PRELIMINARY ACCIDENT REPORT

Accident and Incident Investigations Division

Accident
- Preliminary Report -
AIID Ref No: CA18/2/3/10156

Figure 1: RAF2000 GTX SE FI, ZU-RHL. (Source: Owner)

Description:

On 12 May 2022, a pilot on-board a RAF 2000 GTX SE FI gyrocopter with registration ZU-RHL was involved in an accident during a private flight from Boschplaats Private Airstrip to Schweizer-Reneke, North West province. Visual meteorological conditions (VMC) by day prevailed at the time of flight. Eyewitnesses stationed approximately 2.0 nautical miles (nm) from the private airstrip heard a loud noise and observed the gyrocopter pitch up and immediately down. The gyrocopter impacted the soft, muddy terrain whilst in a steep nose-down attitude and came to rest on its port side (left side). The eyewitnesses ran to the accident site and dragged the gyrocopter away from the unstable muddy terrain and, thereafter, removed the pilot out of the gyrocopter. However, the pilot was fatally injured during the accident sequence and the gyrocopter was destroyed.

Occurrence Details

Reference Number	**:** CA18/2/3/10156
Occurrence Category	**:** Category 1
Type of Operation	**:** Private (Part 94)
Name of Owner	**:** Strauss FJ
Gyrocopter Make and Model	**:** RAF 2000 GTX SE FI
Nationality	**:** South African
Registration Marks	**:** ZU-RHL
Place	**:** Boschplaats private farm
Date and Time	**:** 12 May 2022, 1742Z
Injuries	**:** Fatal
Damage	**:** Destroyed

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 involving a RAF 2000 GTX SE FI gyrocopter, which occurred at Boschplaats private farm, North West province, on 12 May 2022 at 1742Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and ICAO STD Annex 13 definitions.

The AIID has appointed an investigator-in-charge and a co-investigator who dispatched to the site to conduct a full investigation. Notifications were sent to the State of Registry/Operator/Manufacturer in accordance with CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The State of manufacturer is South African; therefore, an advisor has been appointed. The AIID will lead the investigation and issue the final report of this accident in accordance with CAR 2011 Part 12 and ICAO Annex 13.

The information contained in this preliminary report is derived from the information gathered during the on-going investigation into the occurrence. Later, an interim or final report may contain altered information in case new evidence is found during the on-going investigation that requires changes to the information depicted in this report.

The AIID reports are made available to the public at:
http://www.caa.co.za/Pages/Accidents%20and%20Incidents/Aircraft-accident-reports.aspx

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Accident — this investigated accident
   Gyrocopter— the RAF 2000 GTX SE FI 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

Table of Contents

Abbreviation	Description
°	Degrees
°C	Degrees Celsius
AGL	Above Ground Level
AIID	Accident and Incident Investigations Division
AP	Approved Person
ATF	Authority to Fly
CAR	Civil Aviation Regulations
CAVOK	Cloud and Visibility OK
C of R	Certificate of Registration
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
FAPM	Pietermaritzburg Airport
FDR	Flight Data Recorder
ft	Feet
GPS	Global Positioning System
hPa	Hectopascal
ICAO	International Civil Aviation Organisation
m	Metre
METAR	Meteorological Routine Aerodrome Report
MHz	Megahertz
NM	Nautical miles
NOSIG	No Significant Change
NPL	National Pilots Licence
QNH	Barometric Pressure Adjusted to Sea Level (Query Nautical Height)
RAF	Rotary Air Force
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
TBO	Time Between Overhaul
UTC	Coordinated Universal Time
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Radio Range
Z	Zulu (Term for Universal Coordinated Time – Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On 12 May 2022, a pilot on-board a RAF 2000 GTX SE FI gyrocopter with registration ZU-RHL took off on a private flight from Boschplaats Private Airstrip in North West province to Schweizer-Reneke, also in the same province. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2 Two eyewitnesses stationed 2.0 nautical miles (nm) from the private airstrip stated that they observed the gyrocopter approaching towards their location at approximately 150 feet (ft) above ground level (AGL). Soon after, they heard a loud bang followed by the gyrocopter pitching up and abruptly down. The gyrocopter descended in a steep nose-down attitude towards the soft, muddy terrain (mine) where it came to rest on its port side (left side).

1.1.3 The pilot was fatally injured during the accident sequence, and the gyrocopter was destroyed.

1.1.4 The accident occurred during daylight at Global Positioning System (GPS) co-ordinates determined to be 27°29'45.95" South, 029°15'13.99" East, at an elevation of 4 445ft.

Figure 2: The gyrocopter after the eyewitnesses had moved it to stable ground.

Figure 3: Distance from where the aircraft was dragged.

1.2. Injuries to Persons

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

Note: Other means people on ground.

1.3. Damage to Gyrocopter

1.3.1. The gyrocopter was destroyed.

Figure 4: The gyrocopter after the mud (dirt) was washed off.

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	37
Licence Type	National Pilot Licence (NPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	28 February 2027				
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	228.0
Total Past 24 Hours	0.1
Total Past 7 Days	0.1
Total Past 90 Days	2.3
Total on Type Past 90 Days	2.3
Total on Type	228.0

1.5.1. The pilot was issued a National Pilot Licence (NPL) on 17 February 2021 with an expiry date of 16 February 2023. The pilot's hours in the table above are as per the hours in his logbook until 30 April 2022, which was the pilot's last flight before undertaking the accident flight on 12 May 2022, which lasted 0.1 hours.

1.5.2. The pilot was issued a Class 4 medical certificate on 24 February 2022 with an expiry date of 28 February 2027 with no restrictions.

1.5.3. The type-rating for the RAF 2000 gyrocopter was endorsed on the pilot's licence since 8 June 2012.

1.6. Gyrocopter Information

1.6.1. *An autogyro (from Spanish autogiro), also known as gyroplane, gyrocopter, or rotaplane, is a type of rotorcraft which uses an unpowered rotor in autorotation to develop lift, and an engine-powered propeller, similar to that of a fixed-wing aircraft, to provide thrust. While similar to a helicopter rotor in appearance, the autogyro's rotor must have air flowing through the rotor disc in order to generate rotation.*

A sleek, well designed, two place RAF 2000 boasts sought after standard features such as side by side seating, in cabin heat, removable doors, full electronic trim, patented rotor stabilator and four-cylinder, four cycle power plant. The patented mast to keel engagement forms a robust framework for unequalled structural integrity, while maintaining a very simplistic design well within the intellectual understanding of the aviation enthusiast. (Source: rafsa.co.za)

Airframe:

Manufacturer/Model	Rotary Air Force 2000 GTX SE FI	
Serial Number	M2-01-07-11-033	
Year of Manufacture	2011	
Total Airframe Hours (At Time of Accident)	371.9	
Last Inspection (Date & Hours)	2 September 2021	361.2
Hours Since Last Inspection	10.7	
CRS Issue Date	2 September 2021	
ATF (Issue Date & Expiry Date)	17 September 2021	30 September 2022
C of R (Issue Date) Present Owner	5 April 2012	
Type of Fuel Used	91-93 Octane	
Operating Category	Private (94)	
Previous Accidents	None	

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

1.6.2 According to available information, the aircraft was first registered to the present owner on 5 April 2012 and the aircraft was re-issued a Certificate of Release to Service (CRS)

on 2 September 2021. The CRS had an expiry date of 1 September 2022 or at 371.0 hours, whichever occurs first, unless the gyrocopter is involved in an accident.

1.6.3 Based on the airframe logbook, the last annual inspection was carried out on 2 September 2021 at 361.2 airframe hours. The gyrocopter had accumulated an additional 10.7 airframe hours since the last inspection, and no major defects were recorded.

Engine:

Manufacturer/Model	Subaru 2.5
Serial Number	B115327
Hours Since New	371.9
Hours Since Overhaul	TBO not reached

Propeller:

Manufacturer/Model	Warp drive 4
Serial Number	N19894
Hours Since New	96.7
Hours Since Overhaul	TBO not reached

1.7. Meteorological Information

1.7.1. The weather information below was obtained from the Meteorological Routine Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS) on 12 May 2022 at 1800Z, recorded at Mmabatho/Mafikeng Airport (FAMM), which is 100nm from the accident site.

FAMM 121800Z 03006KT CAVOK 13/07 Q1023 NOSIG=

Wind Direction	030°	Wind Speed	6kts	Visibility	9999m
Temperature	13°C	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	7°C	QNH	1023hPa		

1.7.2. The closest weather station to the accident site is Taung, which is 26nm away from the accident site. Taung weather report also showed weak surface winds, and the pressure that had been dropping at 0.7 Hectopascal (hPa) in the last three hours on the day, which was normal for that time of the day.

1.7.3. In contrary to the METAR given above, the eyewitnesses stated that there was a strong wind with a significant gust on the day of the accident.

1.8. Aids to Navigation

1.8.1. The gyrocopter 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 gyrocopter 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 accident occurred more than 10 kilometres (km) from the nearest aerodrome. The gyrocopter crashed at GPS co-ordinates determined to be 27°29'45.95" South, 029°15'13.99" East, at an elevation of 4 445ft.

1.11. Flight Recorders

1.11.1. The gyrocopter 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 gyrocopter type.

1.12. Wreckage and Impact Information

1.12.1. The accident site was on an open area in Boschplaats Farm, approximately 2nm north from the threshold of Runway (RWY) 16, which is on the same farm.

1.12.2. Damage to the gyrocopter's structure revealed that it impacted the soft, muddy ground while in a left steep nose-down attitude (high angle of impact) and at high speed. The wreckage distribution of the ZU-RHL gyrocopter consisted of numerous fragments that were scattered over a radius of approximately 100 metres (m), indicative of an in-flight break-up.

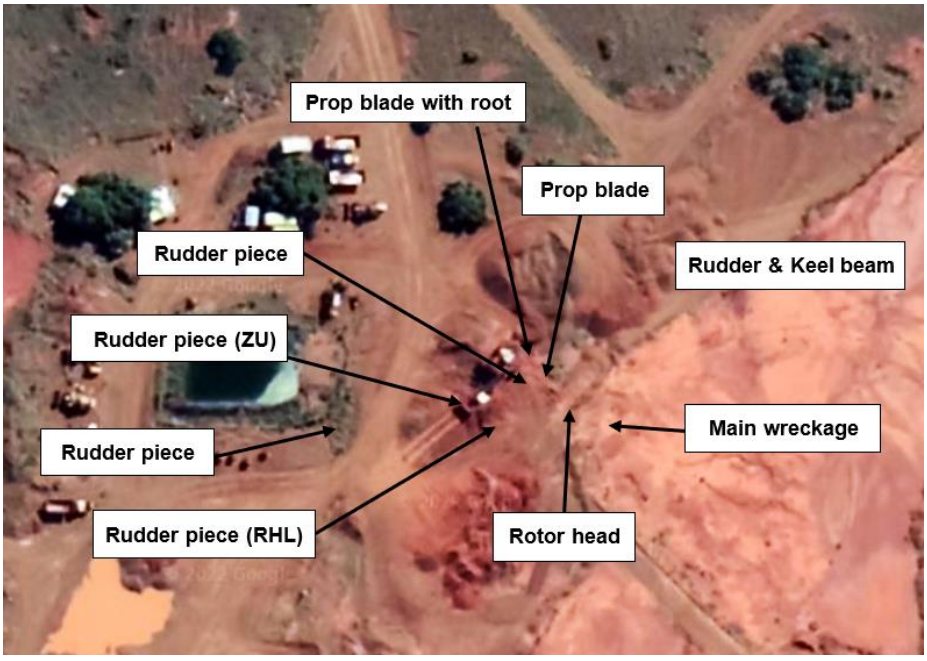

Figure 5: Wreckage distribution of the ZU-RHL gyrocopter. (Source: Google Earth)

1.12.3. The engine was damaged during the accident, attributed to high-impact forces whilst producing power.

1.12.4. The rotor mast and blade assembly detached from the gyrocopter and were found approximately 7 metres (m) from the main wreckage. The location of the rotor assembly indicated that it could have been catapulted while the gyrocopter was airborne due to forces produced as the gyrocopter nose-dived steeply. One of the rotor blades showed evidence of contact marks with a moving object along its shank section at a distance equivalent to the propeller blades position, as well as paint marks from impact with the rudder.

Figure 6: Rotor mast and blade assembly.

1.12.5. All four propeller blades were accounted for and exhibited impact damage on their tips, consistent with impact caused by contacting the rotor blade during flight. Two of the propeller blades had separated from the assembly, while the other two remained attached. The propeller blades showed evidence of rotation and impact with the rotor blades. The subsequent examination of the engine revealed no pre-impact mechanical damage.

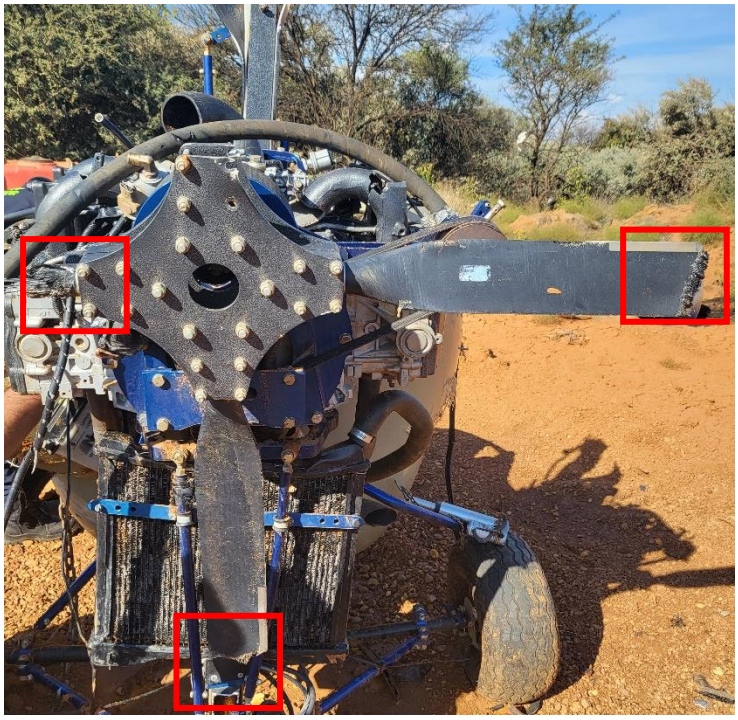

Figure 7: Propeller hub with damaged blades.

1.12.6. One propeller blade was found approximately 20m west of the gyrocopter's flight path. The blade had completely detached (from its root) from the propeller hub and was damaged on its leading-edge tip. The other propeller blade was found approximately 8m west from the first blade and had broken off along its blade shank. The damage on all four propeller blades was consistent with the damage that would occur when coming into contact with the rotor blades and whilst the engine was turning at high power.

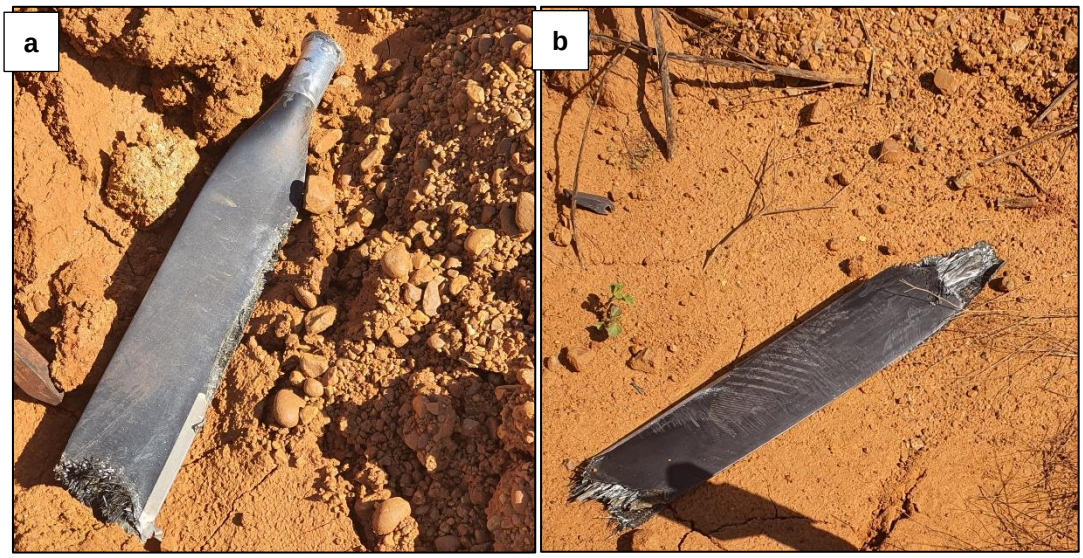

Figure 8: (a) The propeller blade that detached from the root with damage on the leading-edge and tip. **(b)** The propeller blade that broke off along the blank shank with damage on the tip.

1.12.7. The rudder and rear keel beam were found approximately 10m to the west (to the left, in relation to the flight path) of the main wreckage. More wreckage debris comprising the remainder of the rudder section was spread along the path in a southerly direction from the main wreckage and within a radius of up to 20m.

Figure 9: Rudder pieces of the gyrocopter.

1.12.8. The rear keel beam section had broken off along its bolted attachment joint that joins it to the forward section (under the cabin).

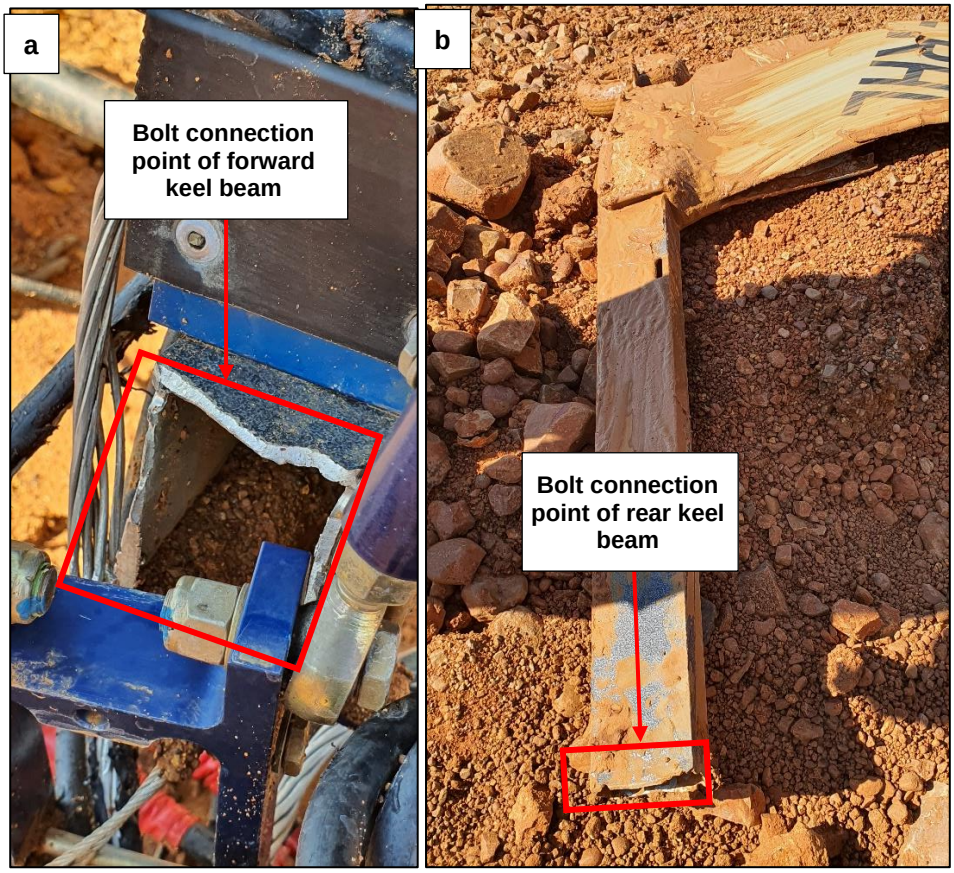

Figure 10: The broken keel beam showing location of failure across the bolt connection point.

1.12.9. The gyrocopter was extensively damaged during impact. Pieces of the canopy were found around the main wreckage.

1.12.10. The fuel tank, located beneath the pilot's seat, had ruptured and there was a strong smell of fuel at the accident site.

1.12.11. An examination of the flying controls showed that there were no pre-impact disconnections, and all failures were consistent with the impact.

1.12.12. The gyrocopter crashed a few metres from where the eyewitnesses were positioned. The eyewitnesses had run to the accident site and dragged the gyrocopter out of the unstable muddy terrain. The witnesses had cut off the pilot's safety harness to remove him from the wreckage, but later realised that the pilot had succumbed to his injuries.

1.13. **Medical and Pathological Information**

1.13.1. To be discussed in the final report.

1.14. **Fire**

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

1.15. **Survival Aspects**

1.15.1. The accident was considered unsurvivable due to the damage caused by impact forces to the cabin and cockpit areas of the gyrocopter. The pilot was trapped inside the wreckage on the muddy terrain that was soft and sinking.

1.16. **Tests and Research**

1.16.1. To be discussed in the final report.

1.17. **Organisational and Management Information**

1.17.1. The flight was conducted under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.17.2. The gyrocopter was first registered to the present owner on 5 April 2012.

1.18. **Additional Information**

1.18.1. To be discussed in the final report.

1.19. **Useful or Effective Investigation Techniques**

1.19.1. To be discussed in the final report.

2. FINDINGS

2.1. **General**

From the available evidence, the following preliminary findings 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 conclusions 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.

2.2. Findings

2.2.1. The pilot was issued a NPL on 17 February 2021 with an expiry date of 16 February 2023. The pilot's Class 4 medical certificate was issued on 24 February 2022 with an expiry date of 28 February 2027 with no restrictions. The gyrocopter type was endorsed on his licence.

2.2.2. The flight was conducted under the provisions of Part 94 of the CAR 2011 as amended and in VMC by day. Fine weather conditions prevailed at the time of the flight.

2.2.3. The gyrocopter was originally issued an Authority to Fly (ATF) on 17 September 2021 with an expiry date of 30 September 2022.

2.2.4. The Certificate of Registration (C of A) of the gyrocopter was issued to the current owner on 5 April 2012.

2.2.5. The last annual inspection was carried out on 2 September 2021 at 361.2 airframe hours. The gyrocopter had accumulated an additional 10.7 airframe hours in operation since the last inspection, and no major defects were recorded. The gyrocopter was issued a Certificate of Release to Service (CRS) on 2 September 2021 with an expiry date of 1 September 2022 or at 371.0 hours, whichever occurs first unless the gyrocopter is involved in an accident.

2.2.6. The damage and distribution of the wreckage was consistent with the main rotor blades having struck the propeller and rudder whilst the gyrocopter was airborne and whilst the engine was producing power. The loud noise reported by eyewitnesses before the gyrocopter lost directional control and the nose-dive to the ground could be attributed to the above statement.

2.2.7. Damage to the gyrocopter structure revealed that the impact was severe at a nose-down attitude (high angle of impact) and at a high speed.

2.2.8. During a low-level fly past, the main rotor impacted the vertical stabiliser and two propeller blades, rendering the gyrocopter uncontrollable.

3. ON-GOING INVESTIGATION

3.1. The AIID investigation is on-going and the investigators will be looking into other aspects of this occurrence which may or may not have safety implications.

This report is issued by:

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