Serious incident
Occurrence type:	Depressurisation
Aircraft registration:	VH-XFU
Aircraft manufacturer and model:	De Havilland Canada DHC-8-102
Type of operation:	Charter - passenger
Persons on board:	Crew – 3 Passengers – 19
Injuries:	Crew – Nil Passengers – Nil
Damage to aircraft:	Nil

SYNOPSIS

On 15 December 2009, a De Havilland Canada DHC-8-102 aircraft, registered VH-XFU, departed Perth, Western Australia (WA) on a charter passenger service to Darlot, WA. While cruising at flight level (FL)[1] 230, the aircraft sustained multiple system failures, followed by a depressurisation. The crew actioned the aircraft depressurisation checklist and commenced an emergency descent. During the descent, a number of system cautions and warnings illuminated. The crew elected to return to Perth and a descent to 8,000 ft was made. Shortly after, the majority of the aircraft's systems returned to normal.

A subsequent engineering investigation was unable to replicate the system faults. However, it appeared that the number-1 direct current (DC) generator output was spiking, causing power to the left DC buses to be repeatedly switched between the number-1 transformer rectifier unit[2] and the left DC generator. This repeated power switching resulted in some of the aircraft's systems behaving erratically.

As a precaution, the number-1 generator control unit[3], number-1 DC generator and left bus tie relay were replaced.

FACTUAL INFORMATION

On 15 December 2009, a De Havilland Canada DHC-8-102 aircraft, registered VH-XFU (Figure 1), was being operated on a 'closed charter'[4] passenger service from Perth to Darlot, WA for the purposes of transporting mining personnel. On board the aircraft were two flight crew, one cabin crew member and 19 passengers.

Figure 1: VH-XFU

Photograph courtesy of Neville Murphy

1 Flight level is a level of constant atmospheric pressure related to a datum of 1013.25 hectopascals, expressed in hundreds of feet. Therefore, flight level 230 indicates 23,000 ft.

2 Transformer rectifier units convert alternating current (AC) to DC.

3 Generator control units control the supply and switching of electrical power to aircraft systems.

4 'Closed charter' operations refer to the carriage of passengers and/or cargo on fixed schedules to and from fixed terminals where accommodation in the aircraft is not available for use by persons generally (Civil Aviation Regulation 206(1)(b)(ii)).

At about 1451 Western Standard Time[5], the aircraft reached its cruising altitude of FL230. About 3 minutes later, the pilot in command's (PIC's) altimeter began to fluctuate intermittently between plus and minus 300 to 400 ft, with the orange fail flag appearing. This occurred five times, lasting 15 to 20 seconds on each occasion. At the same time, both advisory display units went blank. This was followed by the pressurisation fault light illuminating and the cabin altitude rate of climb indicator showing an increase, signifying depressurisation of the cabin.

The flight crew requested an emergency descent from air traffic control and attempted to establish communications with the cabin crew member via the intercom and emergency call switch, with no success. The crew then used the seat belt sign to alert the cabin crew member and passengers to be seated.

The crew actioned the immediate checklist items for an aircraft depressurisation and donned their oxygen masks, confirmed the seat belt sign was turned on, and commenced descent.

Shortly after the descent was initiated, the number-1 DC generator caution light illuminated followed by cautions and warnings for the transponder, enhanced ground proximity warning system (EGPWS), traffic alert and collision avoidance system (TCAS), weight on wheels, and configuration warning horn. The crew elected to return to Perth and descended to 8,000 ft. Soon after, the number-1 DC generator caution light, weight on wheels, and TCAS warnings/cautions extinguished. The cabin pressurisation system also returned to normal; however, the EGPWS caution remained on.

The crew attempted to advise the passengers of the situation, but the announcement was inaudible. The cabin crew member relayed the crew's intentions. The aircraft returned to Perth without further incident.

Aircraft information

The aircraft's electrical system was separated into left (number-1) and right (number-2) systems. The two sets of electrical buses used DC power, normally provided by two DC generators in the aircraft's engines. If one of the DC generators became inoperable, electrical power could be sourced from one of two engine-mounted AC generators via transformer rectifier units to convert AC power to DC power. The switching of electrical power was carried out by two generator control units controlling several bus tie relays. The aircraft's left main DC electrical bus powered the cabin pressure control system.

Electrical spiking

An engineering investigation conducted by the operator was unable to reproduce the system faults. However, all of the systems affected were powered by the number-1 main DC bus. It appeared that the number-1 DC generator output was spiking, causing power to the left DC buses to be repeatedly switched between the number-1 transformer rectifier unit and the left DC generator. This repeated power switching resulted in some of the aircraft's systems, including the cabin pressure control system, behaving erratically. The number-1 generator control unit, number-1 DC generator, and the left hand bus tie relay were replaced.

Cabin information

The cabin crew member was serving lunch to the crew when the PIC's altimeter began to fluctuate; she immediately left the flight deck, secured the galley and sat down. The cabin crew member reported that she could hear chimes and noticed the seat belt sign turning on and off, indicating an emergency; however, no lights appeared on the cabin crew panel. In response, the cabin crew member made an announcement to the passengers and advised them to remain seated as the aircraft was experiencing technical problems.

The call button light then illuminated on the panel and the cabin crew member picked up the handset, but only interference could be heard. Communications were eventually established with the crew who enquired about the welfare of the passengers and advised that the aircraft had experienced a depressurisation.

The cabin crew member informed the passengers of the situation and to remain seated as the aircraft was descending to a lower altitude. The passengers were asked if they were feeling faint or

[5] The 24-hour clock is used in this report to describe the local time of day, Western Standard Time, as particular events occurred. Western Standard Time was Coordinated Universal Time (UTC) + 8 hours.

experiencing ear problems. None of the passengers experienced medical difficulties. The crew informed the cabin crew member that they were returning to Perth and to advise the passengers.

ATSB COMMENT

Research published by the ATSB has shown that the chances of having a depressurisation problem are very low; however, they do happen. While infrequent, it is important that not only the flight crew and cabin crew respond appropriately, but passengers are aware of how it affects them and what they can do when such an event occurs. The following ATSB publications provide some useful information on aircraft depressurisation events:

- Aircraft Depressurisation: Cabin crew information bulletin (2009)
- Staying Safe during an Aircraft Depressurisation: Passenger Information Bulletin (2008)
- Depressurisation Accidents and Incidents Involving Australian Civil Aircraft: 1 January 1975 to 31 March 2006 (2006)

For a full copy of these reports, please visit the ATSB's website at www.atsb.gov.au.

AO-2009-079: VH-NZB, Loss of aircraft control

Date and time:	25 November 2009, 1151 EST
Location:	Longreach Aerodrome, Queensland
Occurrence category:	Serious incident
Occurrence type:	Loss of aircraft control
Aircraft registration:	VH-NZB
Aircraft manufacturer and model:	Ayres Corporation S2R-T34
Type of operation:	Aerial work – test and ferry
Persons on board:	Crew – 1 Passengers – Nil
Injuries:	Crew – Nil Passengers – Nil
Damage to aircraft:	Nil

SYNOPSIS

On 25 November 2009, an Ayres Corporation S2R-T34[1] aircraft, registered VH-NZB (Figure 1), was being operated on a ferry flight from Parkes, New South Wales (NSW) to Batchelor, Northern Territory (NT), with an initial intermediate stop at Longreach, Queensland (Qld). While on final approach to Longreach, without warning, the aircraft's nose pitched upward and an aerodynamic stall resulted. The pilot, the sole occupant, regained control and the aircraft landed safely.

Figure 1: VH-NZB

Photograph courtesy of Martin Eadie

A subsequent engineering investigation by the aircraft's maintenance provider determined that the elevator push rods had been fitted in the reverse order during recent maintenance, thus restricting the amount of nose down elevator travel available to the pilot.

The maintenance organisation advised the ATSB that, as a result of this occurrence, it has initiated a number of safety actions, including:

- exploring options for modifying the design of the bellcrank assembly to ensure that the push rods can only be fitted in the correct position
- ensuring that all employees are aware of their responsibilities when conducting dual maintenance inspections on flight control systems.

FACTUAL INFORMATION

On 25 November 2009, at about 0800 Eastern Daylight-saving Time[2], an Ayres Corporation S2R-T34 aircraft, registered VH-NZB, departed Parkes, NSW on a ferry flight to Batchelor, NT. The aircraft was being transported for the purposes of spraying operations in the Batchelor region, with intermediate stops planned for Longreach and Mt. Isa, Qld.

On arrival at Longreach, the pilot joined the circuit on the downwind leg. At 1151 Eastern Standard Time, while on final approach, at about 300 ft and

[1] The aircraft was imported into Australia as an Ayres Corporation S2R-R1820 (radial engine). In the early 1990's, the aircraft was converted to an S2R-T34 variant (turbine engine).

[2] The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time and Eastern Standard Time, as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours and Eastern Standard Time was UTC + 10 hours.

1.9km from the runway, the nose of the aircraft pitched upwards. The pilot responded by applying full nose down trim and pushing the control stick forward. Despite the pilot's attempts to regain control of the aircraft, the aircraft continued to climb and consequently sustained an aerodynamic stall, with the right wing dropping. The pilot applied full power, full opposite (left) rudder, and released the load in the hopper. The pilot regained control and climbed the aircraft to a safe height. A second circuit was performed and the aircraft was landed without further incident.

After landing, the aircraft was inspected by a Licensed Aircraft Maintenance Engineer (LAME) who identified that the elevator push rods had been incorrectly positioned, thus limiting the nose-down travel of the elevator.

Recent maintenance

The most recent maintenance performed on the aircraft was 3 weeks prior to the incident, when a 100-hour inspection was carried out.

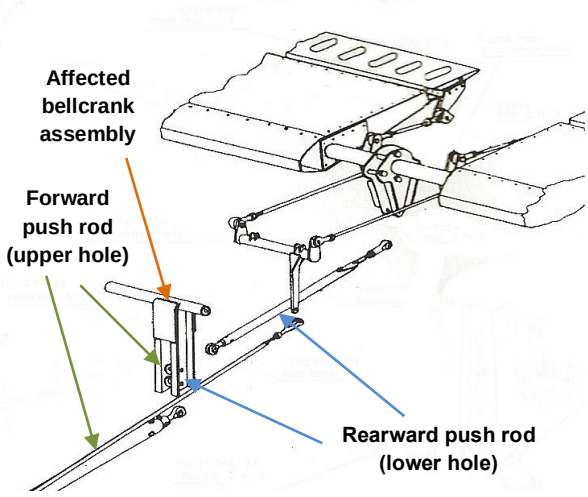
As part of the maintenance, an apprentice, who had been employed with the organisation for a period of 6 months, was tasked with removing the elevator bellcrank assembly and replacing two bearings on the hinge point in accordance with the Thrush Aircraft[3] maintenance manual. The apprentice replaced the bearings, refitted the bellcrank assembly, and then refitted the bellcrank push rods to the bellcrank assembly. The bolts were tightened and the bellcrank pivot bolts split pinned. The work was then inspected by two LAME's (including the Chief Engineer/owner) who found all bolts and split pins to be serviceable and the movement of the system functioning correctly. The aircraft was placed back into service, with no difficulties reported by the pilot or operator up until the incident flight. The aircraft had flown for about 22 hours after the maintenance was performed.

Bellcrank assembly

As shown in Figure 2, the bellcrank assembly has two vertical holes about 1.5 inches apart; with the push rod coming from the control stick (forward push rod) positioned in the upper hole and the push rod from the elevator (rearward push rod) positioned in the lower hole. Both holes are the same size, thus allowing both push rods to be positioned in either hole.

When the push rods were refitted into the bellcrank assembly, they were placed in reverse order; the forward push rod placed in the lower hole and the rearward push rod placed in the upper hole. While the elevator system still functioned correctly, the incorrect positioning of the push rods limited the nose down travel of the elevator. Ground simulations conducted by the maintenance organisation determined that the last 6º of elevator down was not available due to the incorrect fitment of the push rods.

Figure 2: Elevator bellcrank assembly



Drawing provided by VH-NZB's maintenance provider

Dual maintenance inspections

Civil Aviation Regulation (1998) (CAR) 42G stipulates requirements when any part an aircraft's flight control system is assembled, adjusted, repaired, modified or replaced in the course of carrying out maintenance. In these cases, the system must be inspected by the person who carried out the work and by an independent person such as a LAME. The person performing the inspection must check that the work was carried out in accordance with approved maintenance data and check that the system functions correctly.

As required by CAR 42G, the work performed by the apprentice was independently checked by two LAME's. The organisation reported that when the inspections were carried out, the safety of the bolts, split pins and movement of the system were examined; however, particular attention was not given to the position of the push rods. The

[3] Ayres Corporation was purchased by Thrush Aircraft Inc. on 30 June 2003.

proximity of the two bellcrank assembly holes necessitates a thorough inspection to ensure that the push rods have been correctly fitted.

Weight and balance

Due to the nature of the flight, the aircraft was loaded with luggage and equipment in the back seat and about 800 L of fuel in the hopper, resulting in a rearwards centre of gravity (c.g). The operator advised that the aircraft was within the manufacturer's stipulated weight and balance limits.

On final approach, when the aircraft was slowed to the landing speed, the rearwards c.g necessitated more nose-down elevator deflection than that previously required. Due to the incorrect positioning of the push rods, full nose-down elevator deflection was not available.

Consequently, the nose of the aircraft pitched upwards, and despite the pilot's attempts to arrest the situation, the aircraft continued to climb and sustained an aerodynamic stall.

The incident flight was the first time the pilot had landed the aircraft with a rearwards c.g since the maintenance was performed.

SAFETY ACTION

While there is the possibility for safety issues to be identified throughout the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The following proactive safety action in response to this incident has been submitted by those organisations.

Aircraft maintenance organisation

Design modification

The aircraft maintenance organisation advised the ATSB that it has approached the aircraft manufacturer and discussed options for modifying the bellcrank assembly so that the push rods can only be fitted in the correct position. Additionally, the organisation has proposed that an engineering order could be generated to weld a tag across the front of the lower bellcrank assembly hole to ensure that the forward push rod cannot be fitted to this position.

Dual inspections and certification

The owner of the organisation has held discussions will all employees to highlight the importance of a thorough dual inspection and the need to examine the entire flight control system for travel distances and functionality. All employees were also provided with a copy of CAR 42G (flight control system: additional requirements) and CAR 42ZP (certification not to be made) to ensure that they were aware of their regulatory responsibilities.

Human performance

The owner of the organisation has recognised the personal impact of fulfilling the role of both business owner and Chief Engineer, citing high workload and fatigue as performance decrements. The owner has advised the ATSB that his workload has been dispersed amongst his employees and that he intends to 'work on the business rather than heavily in it'.

ATSB COMMENT

The study of human factors in maintenance has become increasingly significant to ensure aircraft remain reliable and safe. The ATSB and its predecessor, the Bureau of Air Safety Investigation, have published a number of informative research reports examining human factors in maintenance:

- An overview of Human Factors in Aviation Maintenance (2008)
- ATSB Survey of Licensed Aircraft Maintenance Engineers in Australia (2001)
- Aircraft Maintenance Safety Survey (1997)
- Human Factors in Airline Maintenance: A Study of Incident Reports (1997)

For a full copy of these reports, please visit the ATSB's website at www.atsb.gov.au.

AO-2010-001: VH-PDW, In-flight fire

Date and time:	7 January 2010, 1828 EDT
Location:	74 km S of Tamworth Airport, New South Wales
Occurrence category:	Serious incident
Occurrence type:	Inflight fire
Aircraft registration:	VH-PDW
Aircraft manufacturer and model:	Convair 580
Type of operation:	Flying training
Persons on board:	Crew – 3 Passengers – Nil
Injuries:	Crew – Nil Passengers - Nil
Damage to aircraft:	Minor

SYNOPSIS

On 7 January 2010, the crew of a Convair 580 aircraft, registered VH-PDW, were conducting a training flight from Bankstown to Tamworth, New South Wales (NSW). While on descent to Tamworth, the crew noticed smoke emanating from below the instrument panel. Shortly after, the smoke intensified and flames appeared. The flight crew declared an emergency and suppressed the flames using a portable fire extinguisher. The crew continued the descent and the aircraft landed without further incident.

A subsequent engineering inspection revealed that a small amount of insulation material had become detached and fallen onto the right red instrument panel light rheostat[1] and surrounding wires. The rheostat had developed a 'hot spot' and consequently, the insulation absorbed the heat and transferred it to the wires, which produced smoke and flames.

The operator has advised the ATSB that, as a result of this occurrence, it has implemented a number of safety actions, including:

- all of the organisation's aircraft have been examined to ensure that there is sufficient clearance between the rheostats, insulation material and wires
- any insulation material located in close proximity to a rheostat has been removed
- a notice to crew was issued to emphasise the importance of recording defects in the maintenance log.

FACTUAL INFORMATION

On 7 January 2010, at about 1755 Eastern Daylight-saving Time[2], a Convair 580 aircraft, registered VH-PDW (Figure 1), departed Bankstown, NSW on a training flight to Tamworth, NSW operating under instrument flight rules. On board the aircraft were two flight crew and a safety pilot.

Figure 1: VH-PDW

Photograph courtesy of Martin Eadie

[1] A rheostat is an electrical component that varies resistance in a circuit.

[2] The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time, as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

While on descent, about 74 km south of Tamworth, the crew smelt smoke in the cockpit. Smoke then appeared from below the instrument panel. The crew transmitted a PAN[3] to air traffic control (ATC).

The crew donned oxygen masks, but the safety pilot's supply hose for the portable oxygen bottle was split. The safety pilot moved to the rear of the aircraft to avoid the smoke.

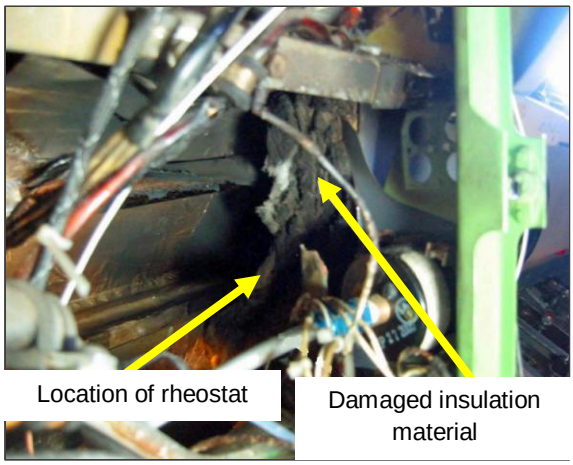
The crew reported that shortly after, the smoke intensified and flames were observed. In response, the crew suppressed the flames and smoke using a portable fire extinguisher and broadcast a MAYDAY[4] to ATC. At the same time, the red instrument light circuit breaker popped.

The descent was continued and the aircraft landed without further incident. The crew were taken to hospital as a precaution, but released soon after without any reported medical concerns.

Panel light rheostat

An engineering investigation conducted by the operator determined that the right red instrument panel light rheostat had developed a 'hot spot'. A small amount of insulation material located adjacent to, and above the rheostat had become detached and fallen onto the rheostat and wires within close proximity (Figure 2). The insulation material absorbed the heat from the 'hot spot' and transferred it to the wires, which produced smoke and flames.

Figure 2: Back of right instrument panel



Photograph courtesy of aircraft operator

Further examination identified that the rheostat had a broken moveable contact and a burnt contact surface; eight wires surrounding the rheostat were also damaged. The rheostat and affected wires were replaced.

Previous defect

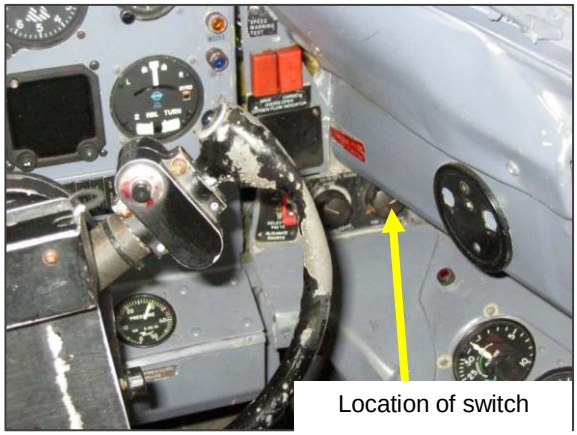
About 2 months prior to the incident, the aircraft was being operated on a night cargo flight. The pilot in command of this flight advised a Licensed Aircraft Maintenance Engineer (LAME) with aircraft electrical qualifications that the right red instrument panel light rheostat was not operating as expected. The defect was not recorded in the aircraft maintenance log.

The LAME inspected the rheostat and confirmed that it was working intermittently and subsequently placed an 'INOP' sticker on the panel light switch. Due to the obscure location of the switch (Figure 3), the 'INOP' sticker went unnoticed.

[3] PAN - A transmission made in the case of an urgency condition, which concerns the safety of an aircraft or its occupants, but where the crew does not require immediate assistance.

[4] MAYDAY – The international call for urgent assistance.

Figure 3: Location of right red instrument panel light switch



Photograph courtesy of aircraft operator

SAFETY ACTION

While there is the possibility for safety issues to be identified throughout the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The following proactive safety actions in response to this incident have been submitted by those organisations.

Aircraft operator

Maintenance defects

The aircraft operator has issued a notice to crews to emphasise the importance of recording defects in the aircraft maintenance log.

At a recent flight crew meeting, the operator informed crews of the actions to be taken when any part of the aircraft has been classified as 'inoperative'. This information will also be communicated to maintenance personnel.

Rheostats

The operator advised the ATSB that the following actions have been taken in relation to the inspection and replacement of rheostats:

- all of the operator's aircraft have been examined to ensure that there is sufficient clearance between the rheostats, insulation material, and surrounding wires. The operator will continue this examination as part of the aircraft's 375 hourly inspection.
- any insulation material located in close proximity to a rheostat has been removed.
- a search has been conducted to locate replacement rheostats that produce minimal heat. The operator is now in the process of selecting the most suitable rheostat and will seek the appropriate approval from the Civil Aviation Safety Authority for fitment.

Oxygen masks

The safety pilot's oxygen mask and hose were replaced. All other oxygen masks were examined for signs of deterioration, wear or damage – no defects were found. The operator has advised that the following additional actions have been taken:

- the operator is in the process of obtaining and trialling a longer hose for the portable oxygen bottle in an attempt to minimise the potential for damage
- at the 25-hour safety equipment inspection, a more detailed examination of the oxygen masks and hoses will be conducted
- the oxygen masks will be removed at the 6 month inspection and be examined for damage or deterioration.

Level 5 Factual Investigations:
1 December 2009 to 30 March 2010
Issue 1