AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:	CA18/2/3/10526		
Aircraft Registration	ZS-RWG	**Date of Accident**	21 November 2024	**Time of Accident**	0923Z	
Type of Aircraft	Eurocopter AS350B3		**Type of Operation**	Surveillance (Part 127)		
Pilot-in-command Licence Type	Airline Transport Pilot Licence (ATPL)	**Age**	38	Licence Valid	Yes	
Pilot-in-command Flying Experience	**Total Flying Hours**		4 542	**Hours on Type**	1 506	
Last Point of Departure	Ultimate Heliport, Midrand, Gauteng Province					
Next Point of Intended Landing	Ultimate Heliport, Midrand, Gauteng Province					
Damage to Aircraft	Substantial					

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

On a field of plot 399 JR in Brakfontein, near Midstream Estate, Centurion, Gauteng Province

Meteorological Information	Wind direction: 350°; Wind speed: 5 kt; Temperature: 28°C; Dew Point: 10°C; Visibility: 9999; Cloud cover: FEW; Cloud Base: 2000 ft						
Number of People On-board	1+2	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On Thursday, 21 November 2024, a pilot and two passengers on-board an Airbus AS350B3 helicopter with registration ZS-RWG took off from Ultimate Heli helipad in Midrand, Gauteng province, to conduct traffic surveillance in Pretoria East, with the intention to land back at Ultimate Heli helipad.

The pilot stated that on their return leg to Ultimate Heli whilst the helicopter was overhead Eco-Park Estate near Midstream suburb and at 400 feet (ft) above ground level (AGL), he heard a loud sound (gong) which was followed by an engine torque failure indication on the instrument panel. The Vehicle and Engine Monitoring Display (VEMD) indicated that the engine torque and engine power available (NG) were offline as they were on the yellow arc. As the main rotor revolutions per minute (RPM) decreased to about 360, the pilot identified a suitable landing spot on which to conduct a forced landing. He then initiated autorotation heading south-west. The helicopter descended rapidly and impacted the ground hard with the left front skid gear first and, thereafter, slid on the grass before it stopped 20 metres (m) from the first point of impact. The pilot waited for the main rotor blades to slow down before he applied the rotor brakes. Once the rotors had stopped, he switched off the battery (electrical system) and disembarked from the helicopter together with the passengers. The helicopter was substantially damaged. None of the occupants was injured.

The investigation revealed that a capacitor on Lane A power-supply board had failed; this contributed to a loss of electrical power to the stepper motor and, thus, prevented fuel delivery to the engine. The helicopter maintenance documentation revealed non-compliance to the critical maintenance-related service bulletin (SB) that was released by the manufacturer. This non-compliance created vulnerability of electronic engine control unit (EECU) and its components to power supply which increased the risk of engine flameout.

Probable Cause/s and/or Contributory Factors			
The capacitor on Lane A power-supply board failed due to a sudden loss of engine torque and power. This failure interrupted electrical power to the stepper motor, thus, preventing fuel delivery to the engine. This led to the pilot conducting an unsuccessful forced landing. **Contributory Factor** 1. Non-compliance to the critical maintenance-related service bulletin (SB) that was released by the manufacturer which created vulnerability to power supply to the EECU and its components and, thus, increasing the risk of engine flameout.			
SRP Date	13 January 2026	Publication Date	19 January 2026

Occurrence Details

Reference Number	**:** CA18/2/3/10526
Occurrence Category	**:** Category 1
Type of Operation	**:** Surveillance (Part 127)
Name of Operator	**:** Ultimate Heli
Helicopter Registration	**:** ZS-RWG
Helicopter Make and Model	**:** Eurocopter Airbus AS350B3
Nationality	**:** South African
Place	**:** On a field within the borders of Plot 399 JR, Brakfontein in Centurion, Gauteng Province
Date and Time	**:** 21 November 2024 at 0923Z
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) was notified of the occurrence which took place on 21 November 2024 at 0923Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and the International Civil Aviation Organisation (ICAO) STD Annex 13 definitions. Notifications were sent to the State of Registry, Operator, and Design and Manufacturer in accordance with the CAR 2011 Part 12 and the ICAO Annex 13 Chapter 4. The State of France (BEA) appointed an accredited representative and advisor. The investigator was dispatched to the accident site for this occurrence.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Accident — this investigated accident
   Aircraft — the Airbus AS350B3 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
AOC	Air Operator Certificate
ATPL	Airline Transport Pilot Licence
CAR	Civil Aviation Regulations
CIT	Cash-in-transit
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
DOT	Department of Transport
EECU	Electronic Engine Control Unit
FADEC	Full Authority and Digital Engine Control
FDR	Flight Data Recorder
Ft	Feet
GPS	Global Positioning System
GTP	Gauteng Traffic Police
HMU	Hydromechanical Unit
hPa	Hectopascal
Kt	Knots
M	Metres
METAR	Meteorological Aerodrome Report
NG	Engine Power Available
RPM	Revolutions per Minute
SACAA	South African Civil Aviation Authority
SAR	Search and Rescue
SAWS	South African Weather Service
QNH	Altitude Above Mean Sea Level
UL	Ultimate Heli
VEMD	Vehicle and engine Multifunctional Display
VMC	Visual Meteorological Condition
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On Thursday, 21 November 2024, a pilot and two passengers on-board an Airbus AS350B3 helicopter with registration ZS-RWG took off from Ultimate Heli (UL) helipad in Midrand, Gauteng province, to conduct traffic surveillance in Pretoria East with the intention to land back at the same helipad. The flight was conducted under visual meteorological conditions (VMC) and under the provisions of Part 127 of the Civil Aviation Regulations (CAR) 2011, as amended.

1.1.2. The pilot stated that he was on a call-out for traffic surveillance operation, and that the two passengers on-board were members of the Gauteng Traffic Police (GTP). The helicopter took off at approximately 0900Z and routed north of Pretoria and, later east. The surveillance operation was completed without incident. On their return leg to Ultimate Heli at approximately 0923Z whilst flying south-westerly overhead Eco-Park Estate near Midstream suburb at 400 feet (ft) above ground level (AGL), the pilot heard a loud sound (gong). This was followed by a decline in engine torque and engine power available (NG); these indicators dropped to the yellow range arc on the Vehicle and Engine Multifunctional Display (VEMD). The pilot also noticed that the main rotor revolutions per minute (RPM) indicator was rapidly spooling down; it dropped to below 360 RPM which confirmed engine failure.

1.1.3. The pilot-initiated autorotation whilst scanning the area for a suitable location on which to execute a forced landing as the helicopter was rapidly losing altitude. He identified an open area; however, during the forced landing, the helicopter impacted the ground hard with its left front skid gear. This caused the bottom skid bar to break. Subsequently, the left side of the helicopter's nose contacted the ground at high impact and the helicopter skidded forward. It continued to slide on the ground and eventually settled upright on its skid gear. During the accident sequence, the tail boom folded downward due to overload which caused the tail rotor drive shaft to decouple near the front shaft assembly bearing (Part No: 350A34-1015-2201). The helicopter came to a stop approximately 20 metres (m) facing south-west.

1.1.4. After the helicopter had come to a stop, the pilot immediately shut down all electrical systems, including the gyroscope and fan. He waited for the rotor blades to slow down to a safe speed before he applied the rotor brake. Once the blades had stopped, he switched off the battery (master switch) and disembarked from the helicopter together with the passengers. No person was injured. The helicopter sustained significant damage to the left landing skid, left nose section and tail boom, as well as the rotating shaft which decoupled.

1.1.5. The accident occurred on a field within the borders of Plot 399 JR, Brakfontein, at Global Positioning System (GPS) co-ordinates determined to be S 25° 53' 58" E 028° 10' 27", at a field elevation of 4 921 ft.

Figure 1: An aerial view of the approximate area where the accident occurred. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	1	-	2	3	-
Total	**1**	**-**	**2**	**3**	**-**

Note: Other means people on the ground.

1.2.1. No person was injured during the accident.

1.3. Damage to Helicopter

1.3.1. The helicopter's left landing skid, tail boom and left side of the nose section were substantially damaged. Moreover, the rotating shaft decoupled during the accident sequence.

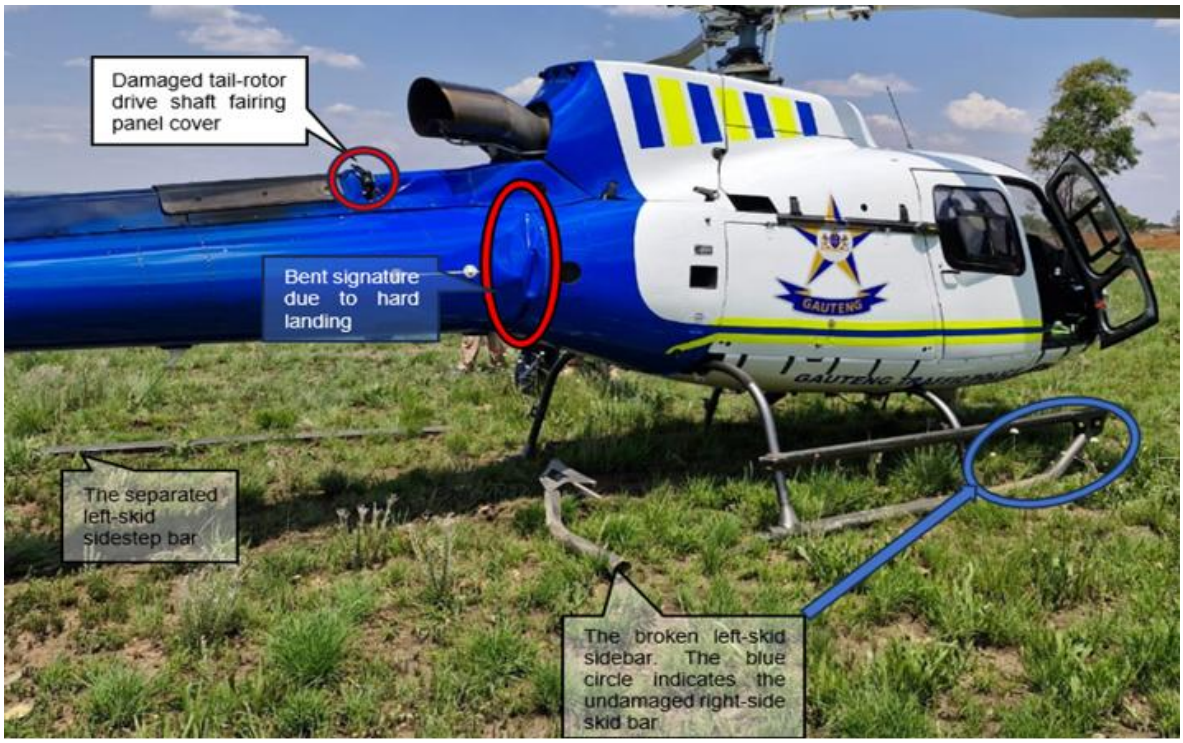

Figure 2: The helicopter post-accident.

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	38
Licence Type	Airline Transport Pilot Licence (ATPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Game/Livestock cull, Night, Class 2 Test Pilot, Under Sling/ Winching				
Medical Expiry Date	31 December 2024				
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	4 542
Total Past 24 Hours	4
Total Past 7 Days	14
Total Past 90 Days	69
Total on Type Past 90 Days	62
Total on Type	1 506

1.5.1. The pilot had an Airline Transport Pilot Licence (ATPL) that was initially issued by the Regulator (SACAA) on 31 July 2019. The renewed licence was issued on 2 August 2024 with an expiry date of 31 July 2025. His Class 1 aviation medical certificate was issued on 7 December 2023 with an expiry date of 31 December 2024.

1.6. Helicopter Information

1.6.1. The information below is an extract from the Pilot's Operating Handbook (POH).

The Eurocopter AS350 B3 is a single-engine, light utility helicopter that is particularly recognised for its high altitude and hot-weather performance, making it ideal for challenging environments such as mountain regions or dense forests. Its versatility in various operational settings, from Search and Rescue (SAR) to aerial work and law enforcement, makes it one of the leading helicopters in its class.

Airframe:

Manufacturer/Model	Eurocopter/Airbus AS350B3	
Serial Number	3773	
Year of Manufacture	2003	
Total Airframe Hours (At Time of Accident)	4 419.2	
Last Inspection (Date & Hours)	1 July 2024	4 296.10
Hours Since Last Inspection	123.1	
CRS Issue Date	14 December 2023	
C of A (Issue Date & Expiry Date)	17 January 2024	28 February 2025
C of R (Issue Date) (Present Owner)	6 September 2024	
Type of Fuel Used	Jet A-1	
Operating Category	Part 127	
Previous Accidents	None	

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

Engine:

Manufacturer/Model	Turbomeca/Arriel 2B
Serial Number	22443
Part Number	0292005340
Hours Since New	4 419.2
Hours Since Overhaul	989.2

Main Rotor:

Manufacturer/Model	355A1003064
Serial Number	42408/ 42410/ 42481
Part Number	N/A
Hours Since New	1 026.05
Hours Since Overhaul	TBO not yet reached

Tail Rotor:

Manufacturer/Model	350A120050-14
Serial Number	22302
Part Number	N/A
Hours Since New	1443.8 hrs
Hours Since Overhaul	TBO not yet reached

1.6.2. A review of the helicopter's maintenance records, including the airframe and engine logbooks as well as the recent mandatory periodic inspection (MPI) record, was conducted. All records were found to be compliant with the regulatory requirements. The MPI of the helicopter was conducted at every 150 airframe hours in accordance with the maintenance plan. The helicopter was issued a Certificate of Airworthiness (C of A) on 17 January 2024 with an expiry date of 28 February 2025.

1.6.3. The latest maintenance inspection of the helicopter was conducted on 1 July 2024 at 4 296.10 airframe hours after which a Certificate of Release to Service (CRS) was issued with an expiry date of 1 July 2025 or at 4 442.5 airframe hours, whichever comes first. The helicopter had accrued 123.1 airframe hours since the last MPI. At the time of the accident, it had a total of 4419.2 airframe hours.

1.6.4. There were no defect entries recorded that related to the operation and maintenance of the helicopter in the logbooks.

1.7. Meteorological Information

1.7.1. The following weather information was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS), recorded in Irene,

Centurion, on 21 November 2024 at 0900Z. Irene is located 0.4 nautical miles (nm) from the accident site. Good weather conditions prevailed at the time of the flight.

Wind Direction	350°	Wind Speed	5 kt	Visibility	9999
Temperature	28°C	Cloud Cover	FEW	Cloud Base	2000 ft
Dew Point	10°C	QNH	Q1023hP		

1.8. Aids to Navigation

1.8.1. The helicopter was equipped with standard navigational equipment as approved by the Regulator. There were no records indicating that the navigational equipment was unserviceable before the flight.

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 before the flight.

1.10. Aerodrome Information

1.10.1. The accident occurred on a field within the borders of Plot 399 JR, Brakfontein, at GPS co-ordinate determined to be S 25° 53' 58" E 028° 10' 27" at a field elevation of 4 921 ft.

1.11. Flight Recorders

1.11.1. The helicopter was neither 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 accident occurred on a field within the borders of Plot 399 JR, Brakfontein. The accident site was also approximately 200m from the industrial and residential areas (see Figure 1). The site had potential obstacles, including tall trees to the north (direction of approach) and high-tension electrical power lines.

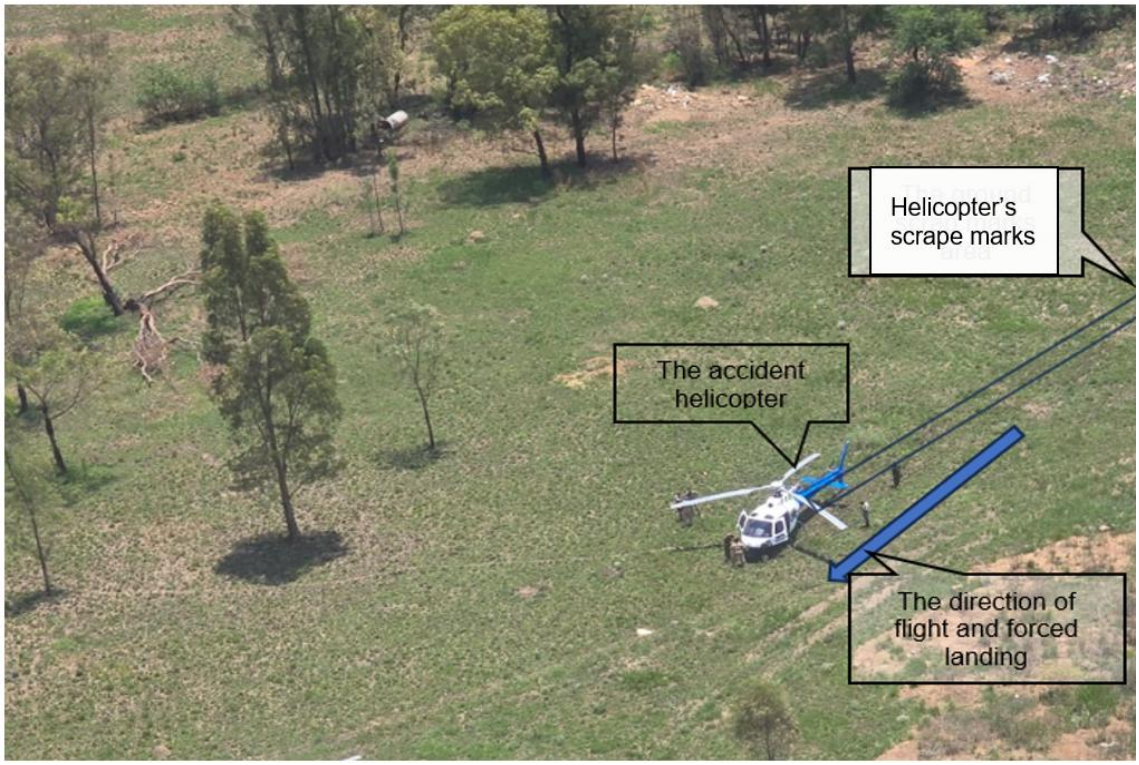

Figure 3: The accident site showing obstacles in the vicinity as well as scrape marks on the ground. (Source: Operator)

1.12.2. Post-accident, the helicopter fuselage was found relatively intact, except for the severely damaged left skid gear and the separated side-step bar (see Figure 4).

Figure 4: Damage on the left skid bar.

1.12.3. The bottom skid bar had broken into three pieces (segments) during the accident sequence. The damage pattern suggested that it was subjected to significant impact forces, likely from a heavy object, which resulted in its structural failure (see Figure 4).

1.12.4. The bottom of the nose section towards the left side had damage that was consistent with contact with the ground (skidding), possibly as subjection to heavy, momentary forces.

Figure 5: Damage on the bottom nose section.

1.12.5. The helicopter's tail boom had bent near the attachment points, which led to the tail rotor shaft decoupling. Both components (coupler and shaft) sustained minor damage during decoupling whilst the helicopter was rotating. The decoupling further caused damage to the tail rotor shaft fairings panels (see Figures 6 and 7).

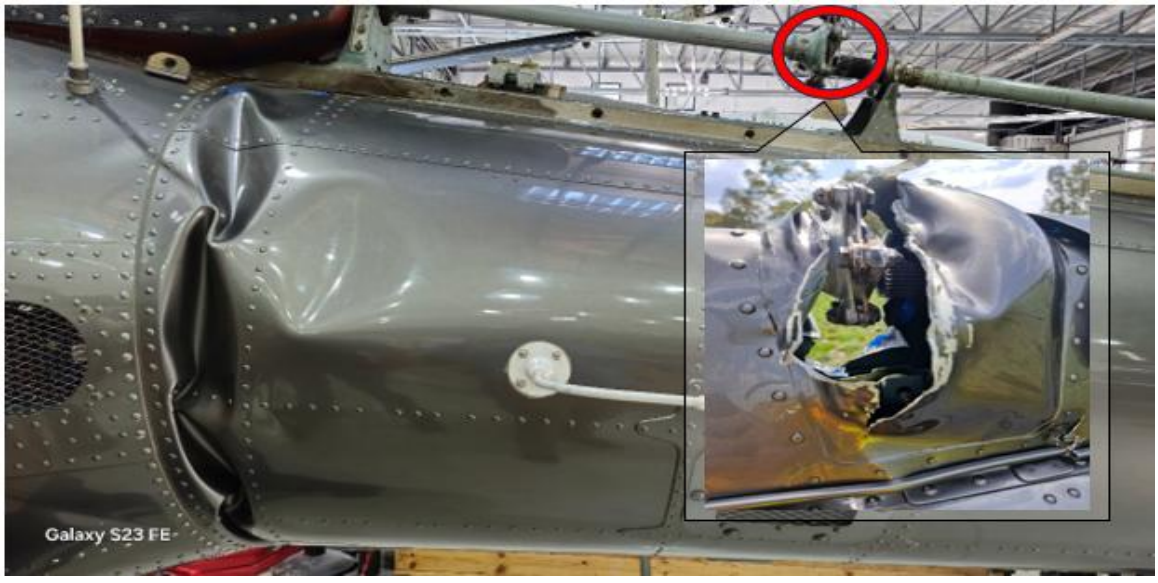

Figure 6: Damage to the tail boom attachment section and the decoupled tail rotor shaft. (Photo was taken after recovery).

Figure 7: Decoupled tail rotor drive shaft.

1.13. Medical and Pathological Information

1.13.1. None.

1.14. Fire

1.14.1. There was no pre- or post-impact fire during the accident.

1.15. Survival Aspects

1.15.1. The cockpit and cabin areas had remained largely intact during the impact sequence. All occupants were secured by safety harnesses which restrained and prevented them from getting injured. The overall impact conditions were within the survivable range.

1.16. Tests and Research

1.16.1. An examination of the helicopter's VEMD was conducted after the accident to assess the cause of engine failure. The following test reference modes were retrieved during the analysis: 44, 47, 48, 49, and 53. Each test mode displayed an "INVAL" message, followed by the name of the corresponding parameter, with either "R" or "L" (indicating an invalid parameter). This

contributed to the decline in engine torque which pointed to a failure in the Electronic Engine Control unit (EECU). These recorded failure modes all occurred within the final minutes before the accident, supporting the reported engine failure occurrence.

Failure Analysis and Interpretation for Mitigation (Source: Manufacturer's Maintenance Manual of the engine)

TEST REF shows one of following codes "44, 47, 48, 49, 53" with the message "INVAL" followed by the name of a parameter, by "R" or "L" (Invalid parameter).	The VEMD has detected that the value of the parameter cited and delivered by the FADEC is not valid. See the LRU NAME list.	Replace or repair the component on the LRU NAME list which is most likely to be faulty. If the fault is still detected after the replacement, replace the next component on the LRU NAME list. Continue in this way until the fault is no longer detected. Refer to the Engine Maintenance Manual (EMM TURBOMECA) for the faults incriminating the FADEC.

1.16.2 The Laboratory Test of the EECU

The EECU with part number C12380GA04 and serial number (S/N): 1697 was recovered and sent to BEA in France for further investigation. On 17 April 2025, the electronic circuit board was examined, and it showed no abnormalities. A continuity test on the alternator was successful. An investigation of the electronic board of the EECU revealed a short circuit on the 28-volt power supply of channel A on the PSM A PN E17025Ab SN 1840 Amdt A B D. A further test using a 28V battery, bypassing the alternator, also failed. Both the battery (28V) and the alternator power supplies were partially applied due to the detection of a short circuit on the 28V line.

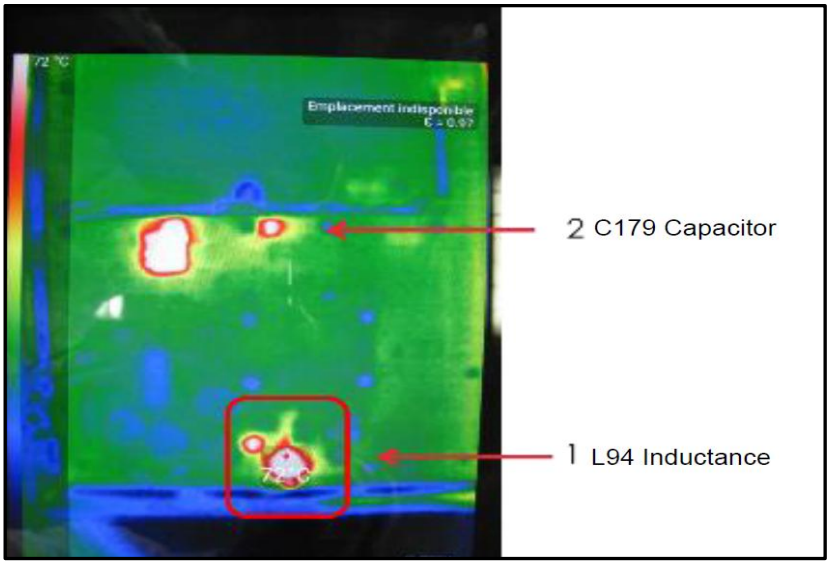

Figure 8: Abnormal thermal detection on the circuit board of components C179 and L94.

Signs of abnormal thermal dissipation were observed on components (1) L94 inductance and (2) C179 capacitor. A crack was also evident on the C179 component, and an audible noise

was heard during the application of both the battery and alternator power supplies. The DC converter test failed. The manual operational test failed because the switch between battery mode and alternator mode did not work, leading to inconsistent results on channel A. To proceed with further testing, all defective components were replaced with new, functional parts.

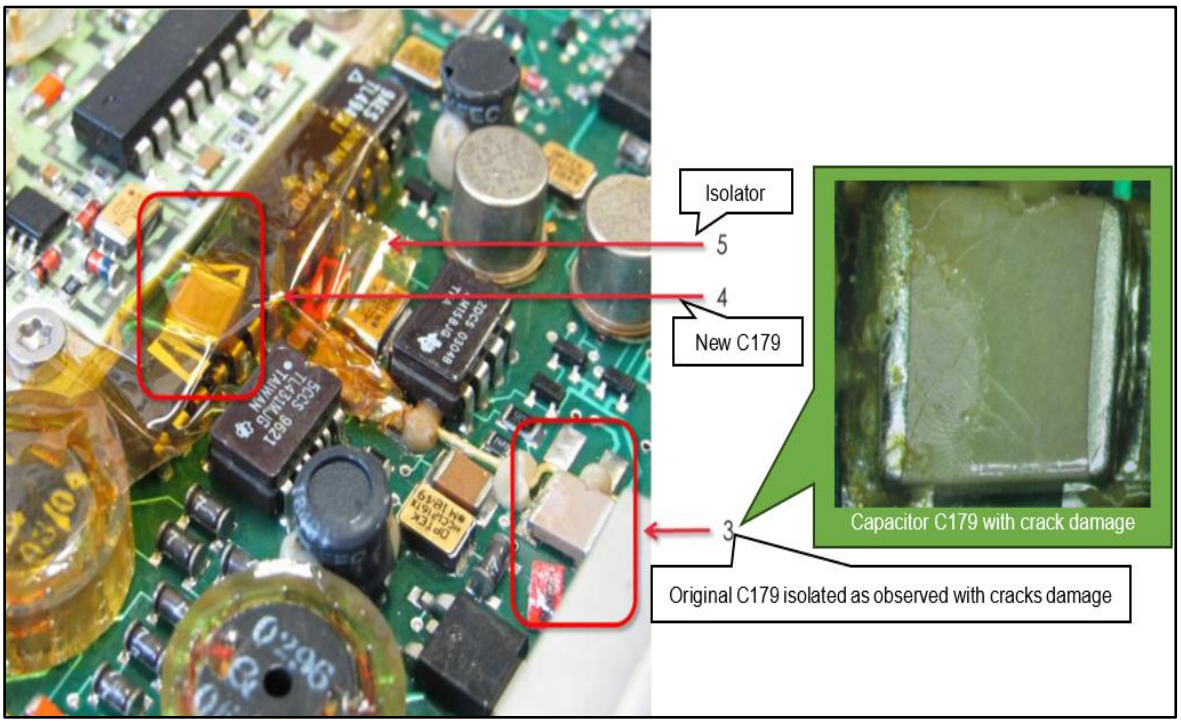

Figure 9: Temporary replacement of defective components.

Alternator

The alternator was tested statically and dynamically and found to be functional.

Metering Unit Closure

As the failure identified on the EECU led to the loss of the stepper motor powered by the EECU, the metering needle was free to move. It will likely move to a closed position due to fuel flow pressure, which led to the engine flameout.

Service Bulletin

On 3 September 2013, the manufacturer issued Service Bulletin SB-C12380-49-009-01, recommending the replacement of a ceramic capacitor. This service bulletin had not been incorporated in the EECU installed on the occurrence aircraft.

In July 2024, Safran Helicopter Engines obtained a European Union Safety Agency (EASA) certification for a modification to the height monitoring unit (HMU). The modification was intended to assess and mitigate the risk of engine flameout resulting from a loss of power supply to the stepper motor.

Conclusion:

Examination of the EECU confirmed that it was inoperative. Inspection revealed a failed capacitor on the Lane A power-supply board. The capacitor's failure caused a loss of electrical power to the stepper motor which controls the fuel-metering needle. With the stepper motor unpowered, the metering needle was free to move and, most likely, migrated to the closed position under fuel-system pressure, resulting in fuel starvation and the subsequent engine flameout.

The root cause of the capacitor failure could not be conclusively determined. Functional testing of the alternator supplying the EECU showed no evidence of overvoltage, making an external electrical surge unlikely. Component ageing remains the most plausible factor, consistent with known in-service cases where ceramic capacitors without polymer terminations have deteriorated over time.

1.17 Organisational and Management Information

1.17.1. The helicopter was operated in accordance with the provisions outlined in Part 127 of the CAR 2011, as amended. This operation was conducted under a contractual agreement between the operator, Ultimate Heli and GTP for the provision of airborne support in conjunction with the government's crime prevention initiatives in Gauteng province. The flight adhered to the established Standard Operating Procedures (SOP) which stipulated that a special flight should be launched within 90 minutes of business hours during weekdays in response to emergencies such as cash-in-transit (CIT) heists or car hijackings. On the day of the accident, the helicopter was en route to base after completing a call-out in east of Pretoria.

1.17.2. The AOC was issued by the Regulator on 26 April 2024 with an expiry date of 30 April 2025.

1.17.3. The maintenance of the helicopter was performed by an approved aircraft maintenance organisation (AMO) in compliance with the manufacturer's maintenance procedures. The AMO had a valid AMO Certificate that was issued by the Regulator on 20 May 2024 with an expiry date of 31 May 2025. The helicopter was listed in the AMO's operational maintenance specifications.

1.18. Additional Information

1.18.1. Processes and Procedures Between the Operator and Gauteng Traffic Police (Source: Operator)

The standard operational procedure defines the processes and procedures applicable to air operations conducted by the operator (Ultimate Heli) and any other service provider stipulated by Ultimate Heli for GTP.

Flight to Perform
Flights shall be performed according to the instructions of GTP Air Operations through the issue of a flight request by the GTP flight co-ordinator/pilot (FC). To be received by Ultimate Heli (UH) Flight Operations by 1700 (local time) for the flight to be conducted the next day.

Special flights to be conducted, such as emergency cash-in-transit (CIT) or car hijackings, etc., shall be launched within 90 minutes during weekday work hours.

After hours and during weekends, the flight must be launched within 120 minutes. Notwithstanding the above, crew shall endeavour to complete all flight planning and preparation safely rather than take the scheduled take-off time.

1.18.2. Back Up Manual Mode Following EECU/ Full Authority and Digital Engine Control (FADEC) Failure Modes. (Source: Pilot Operating Handbook (POH)).

EECU/FADEC Failure Modes

There are two primary levels of EECU failure:

1. *Single Channel Fault (Degraded Mode)*

    - EECU Failure
    - Single channel fails, EECU no longer controls the HMU.
    - Governor “GOV” warning light + aural alert activates.

The Backup Control (manual mode) takes over via a direct mechanical linkage between the twist grip and the HMU

2. *Total EECU Failure*
    - *Both channels fail, FADEC no longer controls the HMU.*
    - *The Backup Control (manual mode) takes over via a direct mechanical linkage between the twist grip and the HMU.*
    - *“FADEC” warning light + aural alert activates.*

Backup (Manual) Mode Operation

- *The pilot must take manual control of the throttle using the twist grip.*
- *In backup mode:*
    - *The HMU still mechanically meters fuel.*
    - *The pilot directly controls fuel flow by rotating the twist grip.*
    - *There are no automatic protections for T4, N1, or N2 — the pilot must manually monitor engine instruments.*

Collective movements no longer auto-compensate.

- *The pilot must anticipate and co-ordinate twist grip adjustments with collective inputs.*

Flight Technique in EECU Failure

- *Maintain NR/N2 (Rotor RPM):*
    - *Pilot adjusts throttle manually to keep rotor speed within limits.*
- *Monitor T4, N1, Torque:*
    - *Avoid exceeding limits since FADEC protections are lost.*
- *Landing:*
    - *Affected helicopter remains flyable and can continue flight.*
    - *Recommended to land as soon as practicable (not immediate forced landing unless control cannot be maintained).*

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 had an Airline Transport Pilot Licence (ATPL) that was initially issued by the Regulator on 31 July 2019. The renewed licence was issued on 2 August 2024 with an expiry date of 31 July 2025. His licence was endorsed with the following ratings: Game/Livestock Cull, Night, Test Pilot Class 2, and Under Sling/Winching. The helicopter type was also endorsed on the licence.

2.2.2. The pilot's Class 1 aviation medical certificate was issued on 7 December 2023 with an expiry date of 31 December 2024.

2.2.3. The pilot had a total of 4542 flight hours of which 1506 hours were accumulated on the helicopter type.

2.2.4. The helicopter was issued a Certificate of Airworthiness (C of A) by the Regulator on 17 January 2024 with an expiry date of 28 February 2025. The Regulator had registered the helicopter under the current owner on 6 September 2024.

2.2.5. The helicopter maintenance was conducted on 1 July 2024 at 4296.10 airframe hours, after which a Certificate of Release to Service (CRS) was issued with an expiry date of 1 July 2025 or at 4442.5 airframe hours, whichever comes first. The helicopter had accrued 123.1 airframe hours after the last MPI.

2.2.6. The helicopter was operated in accordance with the provisions outlined in Part 127 of the CAR 2011, as amended. This operation was conducted under a contractual agreement between the operator, Ultimate Heli and GTP for the provision of airborne support in co-ordination with government's crime prevention initiatives in Gauteng province.

2.2.7. The helicopter's maintenance was performed by an approved AMO in compliance with the manufacturer's maintenance procedures. The AMO had a valid AMO Certificate that was issued by the Regulator on 20 May 2024 with an expiry date of 31 May 2025.

2.2.8. Five test references for failure modes were recorded, which related to the EECU malfunction and were registered at the time of engine failure (leading to the accident). This led to the removal of the EECU, which was sent to the State of Manufacturer's investigation authorities for further testing and analysis.

2.2.9. The Air Operator Certificate (AOC) was issued by the Regulator on 26 April 2024 with an expiry date of 30 April 2025.

2.2.10. During a routine return flight, the helicopter experienced a sudden engine failure at

approximately 400 ft above ground level. The pilot heard a warning sound and noticed a drop in engine power and rotor speed, confirming that the engine had stopped. He quickly entered autorotation and aimed for an open area to land. However, due to low altitude, there was not enough time to fully stabilise the descent. This resulted in a hard landing that damaged the landing skid, nose and tail boom. All occupants on-board were not injured.

2.2.11. The investigation further determined that the Engine Electronic Control Unit (EECU) installed on the helicopter had not been updated in accordance with Service Bulletin SB-C12380-49-009-01 issued on 3 September 2013. This update was intended to address a known vulnerability in the EECU power supply circuitry. The absence of this modification left the system susceptible to power supply issues. This risk was later re-emphasised in 2024 through a Safran-approved modification requirement to the Hydro-Mechanical Unit (HMU) designed to mitigate engine flameout that led to loss of power to the stepper motor. This was never addressed in the specific helicopter unit.

2.2.12. Although the EECU could normally receive power from both the generator and battery, both sources share a single internal electrical path that includes capacitor C179. During the flight, this capacitor failed, interrupting power to the EECU despite the generator operating normally. The loss of EECU power removed electronic control of the fuel metering system, which caused the valve to close progressively as well as reduce fuel supply and, eventually, led to engine flame out. The examination of capacitor C179 revealed signs of arcing and age-related deterioration, although the exact initiating cause of the failure could not be conclusively determined.

2.2.13. The event occurred at low altitude, leaving the pilot insufficient time to diagnose the malfunction or activate the manual fuel backup system, which also required active fuel flow. Under these circumstances, the pilot's only viable option was to prioritise a safe forced landing.

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 an Airline Transport Pilot Licence (ATPL) that was initially issued by the Regulator on 31 July 2019. The renewed licence was issued on 2 August 2024 with an expiry date of 31 July 2025. His licence was endorsed with the following ratings: Game/Livestock Cull, Night, Test Pilot Class 2, and Under Sling/Winching. The helicopter type was also endorsed on the licence.

3.2.2. The pilot's Class 1 aviation medical certificate was issued on 7 December 2023 with an expiry date of 31 December 2024.

3.2.3. The pilot had a total of 4542 flight hours of which 1506 hours were accumulated on the helicopter type.

3.2.4. The helicopter was issued a Certificate of Airworthiness (C of A) by the Regulator on 17 January 2024 with an expiry date of 28 February 2025. The Regulator had registered the helicopter under the current owner on 6 September 2024.

3.2.5. The helicopter maintenance was conducted on 1 July 2024 at 4296.10 airframe hours after which a Certificate of Release to Service (CRS) was issued with an expiry date of 1 July 2025 or at 4442.5 airframe hours, whichever comes first. The helicopter had accrued 123.1 airframe hours after the last MPI.

3.2.6. The helicopter was operated in accordance with the provisions outlined in Part 127 of the Civil Aviation Regulations (CAR) 2011, as amended. This operation was conducted under a contractual agreement between the operator, Ultimate Heli and the Gauteng Traffic Police (GTP) for the provision of airborne support in co-ordination with the government's crime prevention initiatives in Gauteng province.

3.2.7. The helicopter's maintenance was performed by an AMO in compliance with the manufacturer's maintenance procedures. The AMO had a valid AMO Certificate that was issued by the Regulator on 16 May 2023 with an expiry date of 31 May 2024.

3.2.8. The Air Operator Certificate (AOC) was issued by the Regulator on 26 April 2024 with an expiry date of 30 April 2025.

3.2.9. The investigation determined that a failure of capacitor C179 within the Electronic Engine Control Unit (EECU) caused a complete loss of power to the system during flight, disabling the helicopter's ability to control engine fuel flow. With the fuel metering valve no longer held in its position, it gradually closed, resulting in a progressive loss of engine power and an in-flight flameout. Although the EECU could normally receive power from both the generator and battery, both sources relied on a single internal path through C179 which failed despite the generator operating normally.

3.2.10. The EECU had not been updated in accordance with Service Bulletin SB-C12380-49-009-01 issued on 3 September 2013. This update was intended to address a known vulnerability in the power supply circuitry. The absence of this modification left the system susceptible to power supply issues, a risk later addressed in 2024 through a Safran-approved modification to the Hydro-Mechanical Unit designed to mitigate engine flameout caused by loss of power to the stepper motor. The examination of the capacitor C179 revealed signs of arcing and age-related deterioration, although the exact initiating cause of the failure could not be conclusively determined.

3.2.11. The event occurred at low altitude, leaving the pilot insufficient time to diagnose the malfunction or activate the manual fuel backup system, which also required active fuel flow. Under these circumstances, the pilot's only viable option was to prioritise a safe forced landing.

3.3. Probable Cause/s

3.3.1 The capacitor on the Lane A power-supply board failed due to a sudden loss of engine torque and power. This failure interrupted electrical power to the stepper motor, thus, preventing fuel delivery to the engine. This led to the pilot conducting an unsuccessful forced landing.

3.4. Contributory Factor/s

3.4.1. Non-compliance of the critical maintenance-related service bulletin (SB) that was released by the manufacturer, which created vulnerability to power supply to the EECU and its components and, thus, increasing the risk of engine flameout.

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 Recommendation/s

4.2.1. None.

5. APPENDICES

5.1. None.

This report is issued by:

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