Australian Government
Australian Transport Safety Bureau

Depressurisation event involving de Havilland DHC-8, VH-XFP

67 km N Perth Airport, Western Australia, 7 August 2016

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Aviation Occurrence Investigation
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Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

Addendum

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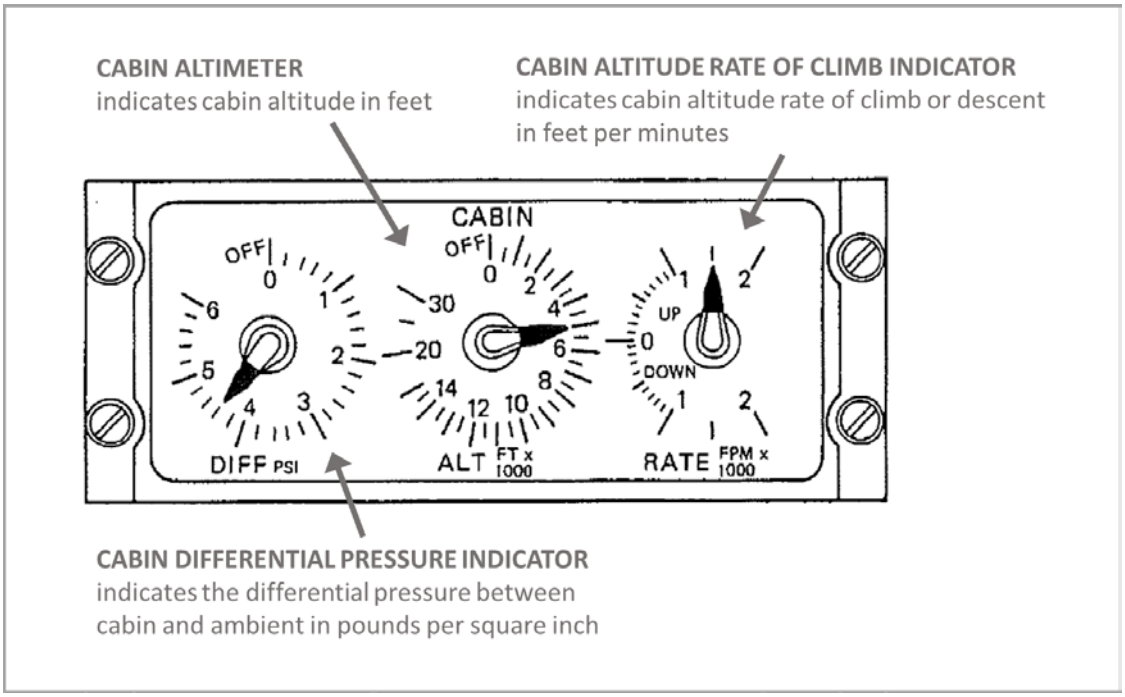
Depressurisation event involving de Havilland DHC-8, VH-XFP

What happened

At about 1330 Western Standard Time (WST) on the 7 August 2016, a Skippers Aviation de Havilland DHC-8-106 aircraft, registered VH-XFP (XFP), departed Perth Airport for Shark Bay Western Australia. Two flight crew, one cabin crew and 30 passengers were on board the regular public transport flight.

At about 10,000 ft, the flight crew conducted the transition checklist items that included checking the cabin pressurisation system and noted that everything was operating normally. The captain observed that the cabin altitude[1] was about 4,000 ft, the rate of climb was between 250 ft and 500 ft, and the maximum differential pressure between the outside air pressure and the cabin air pressure was about 2.5 to 3 psi (Figure 1).

Figure 1: Cabin pressure indicator panel showing the cabin differential pressure, cabin altimeter and cabin altitude rate of climb indicators



Source: Aircraft Maintenance Manual, modified by the ATSB

At about flight level (FL) 176[2] the flight crew engaged the autopilot. As the aircraft approached the cruising altitude FL 180, the master warning activated and the cabin pressure warning light[3] illuminated. The crew observed that the cabin altitude indicated about 12,600 ft with an excessive rate of climb, where the rate of climb indicator had gone to its maximum indicated reading. They conducted their phase one memory checklist items for a rapid depressurisation and an emergency descent. Both crewmembers fitted their oxygen masks and the captain, who was not the flying

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1 Pressurisation of the cabin is displayed as cabin altitude and is the equivalent to outside pressure at different altitudes. A cabin altitude of 4,000 ft corresponds to an atmospheric pressure of 4,000 ft.

2 Flight level: 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 176 equates to 17,600 ft.

3 If the cabin altitude exceeds 10,000 ft, this automatically illuminates the 'CABIN PRESS' warning light on the warning light panel. The light will remain illuminated until the cabin altitude decreases below 10,000 ft.

pilot, took control of the aircraft. The captain made an announcement through the aircraft's public announcement (PA) system. However, the announcement was muffled and distorted and the cabin crewmember did not understand what was being said. The cabin crewmember tried contacting the flight crew but did not get a response. The flight crew selected the passenger seat belt sign on and commenced an emergency descent. The cabin crewmember realised that the aircraft was in a descent, fastened their seatbelt and using the PA system instructed the passengers to do the same. The cabin crewmember did not use supplemental oxygen (available at the flight attendant seat), as they were not aware of the nature of the emergency. Oxygen was not made available for passengers (see *Passenger oxygen requirements* below). The first officer declared an emergency (PAN PAN)[4] to air traffic control and advised that they were on descent through FL 175.

The captain levelled the aircraft at about 10,000 ft, re-engaged the autopilot and the crew conducted the cabin pressurisation failure checklist. The crew were not able to regain control of the cabin pressurisation. The maximum cabin altitude observed by the crew was just over 14,000 ft and this had returned to 10,000 ft when the aircraft was at an altitude of about 10,000 ft. The cabin pressure warning light remained on. The captain called the cabin crewmember and informed them that they were returning to Perth. The cabin crewmember then carried out a cabin check to ensure that the passengers were not injured and the cabin was secured.

The flight crew contacted the operator's maintenance personnel and were not able to isolate the reason for the fault. As the aircraft was above the maximum landing weight, they tracked to Rottnest Island to conduct a holding pattern to burn enough fuel to reduce the weight for a landing at Perth. The cabin pressure warning light extinguished on the way to Rottnest Island. The aircraft returned for a landing at Perth without further incident. The two flight crew, one cabin crew and 30 passengers were not injured and the aircraft was not damaged.

Passenger Oxygen requirements

Due to the lower altitudes that this aircraft model operates at, drop down oxygen masks for passengers and cabin crew were not installed nor required. Instead, the aircraft was supplied with portable oxygen bottles that can be handed out throughout the cabin to 10 per cent of the occupants, providing oxygen for half an hour. This is in accordance with Civil Aviation Order 20.4 (7) *Supplemental oxygen requirements for pressurised aircraft engaged in flights not above flight level 250:*

> 7.5 Supplemental oxygen for passengers
>
> (a) where the aircraft can safely descend to Flight Level 140 or a lower level within 4 minutes at all points along the planned route and maintain Flight Level 140 or a lower level for the remainder of the flight — to provide 10% of the passengers with supplemental oxygen for 30 minutes or 20% of the passengers with supplemental oxygen for 15 minutes;

Captains comment

The captain reported practicing emergency descents and pressurisation faults about two weeks prior to the occurrence when conducting simulator training. They commented how valuable that training was to be prepared for this type of occurrence where they could identify that it was not a gradual or subtle depressurisation.

The captain reported that there was no warning or anything that would have indicated that there was a cabin pressurisation failure apart from the activation of the cabin pressure warning system.

The captain was not aware that the PA to the cabin was muffled. The captain also reported that the cabin crewmember had not heard the instruction for cabin crewmembers to use supplemental oxygen until after the flight had landed.

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[4] PAN PAN: an internationally recognised radio call announcing an urgency condition which concerns the safety of an aircraft or its occupants but where the flight crew does not require immediate assistance.

Operator comments

The operator conducted an investigation into the occurrence, and after testing of the forward safety outflow valve, found that it was outside the aircraft maintenance manual specifications, and believed that it was the reason for the cabin pressurisation failure.

The operator reported that during the occurrence, the captain made a public announcement, which the passengers and cabin attendant did not understand as the announcement was muffled and distorted. The pilot's oxygen mask audio system was tested and found to be serviceable. The most likely reason that the announcement was not heard clearly was that the oxygen masks might have distorted the communication.

Safety analysis

The forward outflow valve was not operating as required which led to a rapid depressurisation of the aircraft as it approached its cruising altitude.

The PA announcement from the captain was muffled, resulting in the cabin crewmember not initialling realising that the flight crew were conducting an emergency descent and that they should use supplemental oxygen.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The aircraft's cabin pressurisation system failed resulting in the aircraft depressurising.
- The PA to the cabin was muffled as the crew were using oxygen masks and potentially critical information was not communicated to the flight attendant and the passengers.
- The flight crew fitted their oxygen masks immediately, when they noticed, at about 12,600 ft cabin altitude that the cabin pressure warning system had activated.

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.

Skippers Aviation

As a result of this occurrence, the aircraft operator has advised the ATSB that they are taking the following safety actions:

Raise pilot awareness on the difficulty of communication when they fit an oxygen mask and its effect on their clarity of speech. In such cases, they may be required to be more deliberate and punctuate their instructions.

The continuing airworthiness management system will continue to monitor XFP for any associated defects. The faulty valve will be overhauled to determine why it failed.

Safety message

The reaction time for pilots to fit oxygen masks is of critical importance when there is a cabin pressurisation failure. For the crew in this occurrence, it was the first action taken when they detected that the cabin pressure warning light was on. A misconception is that it is easy to recognise the symptoms of hypoxia and take corrective action before becoming seriously impaired. The signs and symptoms vary depending on the individual, the altitude and the extent of the exposure. While other significant effects of hypoxia usually do not occur in a healthy person in an unpressurised aircraft below 12,000 ft above mean sea level (AMSL), there is no assurance

that this will always be the case. Furthermore, the altitude range of impairment due to hypoxia is best described as a continuum; there is no definitive altitude at which the effects of hypoxia begin or end. To mitigate the risk associated with these variations, if hypoxia is suspected, a descent to altitudes below 10,000 ft AMSL is suggested.

Additional information is provided in the following publications:

The ATSB research report, *Depressurisation Accidents and Incidents Involving Australian Civil Aircraft* (B2006/0142), is available from the ATSB website.

The ATSB investigation *report Pilot and Passenger Incapacitation Beech Super King Air 200, VH-SKC, Wernadinga Station, Qld, 4 September 2000* (200003771), is available from the ATSB website.

US Federal Aviation Administration (FAA) Advisory Circular AC 61-107B *Aircraft Operations at Altitudes Above 25,000 Feet Mean Sea Level or Mach Numbers Greater Than .75/ with Change 1*, is available from the FAA website.

General details

Occurrence details

Date and time:	7 August 2016 – 1345 WST	
Occurrence category:	Serious incident	
Primary occurrence type:	Depressurisation event	
Location:	67 km N Perth Airport, Western Australia	
	Latitude: 31° 20.35' S	Longitude: 115° 56.85' E

Aircraft details – VH-XFP

Manufacturer and model:	de Havilland DHC-8-106	
Registration:	VH-XFP	
Operator:	Skippers Aviation	
Serial number:	346	
Type of operation:	Air Transport Low Capacity - Passenger	
Persons on board:	Crew – 3	Passengers – 30
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

About the ATSB

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

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 report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.