Australian Government
Australian Transport Safety Bureau

Engine failure involving Fairchild SA227, VH-VEU

170 km south of Brisbane, Queensland, 12 October 2016

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Addendum

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Engine failure involving Fairchild SA227, VH-VEU

What happened

On 12 October 2016, a Vee H Aviation Fairchild Industries Inc. SA227-DC, registered VH-VEU, conducted a regular public transport flight from Armidale, New South Wales, to Brisbane, Queensland. On board the flight were two flight crew and 13 passengers. The captain was the pilot flying (PF) and the first officer was the pilot monitoring (PM).[1]

At 0755 Eastern Daylight-saving Time (EDT), the aircraft was about 170 km south of Brisbane, cruising at FL 170,[2] when the aircraft suddenly yawed to the right.[3] The PF re-stated they had command of the aircraft and directed the PM to identify the failure. The flight crew then employed their 'identify and confirm' crew resource management (CRM) procedures to confirm the right engine was not delivering power and then shut down the right engine and feathered the right propeller.[4] During the diagnosis, the PM noted that all right engine indications were normal except for a low torque reading (10%) and low fuel flow (140 pounds per hour).

Air traffic control contacted the crew to confirm they were maintaining FL 170 and the PM responded with a PAN broadcast[5] that they were descending due to a right engine failure. The crew reviewed their options and decided to continue to Brisbane Airport. They completed the remaining checklist actions and briefed the passengers. The crew then requested, and were given, a direct track to Brisbane Airport from air traffic control. They completed their normal and single engine landing checklist procedures and landed at Brisbane Airport runway 19 without further incident.

Maintenance findings

The engine installed in the aircraft was the Honeywell (previously Garrett) TPE331-12UHR-701G. The operator's engine maintenance organisation found a retainer ring within the engine accessory gear assembly had failed, which allowed the main shaft (which drives the propeller) to de-couple from the engine driven reduction gearbox (Figure 1).

The retainer ring was shipped to the maintenance organisation from Honeywell in December 2008 as part of a batch of 10 with a certificate of conformance from the part manufacturer and Honeywell. It was fitted new to the incident engine in December 2009 at the last engine overhaul, about 2,429 hours prior to the failure. The maintenance organisation introduced this practice of replacing the retainer ring at each overhaul based upon their previous service experience of this part failing. December 2009 was the last overhaul of the accessory gear assembly prior to the failure.

In October 2015, Honeywell added temporary revision 72-241 to the maintenance manual procedure: *removal and installation of accessory gear assembly*, to direct the replacement of the retainer ring at each exposure. Figure 2 depicts the failed retainer ring.

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1 Pilot Flying (PF) and Pilot Monitoring (PM): procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances; such as planning for descent, approach and landing. The PM carries out support duties and monitors the PF's actions and the aircraft's flight path.

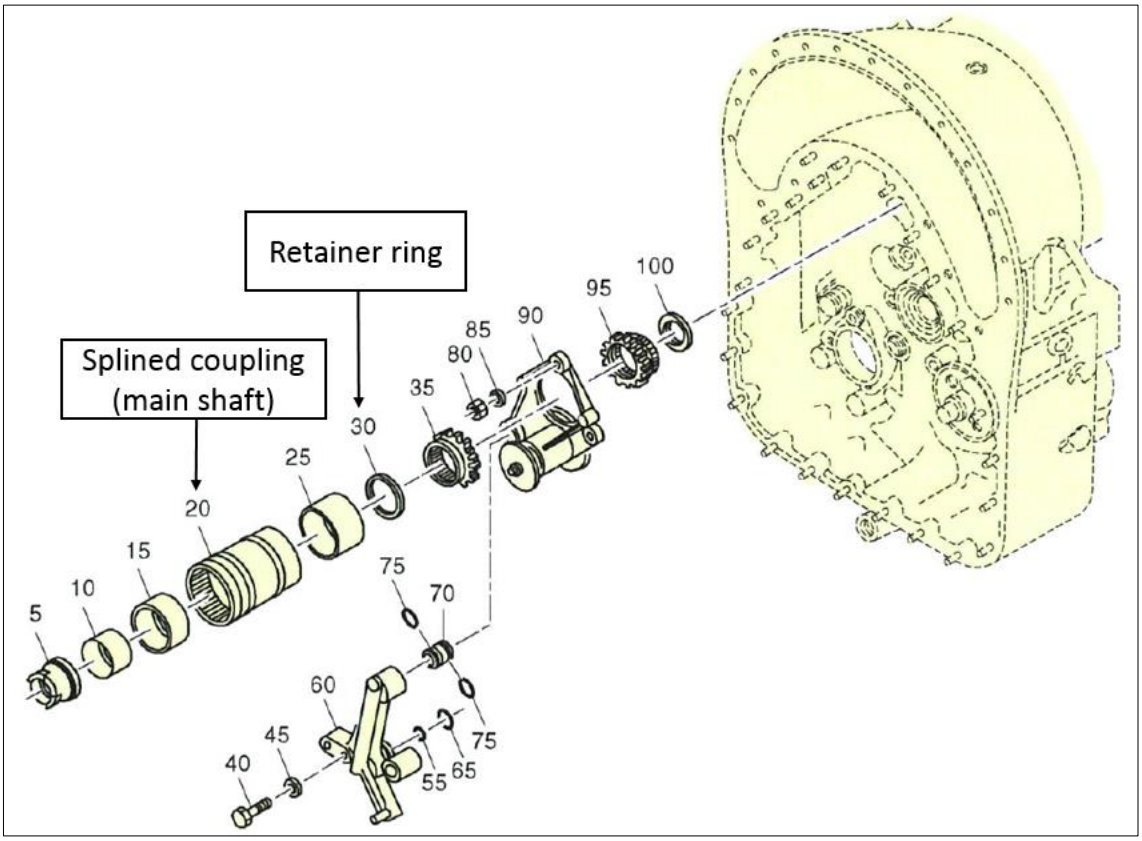
2 Flight level: at altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 170 equates to 17,000 ft.

3 Yawing: the motion of an aircraft about its vertical or normal axis.

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 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.

Figure 1: Engine accessory gear assembly



Source: Maintenance organisation, annotated by ATSB

Figure 2: Retainer ring

Source: Operator

Continuing airworthiness maintenance interval

The operator set their maintenance interval for the incident engine in accordance with the engine manufacturer's service bulletin for periodic inspections, (*Honeywell TPE 331-72-0476*). From the service bulletin, the operator set the inspection of the engine at the 7,000 hour continuing airworthiness maintenance (CAM) interval with gearbox inspection, for commercial operations. This included the requirement for the accessory gear assembly inspection in accordance with the maintenance manual procedures at the 7,000 hour interval.

The operator's spectrometric oil-analysis programme (SOAP analysis) was set at 150 hour intervals at the time of the incident.[6] The previous SOAP analysis was conducted at about 26 hours prior to the failure and did not detect any anomalies. Further information on SOAP is available from Civil Aviation Safety Authority airworthiness bulletin (*AWB 79-1*): *Spectrographic oil analysis program (SOAP)*.

The gearbox is fitted with a single magnetic drain plug (chip detector).[7] If a metallic particle is detected by the chip detector inflight, it will activate a caution light to advise the flight crew. The inspection interval for the chip detector is set at 300 hours. The last inspection was about 144 hours prior to the incident and no anomalies were found. There were no activations of the chip detector between the last scheduled inspection and the incident flight, and the chip detector did not activate during the incident flight.

The operator also conducts propeller dynamic balance checks at 600 hour intervals. There have been no out-of-limit vibration indications since engine installation. The last check was performed 17 September 2016.

Safety analysis

The operator had several preventive maintenance inspections in place, which included an overhaul of the gearbox, SOAP analysis, magnetic drain plug inspection and propeller dynamic balance. The previous overhaul was about 2,429 hours prior to the failure at which time the retainer ring was fitted new to the gearbox. During the time interval to failure of the retainer ring, the SOAP analysis, magnetic drain plug inspections and propeller dynamic balance checks did not detect any anomalies. Therefore, the failure of the retainer ring was within the required gearbox inspection intervals and without prior warning of an impending failure.

Findings

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

- The retainer ring failed within the prescribed maintenance interval.
- There was no prior warning of an impending failure of the retainer ring.

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.

Operator

As a result of this occurrence and subsequent to an update by the engine manufacturer to the engine manufacturer's service bulletin, the aircraft operator has advised the ATSB that they are taking the following safety actions:

SOAP analysis

The operator reduced their SOAP analysis interval from 150 hours to 100 hours.

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6 SOAP is a method to test the health of engines by performing laboratory testing of the engine oil. A sample of oil showing an increase in parts per million of iron material could be a warning of impending failure. The chemical composition of any metal particles in the oil sample is compared to various engine parts to detect the location of abnormal wear.

7 A chip detector is a device, often a permanent magnet, for gathering metal chips from the engine oil to provide early warning of an impending failure. A magnetic drain plug is a removable chip detector.

Damaged parts

The damaged parts from the gearbox were sent to the engine manufacturer for analysis.

Safety message

Following the aircraft yaw, the flight crew actively employed their crew resource management procedures to identify and confirm the engine fault and then shut down the right engine. The use of these procedures reduced the risk of an incorrect diagnosis of the fault or activation of the incorrect engine controls during shut down.

General details

Occurrence details

Date and time:	12 October 2016 – 0755 EDT	
Occurrence category:	Incident	
Primary occurrence type:	Engine failure of malfunction	
Location:	170 km south of Brisbane Airport, Queensland	
	Latitude: 28° 53.37' S	Longitude: 152° 47.10' E

Aircraft details

Manufacturer and model:	Fairchild Industries Incorporated SA227-DC	
Registration:	VH-VEU	
Operator:	VEE H Aviation PTY LTD (Operating as Corporate Air)	
Serial number:	DC-797B	
Type of operation:	Air transport low capacity - Passenger	
Persons on board:	Crew – 2	Passengers – 13
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.