Australian Government
Australian Transport Safety Bureau

Engine failure and forced landing involving Cessna 208, VH-TYV

Darwin Airport, Northern Territory, 11 November 2016

ATSB Transport Safety Report
Occurrence Investigation
AO-2016-149
Final – 9 February 2017

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Publishing information

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

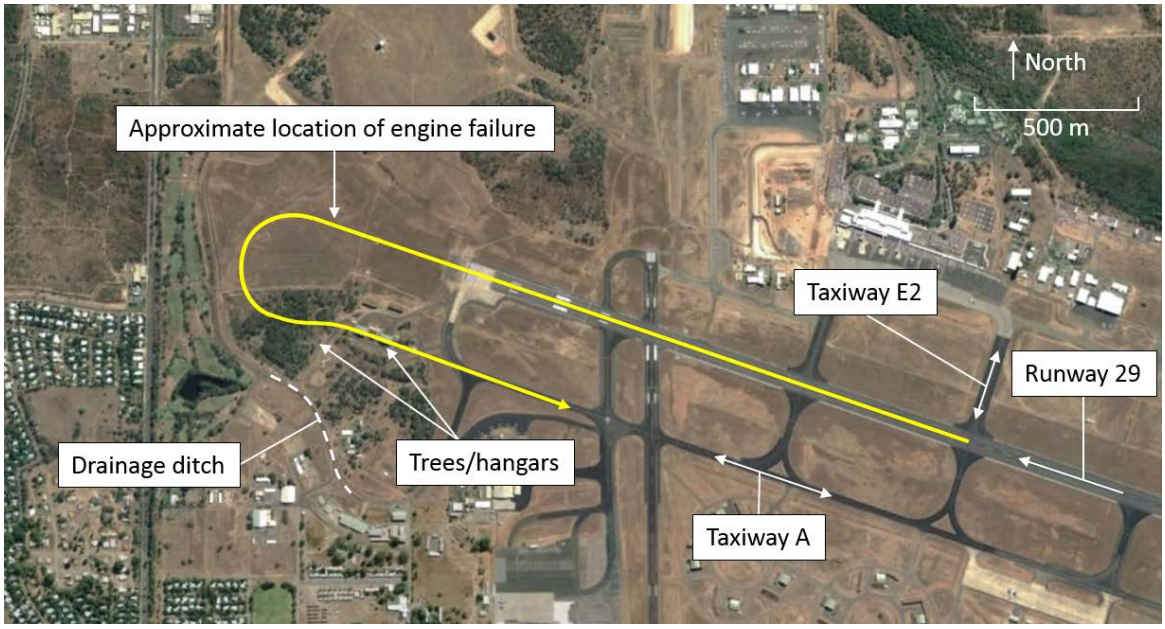
Page	Change	Date

Engine failure and forced landing involving Cessna 208, VH-TYV

What happened

On 11 November 2016, at about 1546 Central Standard Time (CST), a Cessna 208B (C208B) aircraft,[1] registered VH-TYV (TYV) entered runway 29, at the intersection of taxiway E2 (Figure 1) at Darwin Airport, Northern Territory for an aircraft type re-familiarisation training flight. On board were an instructor and trainee pilot.

Figure 1: Darwin Airport overview showing approximate flight path of TYV



Source: Google Earth, annotated by ATSB

At the beginning of the take-off run, the trainee pilot set take-off power prior to releasing the brakes. After releasing the brakes, the aircraft accelerated to the take-off speed. The trainee pilot rotated[2] the aircraft to 12 degrees nose up, to achieve a best angle of climb speed of 80 kt. The trainee pilot maintained 12 degrees nose up and 80 kt until the aircraft climbed to an altitude of about 500 ft above ground level (AGL).

At about 500 ft, the trainee pilot reduced the flap setting from the take-off setting of 20 degrees to 10 degrees. At this time, the instructor noted the climb speed reducing while the trainee continued to maintain the nose attitude for best angle of climb. At the same time, the instructor heard the engine lose power and a thin film of fuel partially obscured the windscreen. The instructor noted reducing engine torque, fuel flow, inter-turbine temperature and airspeed.

As the airspeed reduced to 60 kt, the instructor took control of TYV. They immediately felt a strong nose down force through the control column and the aircraft pitched significantly nose down. They recovered the aircraft to the glide attitude and could not see a suitable landing area ahead of the aircraft. They identified an area to the left of the aircraft as the most suitable for a forced landing and began a left turn towards that clear area at the target glide speed of 85 kt.

---

1 Cessna 208 aeroplanes are powered by a single turboprop engine.

2 Rotation: the positive, nose-up, movement of an aircraft about the lateral (pitch) axis immediately before becoming airborne.

During the left turn, the instructor made a PAN[3] broadcast on the Darwin Tower air traffic control (ATC) frequency advising that the engine had failed and that they intended to turn back to Darwin Airport. As the turn continued, they un-stowed the emergency power lever, in accordance with the engine failure procedures and attempted to recover engine power. The engine did not respond, so they feathered[4] the propeller.

The instructor observed a drainage ditch within the clear area to the left of the aircraft, and initially selected the drainage ditch as the most suitable location for the forced landing. As the aircraft turned, they assessed that sufficient height remained to continue the turn back towards Darwin Airport. At the completion of the turn, they selected 30 degrees of flaps to provide a short climb, which allowed the aircraft to clear two hangars and an area of trees.

After clearing the hangars and trees, the instructor observed taxiway A in line with the aircraft and elected to land on taxiway A. The aircraft landed on taxiway A without further incident.

After landing, the instructor and trainee pilot exited the aircraft. They observed fuel on the canopy and underside of the aircraft along with a significant leak from the engine cowling which had created a large pool of fuel below the aircraft.

The instructor and trainee were not injured and the aircraft was not damaged in the incident.

Instructor comments

The instructor in TYV provided the following comments:

- A pre-flight inspection of the aircraft found no defects and no evidence of fluid leaks in the engine compartment.
- The instructor developed the C208B operating procedures for the operator. The instructor regularly practiced and trained pilots on the conduct of these procedures.
- The instructor had recently conducted significant multi-engine aircraft training, including engine failures where procedures direct a PAN broadcast. They probably reverted to this behaviour when contacting ATC to advise of the emergency rather than declaring MAYDAY.[5] The ATC response indicated that the emergency situation was understood and further declaration of a MAYDAY was not required.
- The operator take-off safety briefing directs a pilot to only attempt a turn-back at altitudes in excess of 700 ft AGL.
- The aircraft departed with a 10-15 kt headwind, only two occupants on board and 900 kg of fuel. The light weight of the aircraft and the assisting headwind, which became a tailwind during the turn-back, led the instructor to continue the turn-back despite commencing the procedure at about 500 ft AGL.
- Departure from the E2 taxiway intersection on runway 29 provides in excess of 1,600 m of runway for take-off. This is ample for a C208B and more than is available at any other runway the C208B is operated to by the company. Departing from the end of runway 29 requires a significantly further taxi distance.
- The initial strong pitch down force, as the instructor took control after the engine failure, was probably due to the loss of thrust along with the drag produced as the propeller pitch initially reduced before the propeller was feathered.
- The turn back procedure is not suitable for all aircraft types, piston engine aircraft do not have the same ability to turn back after an engine failure.

---

[3] 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.

[4] Feathering: the rotation of propeller blades to an edge-on angle to the airflow to minimise aircraft drag following an in-flight engine failure or shutdown.

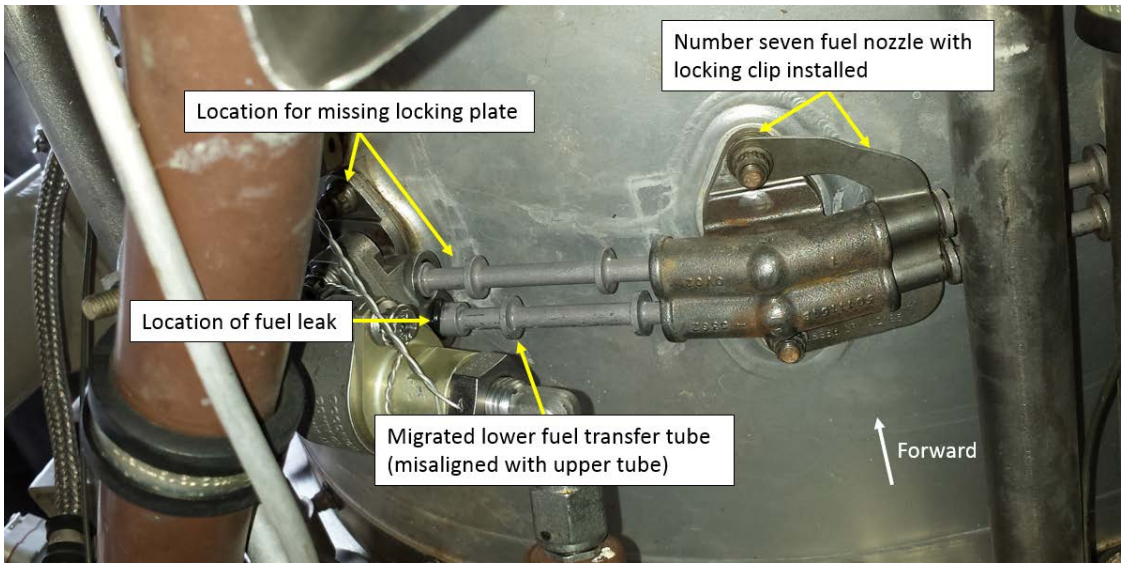
[5] MAYDAY: an internationally recognised radio call announcing a distress condition where an aircraft or its occupants are being threatened by serious and/or imminent danger and the flight crew require immediate assistance.

Engineering examination

A post-incident examination of the engine found the number eight fuel nozzle locking plate missing (Figure 2). This allowed the fuel transfer tube to migrate out of the number eight fuel nozzle adaptor. There was no damage to the locking plate mounts.

The fuel nozzles had been replaced 86 flight hours prior to the incident, while the aircraft underwent maintenance in the United States, prior to importation into Australia. All other required hardware was found to be correctly installed, including the number eight fuel transfer tube locking plate fasteners.

Figure 2: TYV fuel transfer tubes



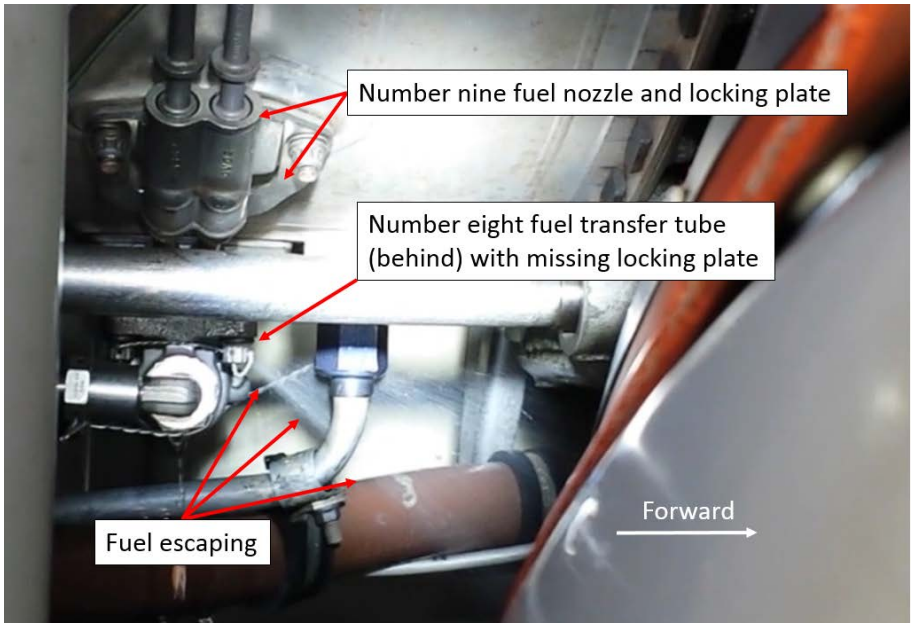
Source: Operator, annotated by ATSB

Safety analysis

The lack of damage to the locking plate mounts, along with the locking plate being entirely missing, and the fasteners being found installed indicates the locking plate probably did not fail. The locking plate was probably not reinstalled when the fuel transfer tubes and nozzles were installed after replacement. The missing locking plate allowed the fuel transfer tube to slowly migrate out of the nozzle adaptor over the subsequent 86 flight hours.

On the incident flight, the fuel transfer tube migrated far enough that fuel under pressure was able to escape from the nozzle adaptor (Figure 3).

Figure 3: Fuel under pressure escaping from migrated fuel transfer tube



Source: Operator, annotated by ATSB

Findings

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

- The number eight fuel transfer tube locking plate was likely not installed when the fuel transfer tubes and nozzles were installed after replacement.
- The missing locking plate allowed the fuel transfer tube to migrate out of the fuel nozzle adaptor and fuel to escape. This starved the engine of fuel and led to the engine power loss in flight.

Safety message

This incident serves to underline the importance of ensuring all maintenance is completed entirely and correctly. The locking plate was not installed during scheduled maintenance, however, the fuel leak did not develop for a further 86 flight hours. This demonstrates how the effects of incomplete maintenance can take a long period of time to manifest. The ATSB research report: *An overview of human factors in aviation maintenance* provides information on human factors errors made in the maintenance environment.

This incident also provides an excellent example of the value of regular training and the effective implementation of procedures following engine failure after take-off in a single engine aircraft.

Successful completion of a turn back manoeuvre to land on the departure runway, or other suitable airport area, requires well-developed procedures and good pilot proficiency to ensure procedures are effectively applied. Careful consideration of the characteristics and performance of each aircraft type is required when developing turn back procedures. The impact of wind and weather conditions must also accounted for when electing to conduct the turn back procedure. As demonstrated in this incident, during the turn back the pilot should constantly assess the ability of the aircraft to complete the procedure and be prepared at any time to cease the turn and land ahead.

The ATSB research report: *Avoidable Accidents No. 3 - Managing partial power loss after take-off in single-engine aircraft* provides information to assist pilots handling both partial and complete engine power loss after take-off.

Pilots can significantly reduce risk following a partial or complete engine power loss using the following strategies:

- pre-flight decision making and planning for emergencies and abnormal situations for the particular aerodrome
- taking positive action and maintaining aircraft control either when turning back to the aerodrome or conducting a forced landing.

General details

Occurrence details

Date and time:	11 November 2016 – 1547 CST	
Occurrence category:	Serious incident	
Primary occurrence type:	Engine failure or malfunction	
Location:	Darwin Airport, Northern Territory	
	Latitude: 12° 24.880’ S	Longitude: 130° 52.600’ E

Aircraft details

Manufacturer and model:	Cessna Aircraft Company 208B	
Registration:	VH-TYV	
Serial number:	208B2137	
Type of operation:	Flying training - Dual	
Persons on board:	Crew – 2	Passengers – 0
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.