

SERIOUS INCIDENT

Aircraft Type and Registration:	Grob G 120TP-A, G-ETPC	
No & Type of Engines:	1 Rolls-Royce M250-B17F turboprop engine	
Year of Manufacture:	2017 (Serial no: 11125)	
Date & Time (UTC):	15 September 2021 at 1215 hrs	
Location:	In flight, RNAS Yeovilton, Somerset	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Oil contamination of windscreen.	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	64 years	
Commander's Flying Experience:	7,241 hours (of which 65 were on type) Last 90 days - 36 hours Last 28 days - 16 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

During a training flight, forward visibility was obscured when engine oil leaked from the propeller onto the windscreen. The pilot made a successful precautionary landing using full sideslip to enable him to use the only part of the windscreen that was clear.

An examination of the propeller revealed a damaged piston seal. The aircraft manufacturer had previously issued a Service Letter regarding oil leaking from the piston seal and following this event the propeller manufacturer issued a Service Bulletin to inform operators of an improved O-ring seal with increased durability.

History of the flight

The pilot in the left seat, was undertaking a training flight under the supervision of an instructor in the right seat who was the PIC. The weather was good, and the flight was uneventful until the PIC noticed the visibility through the windscreen was deteriorating. He thought it was ice forming and elected to take control of the aircraft. The pilot flying was surprised as he was unaware of a reason for the PIC to take control; shortly afterwards his forward visibility was also obscured with what both pilots identified as engine oil (Figure 1 centre).

All the engine parameters stayed within normal limits and the pilot climbed to increase the gliding range should an engine failure occur. A PAN was declared, and the pilot decided to make a precautionary landing at RNAS Yeovilton. A MAYDAY was declared as the pilot

flew a steep final approach with right side slip. This enabled the pilot to use the lower right corner of the windscreen which was the only part that remained clear (Figure 1 right). The left seat pilot monitored and read out the height and airspeed, so the pilot did not have to remove his focus from the area of clear windscreen. The pilot touched down a third of the way along Runway 26, removing the sideslip at the last moment and braked hard to reduce the risk of a runway excursion.



Figure 1

Oil contamination post flight

Aircraft information

The Grob G 120TP-A is an advanced turboprop training aircraft powered by a Rolls-Royce M250-B17F gas turbine engine driving a five bladed MTV-5 propeller. The propeller uses pressurised engine oil to move a piston in the hub assembly to change the pitch of the propeller blades to maintain the selected engine rpm (Figure 2). Sealing between the pitch change piston and the hub assembly is by an O-ring: 120.2 mm in diameter, with a 7 mm diameter cross section. The O-ring is manufactured from a nitrile rubber compound.

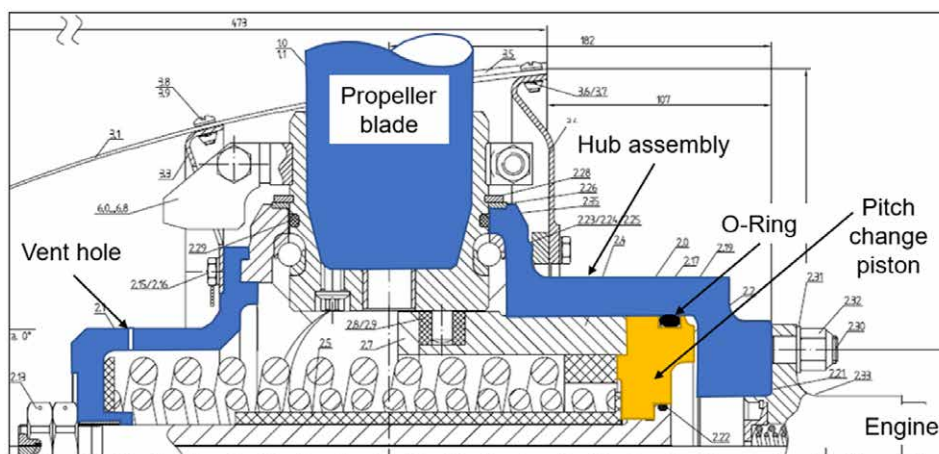


Figure 2

Cross-section through the propeller showing the piston O-ring

The aircraft manufacturer stated that they were aware of two incidents where the pitch change piston O-ring failed resulting in oil leaking from the vent hole in the forward part of the hub. The propeller manufacturer attributed these failures to a compatibility issue

between the O-ring material and the engine oil. Consequently, in July 2019 the aircraft manufacturer issued Service Letter SL 565-009 which highlighted the signs to be aware of during pre-flight and engine run-up checks which would indicate a failed O-ring. It also included reference to the propeller manufacturer's Service Bulletin SB No 36 which detailed compatible engine oils. No anomalies were found during the pre-flight inspection or engine run-up on G-ETPC before the flight.

The propeller manufacturer also made three changes to the O-ring material to increase its durability (Table 1). The shore hardness¹ of the nitrile rubber compound was increased from 70 to 72 and the latest standard has a proprietary surface finish applied which increases the surface hardness and reduces friction. All three O-rings are compatible with the engine oils listed in SB No 36.

Part number	Material	Compound	Finish	Comments
C-047-135	NBR 70	NB7000	None	Original material from 2013
C-047-135-1	NBR 72	707	None	Product improvement in 2020
C-047-135-2	NBR 72	707	OVE70 DF	Introduced by Service Bulletin No 37

Table 1

O-ring material and finish evolution

Propeller examination

The propeller was removed and examined at an authorised overhaul facility. The piston O-ring was found to have multiple cuts and widespread surface damage (Figure 3) allowing oil to pass into the hub, causing a breakdown of the hub bearing grease. The O-ring had part number C-047-135. The propeller manufacturer stated that the damage was a result of the O-ring swelling due to high engine oil temperature and contact with a non-compatible engine oil. The size increase of the O-ring due to swelling, caused it to stick and roll as the piston moved, rather than slide. The surface was then damaged with cuts and tears.

Engine oil

G-ETPC was supplied from new with the engine filled with Mobil Jet Oil 254 and after 21 flying hours it was replaced, in April 2018, with AeroShell 560. The oil was changed again after 151 flying hours, in December 2020, with AeroShell 560 and the aircraft flew a further 106 hours before the leak occurred. Both oils conform to specification MIL-PRF-23699-HTS and are listed in SB No 36.

Footnote

¹ Shore hardness is a mechanical macro indentation test typically used to determine the hardness of polymers.



Figure 3

O-ring damage (left), hub interior (right)

Other incidents

In February 2019 an RAF Grob G 120TP-A² also suffered a pitch change piston seal failure, resulting in oil contamination of the windscreen. The pilot successfully landed the aircraft, and the cause was determined to be a combination of damage incurred during assembly and the engine oil compatibility with the O-ring material. As a result of this incident, the propeller assembly procedures were amended to prevent damage to the seal, and the engine oil was changed to Mobil Jet Oil 254. The original O-ring, part number C-047-035, was replaced with a C-047-135-1 O-ring. The remainder of the RAF fleet was fitted with C-047-135-1 O-rings within 100 flying hours.

Manufacturer's findings

An investigation by the propeller manufacturer determined that there was a compatibility issue between the propeller piston O-ring and the engine oil resulting in softening and damage to the O-ring, which allowed oil to pass the seal. Furthermore, there was evidence that the O-ring was possibly damaged during installation which might also have resulted in an oil leak.

Footnote

² The RAF designation for the Grob G 120TP-A is a 'Prefect'.

Comment

The propeller manufacturer identified a compatibility issue with the pitch change piston O-ring of the MTV-5 propeller and the oils used in the Rolls-Royce M250 engine. They had already issued SB No 36 which detailed compatible engine oils and following this incident, they issued SB No 37 to inform operators of the latest O-ring available with improved durability.

In both the G-ETPC incident and the similar previous incidents, forward visibility was lost due to a film of oil across the windscreen, but the quantity of oil lost was not sufficient to affect the performance of the aircraft. Using effective Crew Resource Management skills, the PIC on G-ETPC was able to delegate essential tasks, such as airspeed and height monitoring, thereby allowing him to maintain full concentration on the limited view afforded through the only clear part of the windscreen.