AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:	CA18/2/3/10064	
Helicopter Registration	ZS-HDX	**Date of Accident**	2 November 2021	**Time of Accident**	1012Z
Type of Helicopter	Bell 206L Jet ranger		**Type of Operation**	Commercial Helicopter Operations (Part 127)	
Pilot-in-command Licence Type	Airline Transport Pilot Licence (H)	**Age**	44	**Licence Valid**	Yes
Pilot-in-command Flying Experience	**Total Flying Hours**	4423.3	**Hours on Type**	164	
Last Point of Departure	Rand Airport (FAGM), Gauteng Province				
Next Point of Intended Landing	Buffels Mine, North West Province				
Damage to Helicopter	Substantial				

Location of the accident site with reference to easily defined geographical points (GPS readings if possible)

On a private farm, 16nm south-west of Fochville at Global Positioning System (GPS) determined to be 26°40'10.6680''S 027°16'14.6640''E, at an elevation of 4602 feet (ft)

Meteorological Information	Wind velocity: 250° at 4KT; Temperature: 26°C; Dew Point: 02°C; Visibility: ≥10000m; Cloud: CAVOK; QNH: 1020 hPa

Number of People On-board	1 + 1	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On 2 November 2021 at 0925Z, a pilot and a passenger on-board a Bell 206L helicopter with registration ZS-HDX were engaged in a repositioning flight operation from Rand Airport (FAGM) in Gauteng province to Buffels Mine near Klerksdorp in the North West province. Approximately 35 minutes into the flight during the cruise phase the pilot noticed an engine out warning light which was followed by the indication of zeros for oil pressure, torque and gas generator (Ng); the rotor revolutions per minute (RRPM) and transmission oil temperature (TOT) gauges read normal. Thereafter, a loud bang was heard from the engine compartment, and the low rotor RPM warning activated. The helicopter entered autorotation, and the pilot reacted by turning the helicopter into wind in preparation for a forced landing. All pedal controls lost effectiveness, but the pilot was able to execute a successful forced landing, thereafter, he shut down the helicopter engine. Fire erupted in the engine bay and the pilot used the portable fire extinguisher to put it out. The pilot and the passenger did not sustain any injuries. The helicopter sustained damage to the engine, cowling, fuselage, tail rotor drive shaft and one main rotor blade.

Metallurgical examination and analysis of the engine components revealed that the engine failure was due to the gas producer bearing thrust plate anti-rotation tab that separated and travelled through the oil system and finally lodged between the oil pump scavenge gear and the wall. As a result, the oil pump could not provide adequate lubrication to the number 6 and 7 bearings. Therefore, the number 6 and 7 bearings failed due to thermal damage, as well as the subsequent damage to other turbine parts.

Probable Cause/s and/or Contributory Factors			
Engine failure due to loss of lubrication to the number 6 and 7 bearings caused by a separated thrust plate anti-rotation tab which lodged between the engine oil scavenge gear and the wall of the oil pump, preventing adequate flow of engine oil.			
SRP Date	14 March 2023	Publication Date	31 March 2023

Occurrence Details

Reference Number	**:** CA18/2/3/10064
Occurrence Category	**:** Commercial
Type of Operation	**:** Positioning Part 127
Name of Operator	**:** Henley Air (PTY) LTD
Helicopter Registration	**:** ZS-HDX
Helicopter Make and Model	**:** Bell B206L
Nationality	**:** South African
Registration	**:** South African
Place	**:** Near Fochville, Gauteng province
Date and Time	**:** 2 November 2021, 1012Z
Injuries	**:** None
Damage	**:** Substantial

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not to apportion blame or liability.

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Investigation Process

The Accident and Incident Investigations Division (AIID) of the South African Civil Aviation Authority (SACAA) was notified of the occurrence on 2 November 2021 at 1030Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and ICAO STD Annex 13 definitions. Notifications were sent to the State of Registry/Operator/Design/Manufacturer in accordance with CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. Investigators were dispatched to the accident site for this accident.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Accident — this investigated accident
   Helicopter — the Bell B206L involved in this accident
   Investigation — the investigation into the circumstances of this accident
   Pilot — the pilot involved in this accident
   Report — this accident report

2. *Photos and figures used in this report were taken from different sources and may have been adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows, or lines.*

Disclaimer

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Abbreviation	Description
°	Degrees
°C	Degrees Celsius
AGL	Above Ground Level
AIID	Accident and Incident Investigations Division
AME	Aircraft Maintenance Organisation
AMO	Aircraft Maintenance Organisation
ATPL	Airline Transport Pilot Licence
CAR	Civil Aviation Regulations
CEB	Commercial Engine Bulletin
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
FAA	Federal Aviation Authority
FAGM	Rand Airport
FAVV	Vereeniging Aerodrome
FDR	Flight Data Recorder
ft	Feet
GPS	Global Positioning System
hPa	Hectopascal
kt	Knots
METAR	Meteorological Aerodrome Report
MPI	Mandatory Periodic Inspection
Ng	Gas Generator Stage
NM	Nautical Mile
RRPM	Rotor revolutions per minute
PIC	Pilot-in-command
QNH	Barometric Pressure Adjusted to Sea Level
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
TBO	Time Between Overhaul
TOT	Transmission Oil Temperature
VFR	Visual Flight Rules
VHF	Very High Frequency
Z	Zulu (Term for Universal Co-ordinated Time – Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

On 2 November 2021, a pilot and a passenger on-board a Bell 206L helicopter with registration ZS-HDX took off on a repositioning flight from Rand Airport (FAGM), routing to Buffels Mine near Klerksdorp, North West province. The flight was conducted under visual flight rules (VFR) by day and under the provisions of Part 127 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.1. The pilot reported that approximately 35 minutes into the flight while cruising at 650 feet (ft) above ground level (AGL), he noticed an engine out warning indication light. He then cross-checked the instrument indicators and noticed that the engine oil pressure, torque and gas generator (Ng) gauges all indicated zero. The rotor revolutions per minute (RRPM) indication was on green and the transmission oil temperature (TOT) and all other parameters read normal.

1.1.2. Minutes later, a loud bang was heard from the engine compartment, followed by a low RRPM warning light indication and audio. Thereafter, the helicopter entered autorotation. In response, the pilot turned the helicopter into wind in preparation for a forced landing. All pedal controls lost effectiveness, but the pilot was able to execute a successful forced landing on an open field in a private farm, 16 nautical miles (nm) south-west of Fochville.

1.1.3. After completing the emergency shutdown procedure, the pilot and the passenger vacated the helicopter unassisted. The pilot noticed smoke emanating from the engine bay and he put the fire out using the on-board fire extinguisher. The pilot and the passenger were not injured. The helicopter sustained damage to the turbine section, fuselage, tail rotor drive shaft and main rotor blade.

1.1.4. The helicopter landed on a private farm 16nm south-west of Fochville at Global Positioning System (GPS) co-ordinates determined to be 26°40’10.6680’’S 027°16’14.6640’’E, at an elevation of 4602 feet (ft).

Figure 1: An overview of the accident site. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	1	-	1	2	-
Total	**1**	**-**	**1**	**2**	**-**

Note: Other means people on the ground.

1.2.1. The pilot and the passenger were not injured during the landing sequence.

1.3. Damage to Helicopter

1.3.1. The helicopter sustained damage to the turbine section, fuselage, tail rotor drive shaft and main rotor blade. The engine sustained severe damage to the power turbine and gas producer supports. The tail rotor drive shaft was severed below the turbine section.

1.3.2. There was debris damage in the baggage compartment.


Figures 2 and 3: Damage to the fuselage and engine bay.

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information: Pilot

Nationality	South African	Gender	Male	Age	44
Licence Type	Airline Transport Pilot Licence (Helicopter)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night, Instrument, Instructor				
Medical Class & Expiry Date	30 September 2022				
Restrictions	None				
Previous Accidents	None				

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

Total Hours	4423.3
Total Past 90 Days	110.0
Total on Type Past 90 Days	31.3
Total on Type	164.0

1.5.1. The pilot had a valid Airline Transport Pilot Licence (ATPL) initially issued on 8 July 2015 and renewed on 12 October 2021 with an expiry date of 31 October 2022. The pilot had last flown the accident helicopter on 31 July 2020 for a duration of 1.7 hours. The pilot had a Class 1 medical certificate which was issued on 17 September 2021 with an expiry date of 30 September 2022.

1.6. Helicopter Information

1.6.1. The Bell 406L Ranger is a six-seat light two-bladed helicopter powered by a single Rolls Royce C30P turbine engine based on the US Army YHO-4 light observation helicopter. The helicopter is of metal construction with hydraulically assisted flight controls. The light utility helicopter first received the Federal Aviation Authority (FAA) certification in 1966.

1.6.2. The helicopter had a valid Certificate of Airworthiness (C of A) that was initially issued by the Regulator (SACAA) on 20 April 2011. The latest reissued C of A had an expiry date of 30 April 2022. The helicopter's Certificate of Registration (C of R) was issued to the current owner on 2 February 2017.

1.6.3. The helicopter had a Certificate of Release to Service (CRS) that was issued on 8 May 2021 at 3136.2 Hobbs hours (21014.5 airframe) with an expiry date of 26 April 2022 or at 21114.5 Hobbs hours, whichever comes first.

Airframe:

Manufacturer/Model	Bell 206L	
Serial Number	45538	
Year of Manufacture	1996	
Total Airframe Hours (At Time of Accident)	21070.9	
Last Inspection (Date & Hours)	24 September 2021	21014.5
Airframe Hours Since Last Inspection	56.4	
CRS Issue Date	8 May 2021	
C of A (Issue Date & Expiry Date)	20 April 2011	30 April 2022
C of R (Issue Date) (Present Owner)	2 February 2017	
Operating Category	Standard Normal Rotorcraft	
Type of Fuel Used	Jet A1	
Previous Accidents	None	

Note: Previous accidents refer to past accidents the helicopter was involved in, when relevant to this accident.

Engine:

Manufacturer/Model	Rolls Royce (Allison) C30 P
Serial Number	CAE-895867
Hours Since New	6192.7
Hours Since Overhaul	1187.4

Main Rotor Gearbox:

Serial Number	BMC-51545
Hours Since New	7110.9
Hours Since Overhaul	3220.9

Tail Rotor Gearbox:

Type	A
Serial Number	A-ES2182
Hours Since New	UNK
Hours Since Overhaul	3220.9

1.6.4. The helicopter oil system was last serviced at 20929 airframe hours on 8 May 2021. The engine hours at the time of the service were 6051.6. The helicopter was in compliance with the commercial engine bulletin (CEB) CEB-73-3147 at 3136.2 hours. The engine gearbox is an on-condition item.

1.6.5. The first and second stage wheel of the engine was installed new at 19883 airframe hours. The first and second stage wheel had a total 1187.4 hours with 837.6 component life remaining at the time of the accident.

1.7. Meteorological Information

1.7.1. The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS) on 2 November 2021 at 1000Z and recorded at Vereeniging (FAVV), which is located 17nm from the accident site.

Wind Direction	250°	Wind Speed	4 KT	Visibility	10000 m
Temperature	26°C	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	02°C	QNH	1020hPa		

1.7.2. The weather conditions did not contribute towards this accident.

1.8. Aids to Navigation

1.8.1. The helicopter was equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no records indicating that the navigation system was unserviceable prior to the accident.

1.9. Communication

1.9.1. The helicopter was equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system prior to the accident.

1.10. Aerodrome Information

1.10.1. The helicopter landed at a private farm 16nm south-west of Fochville, at GPS co-ordinates determined to be 26°40’10.6680’’S 027°16’14.6640’’E, at an elevation of 4602ft.

1.11. Flight Recorders

1.11.1. The helicopter was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by regulation to be fitted to the helicopter type.

1.12. Wreckage and Impact Information

1.12.1. The pilot executed a successful forced landing following an engine failure approximately 35 minutes into the flight at a private farm. A post-landing fire erupted after a successful forced landing. The engine remained within the engine bay with heavy damage to the power turbine and gas producer supports. There was notable engine debris in the engine bay. The tail rotor drive shaft was sheared off, rendering the tail rotor pedals inoperative. Debris also damaged the main rotor blade and punctured the baggage compartment door (Figures 2 and 3).

1.13. Medical and Pathological Information

1.13.1. None.

1.14. Fire

1.14.1. A fuel-fed fire erupted in the engine compartment after the forced landing. The pilot put out the fire using the fire extinguisher on-board the helicopter.

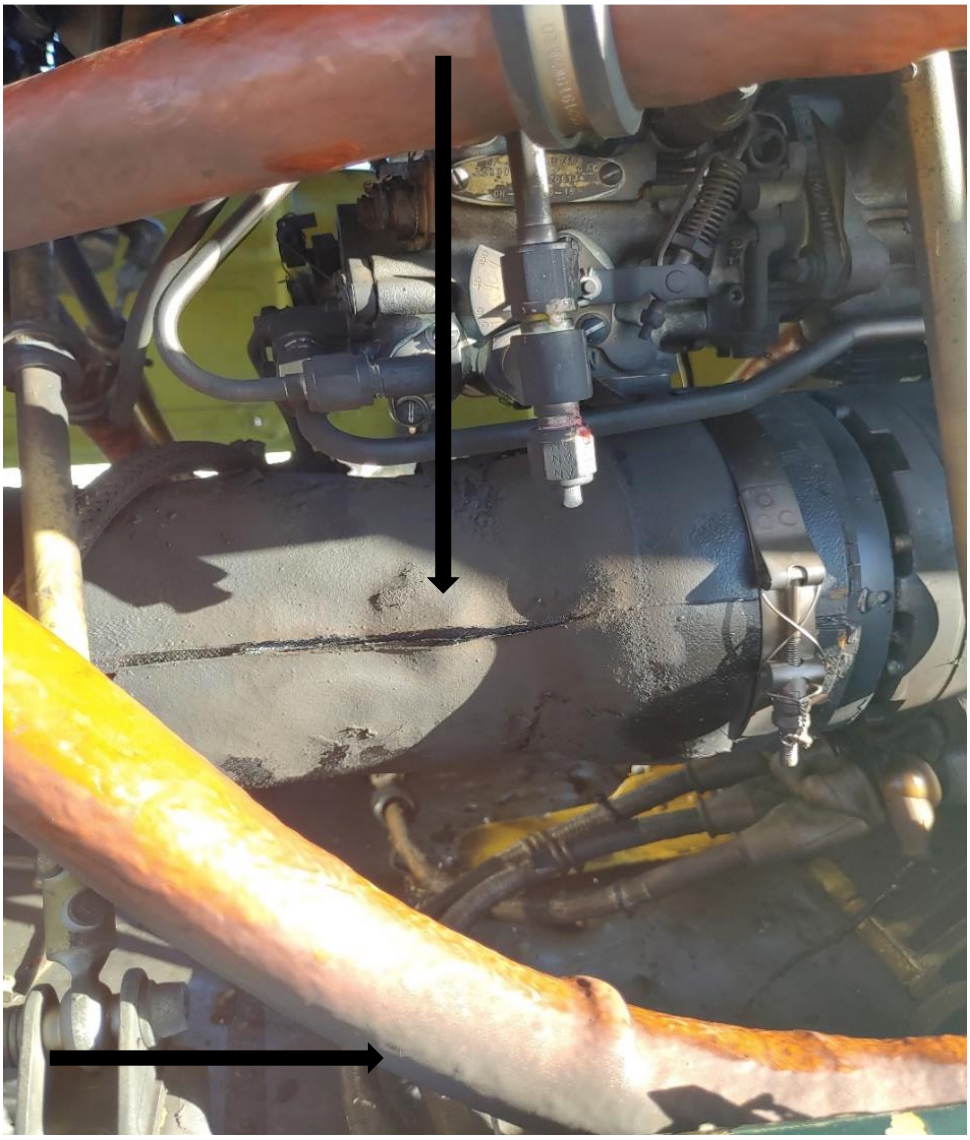

Figure 4: Fire damage on the engine tubing.

1.15. Survival Aspects

1.15.1. The accident was survivable. The pilot initiated autorotation after the engine failure warning activated and successfully executed a forced landing.

1.16. Tests and Research

The following report was provided by the engine manufacturer: ZS-HDX, M250-C30P, CAE 895867 - November 2, 2021:

1.16.1. *On 8 November 2021, the engine was removed from the helicopter by an approved engine shop for further inspection. On 9 November 2021, an engine strip was carried out in the presence of an AIID investigator and the representative from Rolls Royce. During the preliminary findings, it was discovered that a small piece of metal was stuck in the gear in the scavenge side of the oil pump, causing it to stop and, thus, not allowing oil to flow into the engine.*

1.16.2. *An engine component was taken to the engine manufacturer for metallurgical examination and analysis. The piece of debris discovered in the oil pump is consistent in chemistry and morphology with the outboard portion of the anti-rotation tab of a bearing thrust plate. The anti-rotation tab was missing from the gas producer bearing thrust plate installed in the engine. The inboard portion of the tab was not recovered.*

1.16.3. *Semi-quantitative EDS analysis and metallography of the outboard portion of the thrust plate forward face revealed the presence of braze material over the joint surface and the evidence of a braze fillet at the joint extremities. Overall braze coverage could not be determined due to obliteration of the braze on the inboard portion of the thrust plate and the missing inboard portion of the tab. The outer diameter surface exhibits no evidence of fillets on the extremities and approximately 29% braze coverage in the internal braze joint, which did not meet the component definition requirements.*

1.16.4. *The bearing thrust plate removed from engine S/N CAE 895867 exhibited no evidence of braze material on the extremities of the forward face or outer diameter surface in contact with the anti-rotation tab. The braze joint interior on the forward face of the thrust plate exhibited approximately 27% coverage, and the interior of the braze joint on the outer diameter surface exhibited no evidence of braze material. Neither the extremities nor the interior of both braze joints met the component definition.*

1.16.5. *The No. 8 bearing rotated freely, and the anti-rotation slot on the outer ring exhibited no apparent damage. The microstructure of the No 8 bearing subcomponents were consistent with the component definition requirements and revealed no evidence of thermally distressed material. All other damage was considered secondary to the loss of lubrication to the #6 and #7 bearings.*

1.16.6. The analysis revealed that the engine failure was due to the gas producer bearing thrust plate anti-rotation tab that separated and travelled through the oil system and finally lodged between an oil pump scavenge gear and wall, causing the oil pump to provide inadequate lubrication to the number 6 and 7 bearings. This led to the number 6 and 7 bearings failure due to thermal damage (Figure 5-10) and the subsequent damage to other turbine parts (see Appendix 1).

Figures 5 and 6: The oil pump scavenge gears with a tab lodged on the left gear. (Source: Rolls Royce)

Figure 7: New thrust plate (left) and accident thrust plate (right) with a missing tab. (Source: Rolls Royce)

Figures 8 and 9: Thermal damage on the number 6 and 7 bearings. (Source: Rolls Royce)

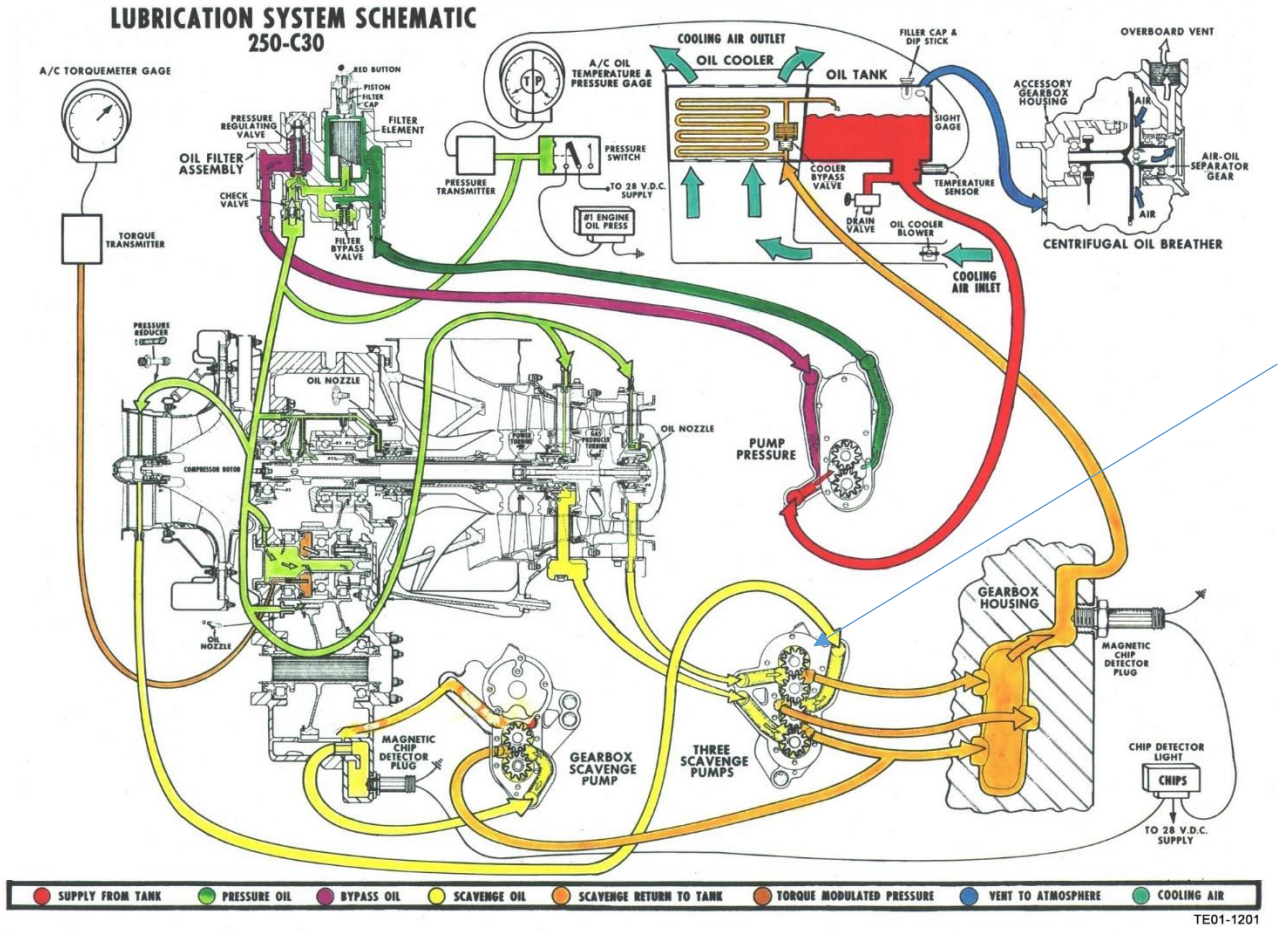

Diagram 1: Schematic of Lubrication System with blue arrow on oil pump. (Source: Rolls Royce)

1.16.7 *The lubricating system furnishes lubrication, scavenging and cooling as needed for bearings, splines, and gears in all conditions of flight. The system is a circulating, dry sump type, with an external reservoir and oil cooler mounted and furnished by the helicopter manufacturer. The torquemeter in the engine gearbox is hydraulic and uses the engine lubrication system as its oil (hydraulic) pressure source. In order to minimize friction effects and provide accurate measurement of torque, the axial gear thrust on the helical torquemeter gearshaft is high. System pressure must always be greater than the torquemeter oil pressure. Therefore, it is necessary to regulate the system oil pressure to the relatively high value of 115-130 psi.*
Oil pressure is a function of (1) volume flow, (2) restriction to flow, and (3) viscosity. Volume flow from the pressure element is determined by N1 RPM...volume flow increases as N1 RPM increases. Restriction to flow is determined by the size of the passages, lines, and nozzles. Viscosity or fluid friction is a function of oil temperature. Thus, if the oil temperature and restriction to flow remain constant, oil pressure will increase with increases in N1 RPM until the regulated oil pressure of 115-130 psi is reached. Further increases in N1 RPM do not result in further increases in pressure because the pressure regulating valve bypasses the excess oil to the inlet of the pump.

Components which have pressure oil delivered to them for lubrication and cooling are as follows:

1. *Compressor Rotor Front (No.1) Bearing*
2. *Compressor Rotor Rear (No.2) Bearing*
3. *Helical Power Train Drive (Pinion) Gear Front (No.3) Bearing*

4. *Helical Power Train Drive (Pinion) Gear Front (No.4) Bearing*
5. *Power Turbine Rotor Front (No.5) Bearing*
6. *Power Turbine Rotor Front (No.6) Bearing*
7. *Gas Producer Turbine Rotor Front (No.7) Bearing*
8. *Gas Producer Turbine Rotor Rear (No.8) Bearing*
9. *1st Stage Gear Reduction where the pinion gear and the large gear on the helical torquemeter gearshaft come "out-of-mesh"*
10. *2nd Stage Gear Reduction where the pinion gear and the large gear on the helical torquemeter gearshaft come "out-of-mesh" with the helical power take-off gearshaft*
11. *Turbine to Compressor Coupling Splines*
12. *Torquemeter Front Roller Bearing*
13. *Torquemeter Rear Roller Bearing*
14. *Torquemeter Ball Bearing*
15. *Spur Adapter Gearshaft (No. 2 ½) Bearing*

The remaining gears and bearings in the accessory gearbox are lubricated by the air-oil mist present within the gearbox.
The engine has the following scavenge oil sumps:

1. *Compressor Front Support Sump*
2. *Accessory Gearbox Sump*
3. *Power Turbine Support External Sump*
4. *Gas Producer Turbine Support Sump*

A gear type pressure and scavenge pump assembly, consisting of one pressure element and five scavenge elements, is mounted within the accessory gearbox. An assembly containing an oil filter, check valve, filter bypass valve, and a pressure regulating valve is located in the upper left hand side of the gearbox housing. The gearbox housing and cover are magnesium alloy castings which have passages for pressure and scavenge oil. The accessory gearbox assembly incorporates a number of oil transfer tubes. External stainless steel tubes are used to transfer tubes, and the external tubes port pressure and scavenge oil as required by the lubrication system.

1.16.8. The engine manufacturer issued a Commercial Engine Bulletin CEB-72-3309 dated 16 December 2022 which stipulated the replacement of the number 8 bearing thrust plate to prevent domestic debris in the engine. The number 8 bearing thrust plate was redesigned.

1.17. Organisational and Management Information

1.17.1. The flight was conducted in VFR by day and under the provisions of Part 127 of the CAR 2011 as amended. The operator was issued an Air Operator Certificate (AOC) on 21 January 2021 with an expiry date of 31 January 2022 by the Regulator.

1.17.2. The aircraft maintenance organisation (AMO) that carried out the last maintenance inspection on the helicopter was issued an AMO certificate on 31 May 2021 with an expiry date of 31 May 2022. The helicopter type was duly authorised to be maintain under the AMO.

1.17.3. The aircraft maintenance engineer (AME) who performed the last mandatory periodic inspection (MPI) prior to the accident flight had a valid AME licence that was issued on 12 January 2021 with an expiry date of 20 January 2023. According to the reviewed records, the helicopter type was endorsed on his licence. The AME was rated on this helicopter type.

1.18. Additional Information

1.18.1. Bell 206L Jet Ranger Flight Manual: Emergencies

WARNING LIGHT (RED)

LIGHT	FAULT AND REMEDY
ENG OUT (audio if functional)	Engine power failure (N1 less than 55%). Reduce pitch immediately to autorotate. If ample altitude remains, investigate failure, attempt engine relight.

1.18.2 ENGINE OIL PRESSURE LOW, HIGH, OR FLACTUATING:

If engine oil pressure is below minimum or above maximum, land as soon as possible.

If engine oil pressure fluctuates but does not exceed a limit, monitor engine oil pressure and temperature, and land as soon as practical.

ENGINE OIL TEMPERATURE HIGH

Land as soon as possible.

1.19. Useful or Effective Investigation Techniques

1.19.1. None.

2. ANALYSIS

2.1. General

From the available evidence, the following analysis was made with respect to this accident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2. Analysis

2.2.1. The pilot was adequately licenced to perform the flight. The engine out red light illuminated during cruise and the pilot autorotated the helicopter as per the flight manual; he turned the helicopter into wind and completed the autorotative landing successfully. He disembarked the helicopter unassisted with the passenger. The weather conditions of the day did not contribute to this accident. The pilot had a total of 4423.3 hours flying experience, of which 164 hours were on the helicopter type.

2.2.2. The flight was conducted under VFR by day and under the provisions of Part 127 of the CAR 2011 as amended. The weather conditions were suitable for the flight. The helicopter was being repositioned from FAGM to Buffels Mine near Klerksdorp, North West province.

2.2.3. The last annual maintenance inspection was carried out on 24 September 2021 at 21014.5 airframe hours and 6084.1 Turbine hours. The helicopter had flown a further 56.4 hours after the said inspection. The helicopter was issued a CRS on 8 May 2021 at 3136.2 Hobbs hours (21014.5 airframe) with an expiry date of 26 April 2022 or at 3196.2 Hobbs hours, whichever comes first. The AMO which carried out the last maintenance inspection on the helicopter was issued an AMO certificate on 31 May 2021 with an expiry date of 31 May 2022.

2.2.4. The helicopter engine failed during cruise, approximately 35 minutes into the flight near Fochville. The pilot executed a successful forced landing at a private farm, 16nm south-west of Fochville, Gauteng province. The two occupants were not injured during the forced landing. The pilot was able to put out the fire that erupted after the forced landing. The helicopter sustained damage to the fuselage, engine, tail rotor drive shaft and main rotor blade.

2.2.5. The helicopter was recovered to the operator's facility for analysis. Inspection revealed that the compressor and accessory gearbox sections were not damaged and in normal position. There was heavy damage to the power turbine and gas producer support. The main bearings number 1 to 5 were undamaged, and they rotated freely. The number 6 and 7 bearings had suffered thermal damage and melted inside the bore of the power turbine support. This was caused by loss of adequate lubrication due to a gas producer bearing thrust plate anti-rotation tab that sheared off and lodged between the oil scavenge gear and the wall in the oil pump.

2.2.6. A small metal piece got stuck in a gear in the scavenge side of the oil pump, causing it to stop, and thus, preventing oil flow to the engine.

3. CONCLUSION

3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this accident. These shall not be read as apportioning blame or liability to any organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusion heading:

- **Findings —** are statements of all significant conditions, events, or circumstances in this accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this accident.
- **Contributing factors —** are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident occurring, or would have mitigated the severity of the consequences of the accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

3.2. Findings

3.2.1. The pilot had a valid ATPL that was initially issued on 8 July 2015. The licence was renewed on 12 October 2021 with an expiry date of 31 October 2022. The pilot had a Class I medical certificate that was issued on 12 July 2019 with an expiry date of 12 July 2021 with no restrictions.

3.2.2. The flight was conducted under VFR by day and under the provisions of Part 127 of the CAR 2011 as amended. The helicopter was being repositioned from FAGM to Buffels Mine. The weather conditions did not contribute to this accident.

3.2.3. The last annual maintenance inspection was carried out on 24 September 2021 at 21014.5 airframe hours and 6084.1 turbine hours. The helicopter was flown a further 56.4 hours after the said inspection.

3.2.4 The helicopter was issued a CRS on 8 May 2021 at 3136.2 Hobbs hours (21014.5 airframe) with an expiry date of 26 April 2022 or at 3196.2 Hobbs hours, whichever comes first. The helicopter had a valid C of A that was initially issued by the Regulator on 20 April 2011. The latest C of A had an expiry date of 30 April 2022. The helicopter was issued a C of R on 2 February 2017.

3.2.5 The helicopter engine failed during cruise, approximately 35 minutes into the flight near Fochville. The pilot executed a successful forced landing at a private farm. The two occupants were not injured during the forced landing sequence. The pilot was able to put out the fire that erupted after the forced landing. The helicopter sustained damage to the fuselage, engine, tail rotor drive shaft and main rotor blade.

3.2.6 Further examination which included metallurgical examination of various engine parts was conducted at the manufacturer's facility. An anti-rotation tab separated from the gas producer bearing thrust plate. It travelled through the oil system and lodged between the gear and the wall in the scavenge side of the oil pump, preventing the gears from rotating and, thus, oil flow to the engine. This resulted in damage to all other turbine parts.

3.2.7 Following the accident, the engine manufacturer issued a Commercial Engine Bulletin on 16 December 2022 which stipulated the replacement of the number 8 gas producer bearing thrust plate with a redesigned thrust plate.

3.3. Probable Cause

3.3.1. Engine failure due to loss of lubrication to the number 6 and 7 bearings caused by a separated thrust plate anti-rotation tab which lodged between the engine oil scavenge gear and the wall of the oil pump, preventing adequate flow of engine oil.

3.4. Contributory Factor

3.4.1. Sheared off gas producer bearing thrust plate anti-rotation tab.

4. SAFETY RECOMMENDATIONS

4.1. General

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report. The AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisations.

4.2. Safety Action

4.2.1. Following the accident, the engine manufacturer issued a Commercial Engine Bulletin on 16 December 2022 which stipulated the replacement of the number 8 gas producer bearing thrust plate with a redesigned thrust plate.

5. APPENDICES

5.1. Commercial Engine Bulletin – CEB-72-3309.

This report is issued by:

Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa

Appendix 1

EXPORT CONTROLLED

COMMERCIAL ENGINE BULLETIN

Rolls-Royce

23058137 THRUST-GAS PROD BEARING PLATE

1. PLANNING INFORMATION

A. Effectivity

(1) Engines

All Rolls-Royce M250®-C30 series, -C40B and -C47 series engines are potentially affected by this bulletin.

(2) Spares - affected

B. Reason

P/N 23058137 thrust plates have been found to have inadequate braze on the anti-rotation feature of the plate. This can lead to liberation of the retaining feature resulting in domestic debris within the engine.

C. Description

This Commercial Engine Bulletin provides the requirements to replace the number 8 bearing thrust plate.

D. Approval

Technical aspects are FAA approved.

E. Compliance

Compliance Code 5: To be complied with at a time when the affected part(s) are directly available.

F. Interchangeability - Not applicable

G. Material Availability

NEW P/N	NAME	QTY/ENG
M250-10982	PLATE, THRUST-GAS PROD BEARING	1

H. Tooling - Not applicable

I. Weight and Balance - Not affected

J. Electrical Load Data - Not affected

NAC ENGINE SHOP
COPY
DATE ISSUED....27. JAN 2023.....
EXPIRY DATE.....
RAND AIRPORT

December 16, 2022

PROPRIETARY

M250-C30 Series	CEB-72-3309
M250-C40	CEB-72-5077
M250-C47 Series	CEB-72-6090
M250-C47E Series	CEB-72-7010

K. References

(1) 14W3 Overhaul Manual, Turboshaft Model M250-C30 Series (OH).

(2) CSP22001 Overhaul Manual, Turboshaft Model M250-C40B, -C47, & -C30R/3 Series (OH).

(3) CSP22011 Overhaul Manual, Turboshaft Model M250-C47E, -C47E/1, & -C47E/4.

L. Other Publications Affected

None.

M. Prerequisites

None.

2. ACCOMPLISHMENT INSTRUCTIONS

A. Replace part.

B. Removed parts are to be scrapped locally.

C. Record compliance with this CEB in the appropriate Engine Logbook page.

M250-C30 Series	CEB 72-3309
M250-C40	CEB 72-5077
M250-C47 Series	CEB 72-6090
M250-C47E Series	CEB 72-7010

3. MATERIAL INFORMATION

A. Configuration Chart

NEW P/N	QTY	NAME	OLD P/N	QTY	INSTRUCTIONS/ DISPOSITION
M250-10982	1	PLATE, THRUST-GAS PROD BEARING	23058137	1	1

INSTRUCTIONS/DISPOSITION NOTES

1. New/exchange item.

CUSTOMER SUPPORT
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December 16, 2022

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