



FINAL REPORT

AIC 13-1008

**PAPUA NEW GUINEA
ACCIDENT INVESTIGATION COMMISSION
SHORT SUMMARY REPORT**

Tropicair

P2-SAH

Cessna Aircraft Company C208B Grand Caravan

Engine failure

Kibeni, Western Province

PAPUA NEW GUINEA

25 November 2013

About the AIC

The Accident Investigation Commission (AIC) is an independent statutory agency within Papua New Guinea (PNG). The AIC is governed by a Commission and is entirely separate from the judiciary, transport regulators, policy makers and service providers. The AIC's function is to improve safety and public confidence in the aviation mode of transport through excellence in: independent investigation of aviation accidents and other safety occurrences within the aviation system; safety data recording and analysis; and fostering safety awareness, knowledge and action.

The AIC is responsible for investigating accidents and other transport safety matters involving civil aviation, in PNG, as well as participating in overseas investigations involving PNG registered aircraft. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The AIC performs its functions in accordance with the provisions of the PNG Civil Aviation Act 2000 (As Amended), Civil Aviation Rules 2004 (as amended), and the Commissions of Inquiry Act 1951 (as amended), and in accordance with Annex 13 to the Convention on International Civil Aviation.

The object of a safety investigation is to identify and reduce safety-related risk. AIC investigations determine and communicate the safety factors related to the transport safety matter being investigated.

Readers are advised that in accordance with Annex 13 to the Convention on International Civil Aviation, it is not the purpose of an AIC aircraft accident investigation to apportion blame or liability. The sole objective of the investigation and the Final Report is the prevention of accidents and incidents. (Reference: ICAO Annex 13, Chapter 3, paragraph 3.1.)

However, it is recognised that an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the AIC endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why it happened, 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.

Engine failure involving a Cessna Aircraft Company C208B, P2-SAH

Occurrence details

On 25 November 2013, a Cessna Aircraft Company C208B Grand Caravan, registered P2-SAH and operated by Tropicair, departed Kamusi, Western Province, for Purari River, Gulf Province, at 0312 UTC¹ on a charter flight under the instrument flight rules (IFR). There were 10 persons on board; one pilot and nine passengers². Earlier in the day, the aircraft had departed Port Moresby for Kamusi from where it flew to Hivaro and back to Kamusi before the accident flight. SAH was due to continue from Purari River to Vailala and Port Moresby.

Google earth images modified by the PNG AIC

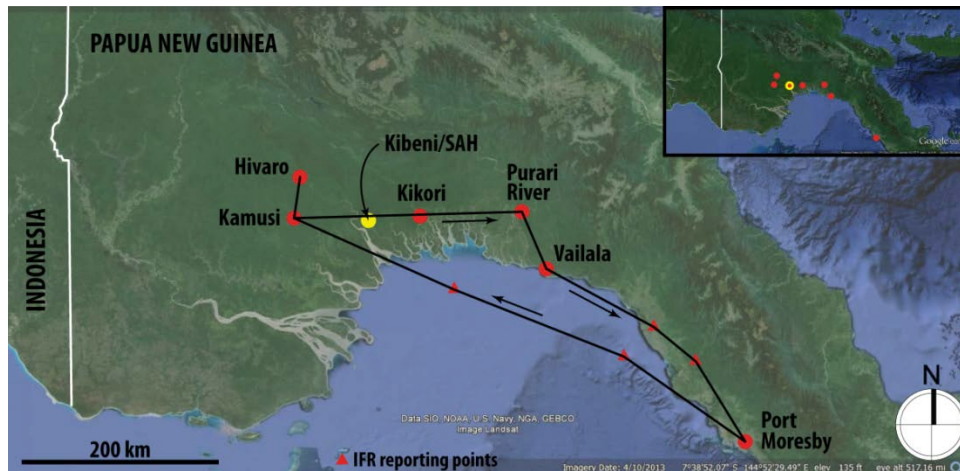


Figure 1: SAH flight-planned route

Google earth image modified by the PNG AIC

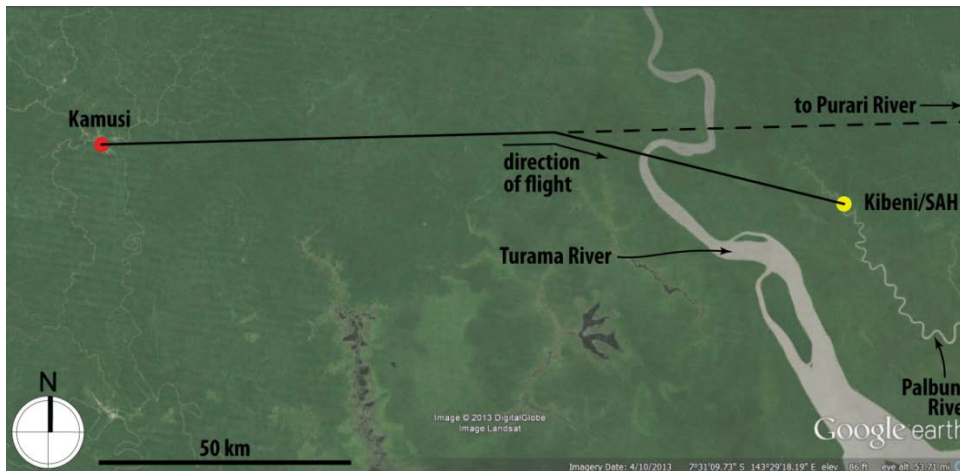


Figure 2: Accident flight route (solid black line)

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

² The passenger in the right pilot seat was a pilot who was about to begin training with Tropicair.

The pilot reported that the takeoff and climb from Kamusi were normal and he levelled off at 9,000 ft and completed the top-of-climb checklist. Between Kamusi and Purari River the terrain is mostly flat and forest covered, with areas of swampland and slow-moving tidal rivers. Habitation is very sparse with occasional small villages along the rivers. The pilot recalled that the weather was generally good in the area with a cloud base of 3,000 ft and good visibility between build-ups.

Insert Google earth image modified by the PNG AIC



Figure 3: The Turama River and terrain between Kamusi and Kibeni approximately 15 km ESE of the engine failure location, looking north

The pilot reported that approximately 2 minutes into the cruise there was a loud ‘pop’ sound followed by a complete loss of engine power. After configuring the aircraft for best glide speed at 95 kts, the pilot turned the aircraft right towards the coast and rivers to the south, and completed the Phase-1 memory recall items³ for engine failure in flight. He was assisted by the passenger in the right pilot seat who switched on the Emergency Locator Transmitter (ELT) and at 0332 broadcast *MAYDAY*⁴ *due engine failure* on the area frequency⁵. Checking the database in the on-board Global Positioning System (GPS), the pilot found the airstrip at Kibeni on the eastern side of the Palbuna River.

The pilot, assisted by the passenger next to him, tried unsuccessfully to restart the engine using the procedure in the aircraft’s Quick Reference Handbook (QRH). The passenger continued to give position reports and to communicate with other aircraft. At about 3,000 ft AMSL the pilot asked for radio silence on the area frequency so he could concentrate on the approach to Kibeni airstrip, flying a left hand circuit to land in a south westerly direction. He selected full flaps during the final stages of the approach, which arrested the aircraft’s rate of descent, but the higher than normal speed of the aircraft during the approach and landing flare caused it to float and touch down half way along the airstrip.

³ The Phase 1 memory recall items for an abnormal or emergency situation constitute a predetermined sequence of actions designed to remedy or manage the abnormal/emergency situation without recourse to ad hoc actions.

⁴ *MAYDAY*. International call for urgent assistance, from French “m’aidez!” (Help me) usually broadcast on the radio frequency of 121.5 MHz.

⁵ The ‘area frequency’ is the very high frequency (VHF) radio frequency used for aircraft-to-aircraft communication in a designated area.



Figure 5: Ground witness marks on Kibeni airstrip

The disused 430 metre long Kibeni airstrip was overgrown with grass and weeds. It was about 60 ft above the river and 120 ft above mean sea level, with trees and other vegetation on the slope down to the river. The aircraft bounced three times and, because the aircraft's speed had not decayed sufficiently to stop in the available length, the pilot elected to pull back on the control column in order to clear the trees that were growing on the slope between the airstrip and the river. The aircraft became airborne, impacting the crown of a coconut palm (that was almost level with the airstrip) as it passed over the trees. The pilot banked the aircraft hard left in an attempt to land/ditch along the river and avoid trees on the opposite bank. He then pushed forward on the control column to avoid stalling⁶ the aircraft and levelled the wings before the aircraft impacted the water.



Figure 4: Kibeni village and airstrip by the Palbuna River. SAH wreckage in the foreground.

⁶ Stall (aerodynamic) is the term used when a wing is no longer producing enough lift to support an aircraft's weight.



Figure 7: SAH in the river approximately 24 hours after the accident

The aircraft came to rest inverted with the cockpit and forward cabin submerged and immediately filled with water. After a short delay while he gained his bearings under water, the pilot was able to undo his harness and open the left cockpit door. He swam to the rear of the aircraft, opened the right rear cabin door, and helped the surviving passengers to safety on the river bank. He made several attempts to reach those still inside the aircraft. When he had determined there was nothing further he could do to reach them, he administered first aid to the survivors with materials from the aircraft's first aid kit. After approximately 20 minutes, villagers arrived in a canoe and transported the pilot and surviving passengers to Kibeni village across the river. About 90 minutes after the accident, rescuers airlifted the survivors by helicopter to Kopi, located 44 km north east of Kibeni.

The aircraft was substantially damaged during the accident by impact forces and immersion in water. The left wing became completely detached during the impact sequence and, although the pilot reported that it floated back to the accident site on the incoming tide in the minutes after the impact, it could not be located by the AIC despite a search downstream by helicopter. During the evening of 27 November 2013, the aircraft wreckage was lifted onto a barge and transported to Panakawa (27 km south of Kamusi).

Photograph courtesy of Tropic Air



Figure 6: P2-SAH on the barge for transport to Panakawa

Weight and balance

The investigation determined that aircraft was loaded according to the approved 'quick trim' system detailed in the Aircraft Flight Manual (AFM). The pilot reported that, on departure from Kamusi, it was approximately 200 kg under its maximum take-off weight (MTOW) of 3,900 kg.

Flight data

The aircraft was fitted with an Altair ADAS Plus engine condition trend monitoring (ECTM) unit, serial no. 1135. The recorded engine data revealed that the engine stopped at 1331 and the ECTM ceased recording at 1340.5 when the aircraft impacted the water.

Engine examination

On 19 December 2011, Pratt and Whitney Canada (A'Asia) Ltd complied with AD CF-2013-21 and Service Bulletin 1669 Rev 9, which resulted in the replacement of the compressor turbine blades on this powerplant, serial number PCE-PC1411.

Representatives of the engine manufacturer travelled to Panakawa on 1 December 2013 and removed the engine and associated components under the supervision of the AIC. The engine was transported by air to Port Moresby where initial investigation revealed substantial internal damage. The engine was subsequently disassembled and examined at the manufacturer's facility in Canada. The manufacturer's summary findings stated:

The Compressor Turbine (CT) blades were fractured within the airfoils at locations between the platform and approximately 2/3 of their height. The blades with the longest remaining airfoils were grouped together on the disk, resulting in significant unbalance of the assembly.

One CT blade was fractured in fatigue. The fatigue initiated from multiple origins near the trailing edge, pressure side of the blade. The crack then propagated 2/3 length chord wise towards the leading edge until final fracture in overload.

The power turbine blades were fractured at various lengths within the airfoil. Blade fracture surfaces exhibited features characteristic of overload and as such is considered as secondary to the CT blade fracture.

The CT and PT vane rings showed significant impact damage, battering, tearing of the airfoils and shrouds, which is secondary to the CT and PT blades fractures.

As a result of the unbalance of the CT disk assembly, the compressor suffered rubbing and scoring damage on all blades, stators, shrouds and spacers.

The engine accessories showed no anomalies which could have contributed to the engine power loss.

The manufacturer concluded that:

The engine power loss was caused by the fracture of one CT blade in fatigue, which resulted in secondary damage to the remainder of the CT blades and downstream components.

The fatigue originated from multiple origins on the pressure side of the blade trailing edge. The root cause for the fatigue initiation could not be determined with certainty.

All other damages to the engine are considered secondary to the primary CT blades fracture.

Photograph courtesy of Pratt and Whitney Canada



Figure 8: CT disk and blades downstream side

Photograph courtesy of Pratt and Whitney Canada



Figure 8: CT disk and blades upstream side

AIC comment

The pilot provided the standard company pre take-off safety briefing and demonstration to the passengers prior to departure from Kamusi. However, they did not open the cabin doors to facilitate their egress, possibly because the aircraft was inverted and that may have disoriented the passengers. The pilot escaped through the left cockpit door and swam to the rear of the aircraft, opened the right rear cabin door, and helped the surviving passengers escape from the aircraft.

Pilots are reminded of the importance of providing pre take-off safety briefings that include instruction/demonstration on the use of emergency equipment and doors in the event of an emergency evacuation, and the need to be ready to assist in the event of an emergency evacuation.

Safety action

US Federal Aviation Administration

The US Federal Aviation Administration issued Airworthiness Directive 2014-17-08 R1 Pratt & Whitney Canada Corp. effective 5 June 2015 stating:

This AD was prompted by several incidents of compressor turbine (CT) blade failure, causing power loss, and engine failure. We are issuing this AD to prevent failure of CT blades, which could lead to damage to the engine and damage to the airplane.

This AD replaces AD 2014-17-08, Amendment 39-17961 (79 FR 52172, September 3, 2014).

This AD applies to all Pratt & Whitney Canada Corp. (P&WC) PT6A-114 and PT6A-114A turboprop engines.

Recommendation

Recommendation number AIC 15-R01/13-1008 to the Civil Aviation Safety Authority of PNG.

The Accident Investigation Commission recommends that the Civil Aviation Safety Authority of PNG should bring this report to the attention of operators in PNG and reinforce the need for clear concise safety briefing instructions and demonstrations and the need to be ready to assist in the event of an emergency evacuation.

General details


Date and time:	25 November 2013 0340 UTC	
Occurrence category:	Accident	
Primary occurrence type:	Engine failure	
Location:	Kibeni, Western Province, Papua New Guinea	
	Latitude: 7°28' 47"S	Longitude: 143° 49' 11"E

Crew details

Nationality	New Zealand
Licence type	Commercial (PNG)
Licence number	P21751
Total hours	2,200 hours
Total hours on type	800 hours

Aircraft details

Aircraft manufacturer and model	Cessna Corporation C208B Grand Caravan	
Registration:	P2-SAH	
Serial number:	208B1263	
Engine manufacturer and model	Pratt and Whitney Canada PT6A-114A	
Engine serial number	PCE-PC1411	
	Hours since new: 5,564 hours	Hours since overhaul: 1,512 hours
	Cycles since new: 5,589	Cycles since overhaul: 1,695
Propeller manufacturer and model	McCauley Propeller Systems 3GFR34C703	
Propeller serial number	070672	
Type of operation:	IFR Charter	
Persons on board:	Crew: 1	Passengers:9
Injuries:	Crew: 1 Minor	Passengers:3 Fatal; 6 Minor
Damage	Substantial	

Approved


David Inau
CEO
Accident Investigation Commission