LIMITED OCCURRENCE INVESTIGATION REPORT – DRAFT

Reference Number	CA18/2/3/10558										
Classification	Accident		**Date**	01 March 2025			**Time**	0840Z			
Type of Operation	Operation of Non-Type Certificated Aircraft (Part 94)										
Location											
Place of Departure	Aloe Bush Game Lodge Airstrip, Mpumalanga Province		Place of Intended Landing			Aloe Bush Game Lodge Airstrip, Mpumalanga Province					
Place of Occurrence	Approximately 5 nautical miles, south-east of Marble Hall at GPS co-ordinates: 25°00´37'' South 29°18´10'' East, at an elevation of 2 998 feet										
GPS Co-ordinates	Latitude	25°00´37'' S	Longitude	29°18´10'' E		Elevation	2 998 ft				
Aircraft Information											
Registration	ZU-EOA										
Make; Model; S/N	Storm RG (Serial Number: S8-00E-0026)										
Damage to Aircraft	Substantial			Total Aircraft Hours		86.42					
Pilot-in-command											
Licence Type	Private Pilot Licence			Gender	Male		Age	67			
Licence Valid	Yes	Total Hours	463.63		Total Hours on Type		18.92				
Total Hours 30 Days	0.98		Total Hours on Type Past 90 Days		2.95						
People On-board	1+0	**Injuries**	0	**Fatalities**	0	**Other (on ground)**	0				

What Happened

On Saturday morning, 1 March 2025, a pilot on-board a Storm RG aircraft with registration ZU-EOA took off on a private flight from Aloe Bush Game Lodge Airstrip (FAMI) in Mpumalanga province with the intention to return to the same airstrip. Visual meteorological conditions (VMC) by day prevailed at the time of the flight which was conducted under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot reported that he conducted a pre-flight inspection of the aircraft, and no anomalies were observed. The aircraft had approximately 70 litres (L) of Avgas 100LL fuel in the tanks. The aircraft took off from a gravel runway at Aloe Bush Game Lodge Airstrip at approximately 0805Z with power set to 5 600 revolutions per minute (RPM) and manifold air pressure (MAP) indication of 40 inches mercury (IN Hg).

The flight initially proceeded without incident as the pilot flew over several farms in the area; the engine performance was satisfactory. After approximately 35 minutes into the flight, the engine ran rough during which the pilot observed white smoke that emanated from the engine compartment.

Thereafter, the engine stopped. The pilot attempted to restart the engine but was unsuccessful. He then decided to perform a forced landing on Vaalfontein Road (R33) in Mpumalanga province. During the landing roll, the pilot lost control of the aircraft and it veered off to the left of R33 and impacted a perimeter fence. The aircraft came to rest approximately 5 nautical miles (nm) south-east of Marble Hall. The pilot disembarked from the aircraft; he was not injured. However, the aircraft sustained substantial damage to the landing gear, propeller, both wings (right and left), canopy and engine (which was significantly damaged).

The accident occurred during daylight at Global Positioning System (GPS) co-ordinates determined to be 25°00´37'' South 29°18´10'' East, at an elevation of 2 998 feet (ft).

Figure 1: Aerial view of the accident site. (Source: Google Earth)

Figure 2: The aircraft as it came to rest. (Source: Pilot)

Post-engine Examination

After the accident, the aircraft was recovered to the SACAA-approved aircraft maintenance organisation (AMO) for further investigation and technical evaluation.

On 9 March 2025, the engine was disassembled and inspected by an Approved Person (AP). During the disassembly process, it was observed that the exhaust valve port of cylinder number 2 had sustained significant damage (refer to Figure 3).

Subsequent detailed inspection and analysis revealed that the valve spring retainer (item 8, Figure 4) had fractured. *The exhaust valve spring retainer plays a critical role in securing both the exhaust valve (item 4, Figure 4) and ensuring proper alignment of the piston assembly (Item 8, Figure 5) during engine operation*. The failure of this component allowed the exhaust valve assembly to lose structural integrity. As a result of the retainer's failure, the piston assembly was displaced from its normal position and forced into the combustion chamber. This mechanical disruption led to abnormal combustion behaviour which contributed to the engine running rough and emitting smoke.

The mechanical failure propagated secondary internal engine damage which resulted in a significant loss of engine power.

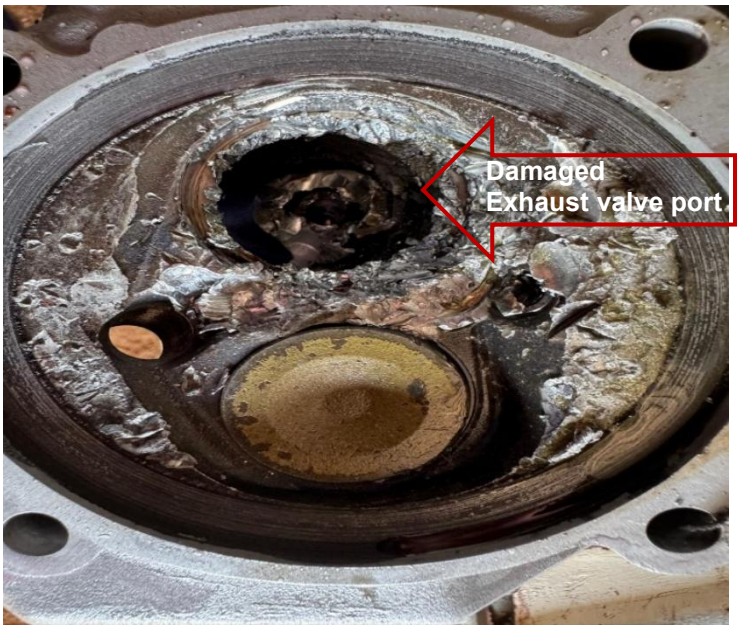

Figure 3: Number 2-cylinder exhaust valve port. (Source: Engineer)

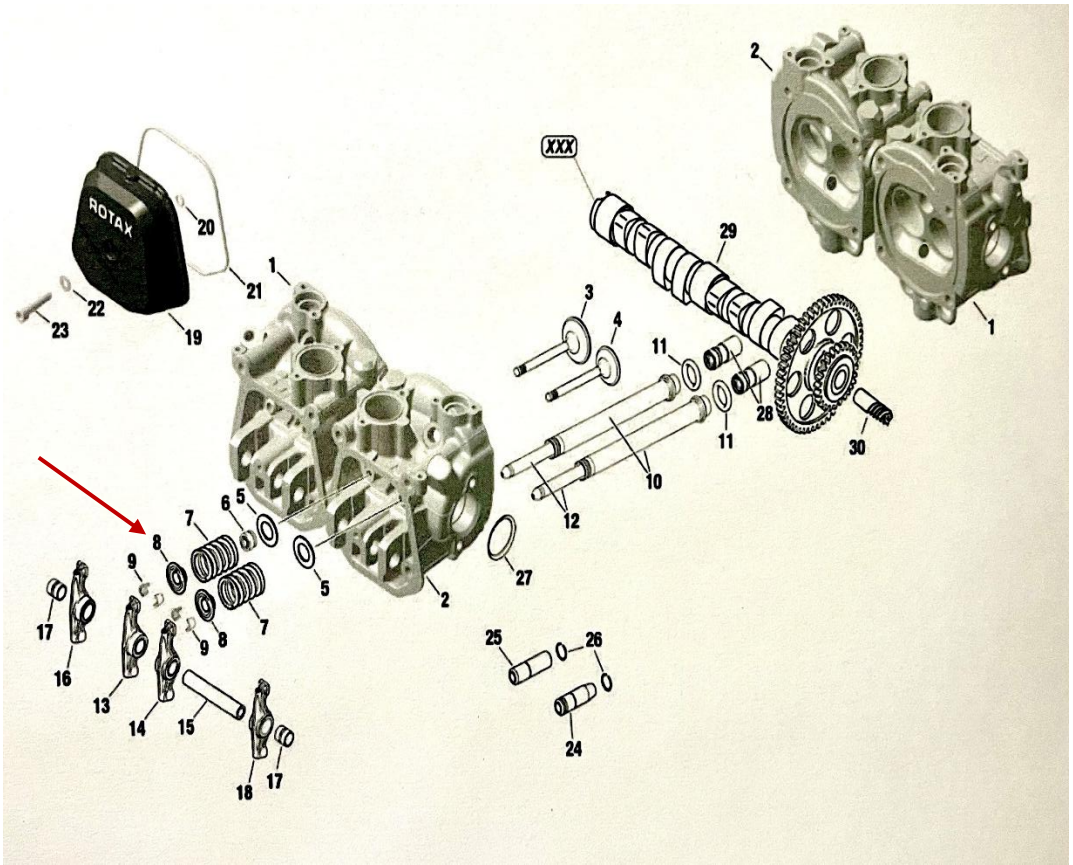

Figure 4: Engine cylinder head and valve components. (Source: Rotax 914 Illustrated Parts Catalogue, Chapter 72-20-00)

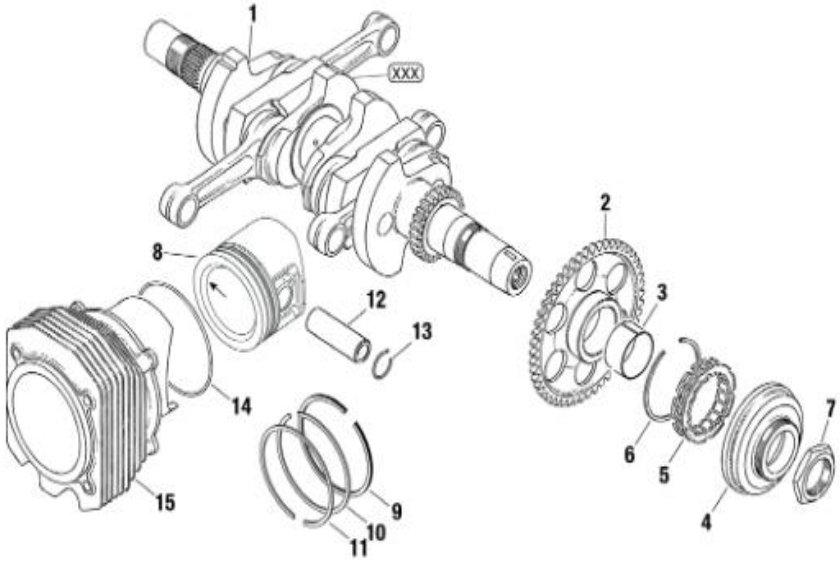

Figure 5: Engine crankshaft, piston, cylinder and spag clutch components. (Source: Rotax 914 Illustrated Parts Catalogue, Chapter 72-20-00)

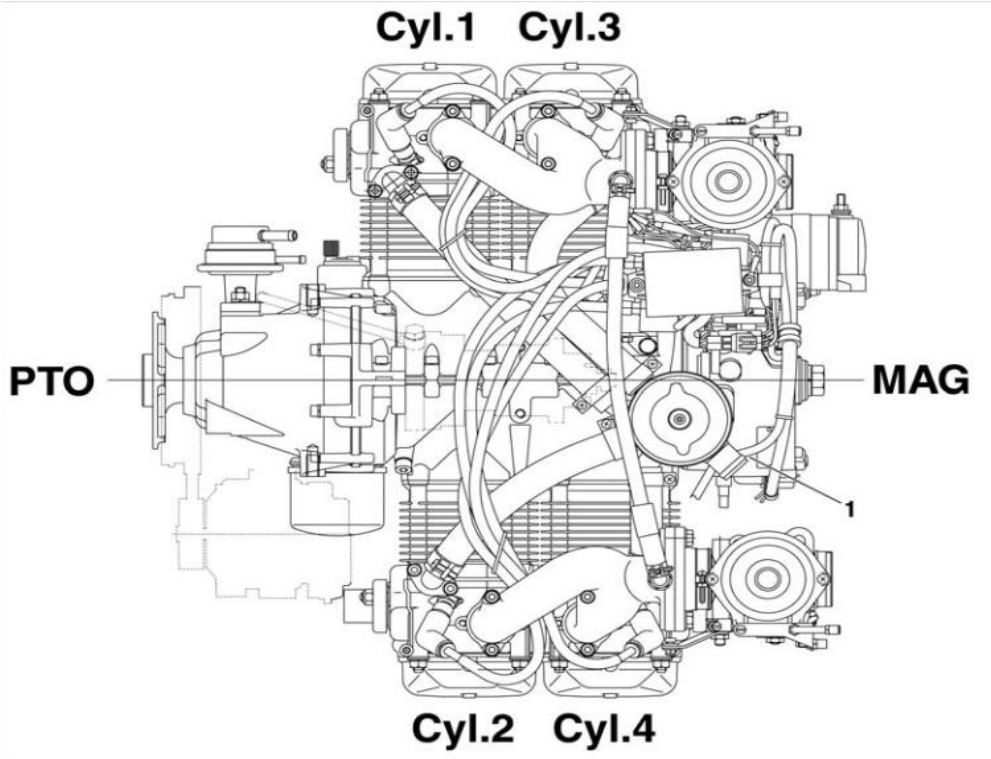

Figure 6: Rotax 914 Engine. (Source: Rotax 914 Illustrated Parts Catalogue)

Aircraft Description (Source: Storm RG Operators Manual)

The fin design of the Storm aircraft is built to handle both high speeds and excellent low-speed handling. It features a unique double taper that reduces the overall size while optimizing lift distribution from the root to the tip. The aircraft's retractable landing gear uses two beams hinged to metal leaf springs inside the fuselage, allowing the gear to retract while maintaining its shock-absorbing properties. The main legs of the landing gear are rotated by two pneumatic actuators.

Aircraft Specifications

The aircraft features an engine producing 80-125 horsepower, a wingspan of 25.6 feet, and a wing area of 107.4 square feet. It seats two, with an empty weight of 645 pounds and a useful load of 990 pounds. The gross weight is not specified, but it has a fuel capacity of 26.4 gallons, providing a range of 870 nautical miles. For performance, the aircraft has a take-off distance of 361 feet, a rate of climb of 1,280 feet per minute, a maximum speed of 170 mph, and a cruise speed of 162 mph. Its landing roll distance is 459 feet.

Meteorological Information

The weather information entered in the table below was obtained from the pilot questionnaire.

Wind Direction	N/A	Wind Speed	N/A	Visibility	9999m
Temperature	24° C	Cloud Cover	BKN	Cloud Base	3000 BKN
Dew Point	N/A	QNH	N/A		

Findings

1. Personnel Information

1.1. The pilot had a Private Pilot Licence (PPL) that was initially issued by the Regulator (SACAA) on 21 December 2006. The licence was reissued on 31 July 2023 with an expiry date of 31 July 2025. The pilot had flown a total of 463.62 hours of which 18.92 hours were flown on the aircraft type.

1.2. The pilot had a Class 2 aviation medical certificate that was issued on 31 July 2024 with an expiry date of 31 July 2025 with no restrictions.

2. Aircraft Information

2.1. The aircraft was maintained by an approved person (AP). The latest maintenance inspection of the aircraft was certified on 6 December 2024 or at a total of 83.47 airframe hours. The aircraft had accrued 2.95 hours since the said inspection.

2.2. The aircraft was issued a Certificate of Release to Service (CRS) on 6 December 2024 or at 83.47 airframe hours with an expiry date of 6 December 2025 or at airframe 183 hours, whichever occurs first.

2.3. The aircraft had a valid Authority-to-fly (ATF) Certificate that was initially issued on 5 February 2021. The latest ATF had an expiry date of 30 June 2025.

2.4. The aircraft's Certificate of Registration (C of R) was issued to the present owner on 18 November 2022.

2.5. The exhaust valve spring retainer fractured and compromised the positioning and control of the exhaust valve. The valve and piston assembly were no longer retained in their proper positions which resulted in mechanical interference in the engine. The mechanical disruption caused the loss of engine power and the subsequent stoppage during operation.

3. Meteorological Information

3.1. Based on the information provided by the in the pilot's questionnaire and post-engine examination, the weather was not a factor in this accident.

Probable Cause(s)

Engine stoppage in-flight followed by an unsuccessful forced landing on the road. The engine stoppage was a result of a fractured exhaust valve retainer spring which led to the loss of structural integrity of the valve and piston assembly.

Contributing Factor(s)

1. Material failure of the exhaust valve retainer spring.
2. Fractured number 2-cylinder exhaust valve retainer spring.
3. Displacement of internal components into the combustion chamber.

Safety Action(s)

None.

Safety Message and/or Safety Recommendation/s

None.

About this Report
The decision to conduct a limited investigation is based on factors including whether the cause is known and the evidence supporting the cause is clear, the level of safety benefit likely to be obtained from an investigation, and that will determine the scope of an investigation. For this occurrence, a limited investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person and organisation to compile this limited report. The report has been compiled using information supplied in the initial notification, as well as from follow-up desktop inquiries to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action that the industry might want to consider in preventing a recurrence of a similar occurrence. *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.*
Purpose
In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011 and ICAO Annex 13, 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.
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This report is issued by:

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