AO-2010-003: VH-NTQ, In-flight engine shut down

Date and time:	14 January 2010, 0645 WST
Location:	Beagle Bay, Western Australia
Occurrence category:	Accident
Occurrence type:	Partial power loss (In-flight engine shutdown)
Aircraft registration:	VH-NTQ
Aircraft manufacturer and model:	Cessna Aircraft Co 208B Caravan
Type of operation:	Charter
Persons on board:	Crew – 1 Passengers – 0
Injuries:	Crew – 1 (Minor)
Damage to aircraft:	Seriously damaged

SYNOPSIS

On 14 January 2010, a Cessna Aircraft Co. 208B Caravan, registered VH-NTQ, was en-route from Broome to Koolan Island, Western Australia (WA) at an altitude of about 9,500 ft, when the pilot noticed a drop in the engine torque indication, with a corresponding drop in the engine oil pressure indication. The pilot diverted to the nearest airstrip, which was Beagle Bay, WA. The pilot shut the engine down when the low oil pressure warning light illuminated and conducted a landing at Beagle Bay airstrip. The aircraft overran the airstrip, coming to rest upside down after impacting a mound of dirt. The aircraft was seriously damaged. The pilot, who was the only occupant, sustained minor injuries.

Following the accident, the Civil Aviation Safety Authority (CASA) issued an airworthiness bulletin, AWB 72-004 Issue 1, on 8 February 2010 to all Cessna 208 aircraft operators in Australia. The bulletin highlighted previous service difficulty reports on similar failures and the possibility of the accident aircraft having experienced the same problem. The bulletin recommended the inspection of the engine oil transfer tube attachment lugs for cracks and the inspection of the engine vibration isolator mounts for correct installation. Any defects in the area of the vibration mounts and oil tubes were to be reported to CASA post inspection. At the time of writing this report, one case of an oil tube with a loose fit and wear had been reported.

FACTUAL INFORMATION

On 14 January 2010, a Cessna Aircraft Company 208B (Caravan), registered VH-NTQ, departed Broome on a charter flight to Koolan Island, WA. At about 0645 Western Standard Time[1], when the aircraft was at an altitude of about 9,500 ft, the pilot noticed a drop in the engine torque indication with a corresponding drop in the engine oil pressure indication. The pilot increased the power lever setting but the engine torque and oil indications continued to reduce, all other engine indications were normal. During an interview with the Australian Transport Safety Bureau (ATSB) the pilot stated that he felt a power loss associated with the drop in indicated engine torque.

The pilot diverted to the nearest airstrip, which was Beagle Bay, WA. He stated that the low oil pressure warning light illuminated so he shut the engine down and prepared for an emergency landing. The pilot reported that on the final approach to the airstrip he realised that the aircraft was too high and its airspeed was too fast. The aircraft touched down about mid way along the runway and overran the end of the runway by about 200 metres. The aircraft impacted a mound of dirt, coming to rest upside down (Figure 1).

[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 Coordinated Universal Time (UTC) + 8 hours.

Figure 1: Accident site

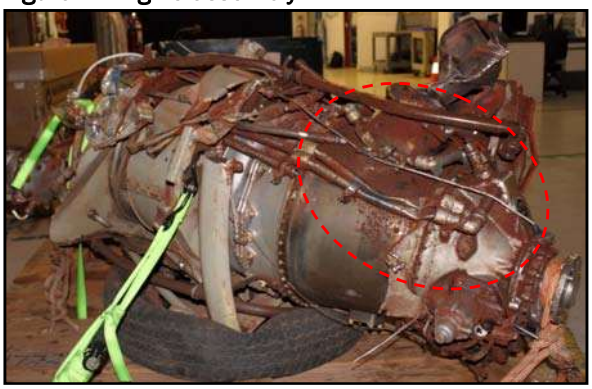
Photograph courtesy of a third party

The pilot, who was the only occupant sustained minor injuries. Examination of the aircraft by a third party and inspection of the photographs taken of the accident site, revealed that the engine, left main gear and nose gear had separated from the airframe during the accident sequence. There was a significant amount of oil present on the underside of the aircraft, indicating that the oil had leaked from the engine during operation. The engine was removed from the accident site as an assembly by a third party. The propeller was removed and the engine was shipped to an engine overhaul facility where a disassembly and examination was conducted under the supervision of the ATSB.

Engine examination

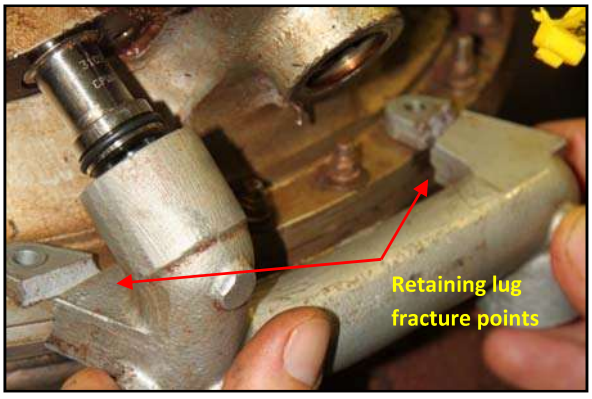
External examination of the engine showed that red dust from the accident site had attached itself to the areas of the engine that had been contaminated with engine oil. It was apparent that there was a high concentration of oil on the outer surface of the reduction gear box between the 4 and 7 o'clock positions, the mid and rear sections of the engine were relatively oil free in comparison. Figure 2 shows the engine assembly as received at the engine overhaul facility, attached to a pallet with the bottom of the engine facing upwards; the highlighted area indicates a high concentration of oil contamination.

Figure 2: Engine assembly



The engine examination revealed accident damage to several components and oil lines. All of the engine's external oil seals were inspected with no pre-accident defects identified. The engine was disassembled at the hot section and accessory gear box, so an internal examination could be conducted. No pre-accident defects were noted during the internal examination. The accessory gear box chip detector, reduction gear box chip detector and the engine's main oil filter were inspected, with no foreign particles or debris noted in the oil system. Approximately 1 quart (0.92 L) of oil was drained from the engine, which had a normal operating capacity of 14 quarts (13.25 L). A sub section of oil pressure tube, that transferred oil from the oil pressure pump to the reduction gear box, was found to have fractured at both attachment lugs (Figure 3).

Figure 3: Oil transfer tube



In order to establish the manner in which the oil tube attachment lugs had fractured and whether or not the failure contributed to the oil pressure issues, the tube was sent to the ATSB engineering facilities for a detailed metallurgical examination.

Oil transfer tube metallurgical examination

The factors that contributed to the oil transfer tube attachment lug failures could not be conclusively

identified during the detailed metallurgical examination. There was no evidence of fatigue cracking or a manufacturing defect that may have contributed to the failure.

Oil transfer tube failure history

There have been a total of five documented cases of the same type of oil transfer tube attachment lug failure in Australia. There were three Civil Aviation Safety Authority (CASA) Service Difficulty Report (SDR) cases on two different Cessna 208 aircraft. One of the reported cases led to the total loss of engine oil in flight and the requirement for the aircraft to conduct an emergency landing on a public road. All of the SDR cases were thought to have been caused by the incorrect installation of an engine vibration isolator mount, which led to high cycle fatigue and the eventual failure of the oil tube at the attachment lugs. Recently, the ATSB has investigated two other engine failures involving Cessna 208 aircraft (AO-2008-005, VH-PSQ and AO-2010-005, VH-UMV). In both occurrences, the oil transfer tubes were noted to have fractured at the attachment lugs in the same manner as the oil tube from VH-NTQ. Both engine failures were related to compressor/power turbine blade failures. A comparison of the VH-NTQ lug fracture surfaces was made with the other failures, which revealed them to be remarkably similar in appearance. No evidence of fatigue was found in the VH-PSQ and VH-UMV oil pipe fractures, despite being exposed to considerable levels of vibration from an out-of-balance engine core.

Aircraft maintenance history

The aircraft had a scheduled maintenance check on the day prior to the accident, which included an engine inspection. The aircraft maintainer stated that he did not identify any defects on the engine during the inspection. Engine runs and leak checks were conducted after the scheduled maintenance was carried out. There was no evidence that the maintenance carried out on the aircraft was related to the engine oil leak. The propeller had been balanced on 19 April 2009 and was within limits.

Engine torque indication system

The engine torque indication system utilised an electric torque indicator and a transmitter. The transmitter sensed the difference in engine torque pressure and oil pressure in the reduction gear box case and transmitted that data to the torque indicator. The torque indicator converted the information into an indication of torque in foot-pounds. In the event of a severe reduction in oil pressure due to the total loss of oil in the engine, the torque indication would reduce, even if power to the engine was maintained.

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 incident.

CASA

Airworthiness bulletin

Following the accident, CASA issued an airworthiness bulletin, AWB 72-004 Issue 1, on 8 February 2010 to all Cessna 208 aircraft operators in Australia. The bulletin highlighted previous SDR failures and the possibility of the accident aircraft having experienced the same problem. The bulletin recommended the inspection of the engine oil transfer tube attachment lugs for cracks and the inspection of the engine vibration isolator mounts for correct installation. Any defects in the area of the vibration mounts and oil tubes were to be reported to CASA post inspection. At the time of writing this report one case of an oil tube with a loose fit and wear had been reported.

ATSB COMMENT

From the evidence available it was evident that the engine had a substantial in-flight oil leak, which necessitated the in-flight shut down of the engine and a diversion to the nearest available airstrip.

The accident damage to the engine in the area of the apparent oil leak precluded a conclusive finding as to the source of the leak. Although the detailed examination of the oil tube attachment lug fracture surfaces was inconclusive, the oil tube remained the most likely source of the oil leak. Evidence from other oil tube failures indicated that significant vibratory loading can cause the oil tube attachment lugs to fracture in the manner observed in the oil tube fitted to VH-NTQ. There was

no evidence that the transfer tube was subjected to vibration from a compressor turbine or power turbine blade failure or of an incorrectly fitted engine mount. There was also no evidence of a pre-accident defect that would have caused a reduction in actual engine torque.