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Australian Transport Safety Bureau

Engine failure involving Airbus A320, VH-VFY

40 km NNW of Narrabri Airport, New South Wales, 22 September 2016

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Addendum

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Engine failure involving Airbus A320, VH-VFY

What happened

On 22 September 2016, at 1608 Eastern Standard Time (EST), a Jetstar Airways Airbus A320-232 aircraft, registered VH-VFY (VFY) (Figure 1), operated a scheduled passenger flight, JQ956, from Sydney, New South Wales, to Cairns, Queensland (Qld).

At about 1630, as the aircraft climbed, the cabin manager (CM) was on the flight deck. A cabin crewmember notified the flight crew and the CM of an unusual odour in the cabin. The CM left the flight deck to conduct an inspection of the cabin and detected a burnt electrical type odour present in rows 1 to 5. They notified the flight crew and continued to inspect the cabin.

At 1632, the flight crew received an ENG 2 OIL FILTER CLOG message on the electronic centralised aircraft monitor (ECAM) system. This message indicated that the engine management system had detected an increase in pressure across the engine oil filter of more than 12 psi. However the increase in pressure did not reach the required level of 20 psi for the engine management system to automatically bypass the engine oil filter. The ENG 2 OIL FILTER CLOG message was an advisory message and did not require any flight crew actions. During this time, all engine indications were within normal limits.

At about the same time, the CM returned to the flight deck having conducted an inspection of the full cabin and reported that the unusual odour had dissipated. The cabin manager returned to the cabin to monitor the situation. The flight crew continued the climb and levelled the aircraft at the planned cruising level of flight level (FL) 340.[1] The flight crew then reviewed the engine oil system and, anticipating a possible diversion, obtained the weather for Brisbane Airport, Qld.

Figure 1: Airbus A320 VFY

Source: Tony Coles

At 1644 the cabin crew detected smoke entering the cabin and the CM instructed the cabin crew to stop the cabin service and stow the cabin carts. The CM reported to the flight crew, via the aircraft interphone, that light smoke was entering the full length of the cabin through the overhead

[1] At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level. Flight level 340 represents 34,000 ft.

air conditioning vents. As the flight crew received this report, they detected a vibration and unusual noise from the right engine and the aircraft yawed[2] to the right. At the same time, the ECAM displayed the message ENG 2 FAIL.

The flight crew then commenced the engine failure checklist and switched on the seat belt sign in the cabin. While conducting the checklist, they observed a small amount of smoke coming from the cockpit ventilation system. At the same time, the cabin crew observed heavy smoke entering the cabin through the overhead air-conditioning vents. The flight crew donned oxygen masks, and in accordance with the engine failure checklist, depressed the right engine fire button. This action isolated the engine systems from the rest of the aircraft and shortly after, the flight crew observed that the smoke had dissipated and they removed their oxygen masks.

The smoke also dissipated in the cabin after a short time.

After completing the checklist, the flight crew diverted the aircraft to Brisbane, declared a PAN[3] to air traffic control and began a descent to FL200. During the descent, the flight crew briefed the CM and advised them of the engine failure and the diversion.

The flight proceeded to Brisbane Airport and landed at about 1720 without further incident. No persons were injured in the incident and the aircraft was not damaged.

Captain comments

The captain provided the following comments:

- The aircraft communications addressing and reporting system (ACARS) notified the company operations centre as the incident unfolded. The information provided by ACARS to the operations centre enabled the company to prepare for the aircraft arrival at Brisbane and reduced the workload of the flight crew during the diversion.
- Training previously undertaken by the captain and first officer was very similar to the incident. This enabled the first officer to anticipate many of the captain's needs and ensured the flight crew worked well as a team during the incident.
- The captain had not met any member of the cabin crew prior to this flight. The captain commented that the procedures in place and training that all crewmembers had undertaken ensured that the flight crew worked very effectively with the cabin crew to manage the incident and diversion.
- The flight crew calculated that the landing would be at a weight above the aircraft maximum landing weight[4]and assessed that the emergency facilities and long runway at Brisbane provided the most suitable airport for diversion.
- Donning the oxygen masks greatly hindered communications with the first officer, performance as a team improved markedly after removal of the oxygen masks.

Cabin manager comments

The cabin manager provided the following comments:

- Due to training requirements, there were five cabin crew on board the flight, rather than the usual four. The additional crew member assisted in the management of the passengers and cabin during the incident and diversion.
- The cabin crew training and procedures were very effective. Two of the cabin crew on the flight were new to the role, however they were able to effectively carry out their tasks during the incident and diversion.

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2 Yaw is the motion of an aircraft about its vertical or normal axis.

3 PAN is 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 Maximum landing weight is the maximum gross weight an aircraft may land at due to structural or performance limitations. Landing at a weight above this weight may require a structural inspection of the aircraft.

Engineering examination

After the incident, the engine manufacturer, International Aero Engines (IAE), conducted an engineering examination of the engine and detected that the number 3 bearing had failed. A detailed examination of the bearing was conducted. IAE reported that due to secondary damage, the engineering examination could not determine the cause of the number three bearing failure.

IAE reported that the ball material was found to be compliant with manufacturing quality requirements.

Airworthiness directives

In 2007, the Civil Aviation Safety Authority released airworthiness directive (AD) *AD/V2500/3* relating to failures of the number 3 bearing within IAE V2500 series engines within a specified range of serial numbers.

This airworthiness directive did not apply to the IAE V2527-A5 engine fitted to VFY, as the serial number (V17515) for the engine was outside the specified range, however the AD contained the following information:

> *The issuing of this AD is to prevent failure of the number three bearing, which could result in an in-flight shutdown and smoke in the cockpit and cabin. The smoke is a result of oil escaping from the bearing compartment due to a fracture of the number three bearing race.*

The United States Federal Aviation Administration released *AD 2016-25-11*, which has an effective date of 20 January 2017. This AD also required inspections and corrective actions for damage to the number 3 bearing. The FAA released this AD after the premature failure of number 3 bearings resulted in nine in-flight engine shutdowns. The AD does not apply to the engine fitted on VFY, as the serial number was once again outside of the specified range.

Applicability of airworthiness directives

The ADs were introduced after failures of the number three bearing led to the discovery of microstructural defects in some bearing components, introduced during the manufacturing process. Following this discovery, the engine manufacturer reviewed manufacturing records to determine the extent of engines with affected bearings.

The engines with the highest level of number 3 bearing material defects, and therefore the highest risk of failure, were included in the original AD. Engines determined to have a lesser level of defects required additional inspections and/or were subject to reduced service life. The second AD was introduced to increase the number of engines affected.

IAE advised that V2500 series engine-powered A320 aircraft currently achieve an in-flight shut down rate of 0.00136 per 1,000 flight hours. This is less than IAE's target in flight shut down rate, of 0.02 per 1,000 flight hours.[5] IAE investigates the cause of each in-flight shut down and takes corrective actions with the goal of maintaining the target in-flight shut down rate. IAE will continue to monitor the performance of the bearings and will adjust the fleet management plan if required.

The engine manufacturer and the United States Federal Aviation Administration advised that no further actions were planned beyond the current ADs.

The Civil Aviation Safety Authority (CASA) commented that they are monitoring the situation and awaiting reports from the aircraft operator and engine manufacturer.

Safety analysis

The initial odour detected by the cabin crewmembers during the aircraft's climb, along with the ENG 2 OIL FILTER CLOG ECAM message, likely resulted from the early stages of the number 3 bearing failure. The later instance of smoke in the cabin and flight deck occurred as the bearing failed. The failure of the number 3 bearing resulted in a complete power loss from the right engine.

[5] 0.02 per 1,000 flight hours is the rate required for an engine and airframe combination to achieve the acceptable in-flight shut rate for 180 min extended operations.

Findings

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

- The right engine number 3 bearing failed, resulting in engine power loss and led to smoke entering the flight deck and cabin.

Safety message

This incident highlights the importance of effective crew management techniques, training and robust emergency procedures. The captain had not met any of the other flight and cabin crewmembers prior to the flight. In addition to this, some cabin crewmembers were new to the role. Despite this, the emergency procedures and training undertaken by the crewmembers ensured that they were able to fulfil their roles and work effectively as a team to manage a difficult situation safely and efficiently.

General details

Occurrence details

Date and time:	22 September 2016 – 1644 EST	
Occurrence category:	Incident	
Primary occurrence type:	Engine failure or malfunction	
Location:	40 km NNW of Narrabri Airport, New South Wales	
	Latitude: 29° 58.150’ S	Longitude: 149° 43.580’ E

Aircraft details

Manufacturer and model:	Airbus A320	
Registration:	VH-VFY	
Operator:	Jetstar Airways	
Serial number:	6362	
Type of operation:	Air transport high capacity - Passenger	
Persons on board:	Crew – 7	Passengers – 172
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.