AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:		CA18/2/3/10190	
Aircraft Registration	ZU-ECG	**Date of Accident**	16 July 2022			**Time of Accident**	1120Z
Type of Aircraft	Rainbow Cheetah			**Type of Operation**		Private (Part 94)	
Pilot-in-command Licence Type	NPL Aeroplane			**Age**	50	**Licence Valid**	Yes
Pilot-in-command Flying Experience		**Total Flying Hours**		434.8		**Hours on Type**	128.3
Last Point of Departure	Wings Park Aerodrome, Eastern Cape Province						
Next Point of Intended Landing	Wavecrest Aerodrome, Eastern Cape Province						
Damage to Aircraft	Substantial						

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

Wings Park Aerodrome RWY04, Eastern Cape Province, at Global Positioning System (GPS) determined to be 32°49'22.63''S 027°50'05.88''E at an elevation of 675 feet

Meteorological Information	Wind velocity: 110° at 6kts; Temperature: 22°C; Dew Point: 11°C; Visibility: ≥10000m; Cloud: CAVOK; QNH: 1024 hPa

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

Synopsis

On 16 July 2022 at 1120Z, a pilot and a passenger on-board a Rainbow Cheetah light aircraft registered ZU-ECG took off on a private flight from Wings Park Aerodrome with the intention to land at Wavecrest Aerodrome, near East London, in the Eastern Cape province. The flight was planned to be conducted under visual flight rules (VFR) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

Shortly after take-off from Runway 09 (RWY09), the engine revolutions per minute (RPM) reduced. When power could not be restored, the pilot attempted to execute a forced landing at the juncture of Runway 04 (RWY04) but was unsuccessful. The aircraft came to a stop at the stopway of RWY04. It sustained substantial damage to the nose gear and the propeller. The two occupants on-board were not injured; they disembarked from the aircraft without assistance.

The investigation established that the engine RPM dropped shortly after take-off, resulting in power loss. The pilot stated that after the RPM reduced during take-off, he verified and confirmed that the auxiliary fuel pump was switched on. When the aircraft continued to lose altitude, he decided to execute a forced landing. The investigation found the engine power loss to have been caused by a defective auxiliary fuel pump which boosts fuel pressure system during take-off. Following the accident, the auxiliary fuel pump was replaced, and the engine operated as expected.

Probable Cause/s and/or Contributory Factors

The pilot performed an unsuccessful forced landing following an engine power loss after take-off due to a defective auxiliary fuel pump which boosts fuel pressure system during take-off.

Contributory:
Non-replacement of auxiliary fuel pump after five years in operation.

SRP Date	14 April 2023	Publication Date	28 April 2023

Occurrence Details

Reference Number	**:** CA18/2/3/10190
Occurrence Category	**:** Accident
Type of Operation	**:** Private (Part 94)
Name of Operator	**:** J N Moolman
Aircraft Registration	**:** ZU-ECG
Aircraft Make and Model	**:** Rainbow Aircraft Cheetah
Nationality	**:** South African
Registration	**:** ZU-ECG
Place	**:** Wings Park Aerodrome, Eastern Cape Province
Date and Time	**:** 16 July 2022 at 1120Z
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 at Wings Park Aerodrome on 16 July 2022 at 1120Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and ICAO STD Annex 13 definitions. Notifications sent to the State of Registry, Operator, Design and Manufacturer in accordance with the CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The investigator did not dispatch 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 Rainbow Cheetah 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
AIID	Accident and Incident Investigations Division
AP	Approved Person
ATF	Authority to Fly
C of R	Certificate of Registration
CAR	Civil Aviation Regulations
CRS	Certificate of Release to Service
FAEL	East London Airport
Ft	Feet
hPa	Hectopascal
Kt	Knots
LSA	Light Sport Aircraft
M	Metres
METAR	Meteorological Aerodrome Report
MHz	Megahertz
QNH	Altitude Above Mean Sea Level
RPM	Revolutions per Minute
RWY	Runway
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On 16 July 2022 at 1120Z, a pilot and a passenger on-board a Cheetah light aircraft with registration ZU-ECG took off on a private flight from Wings Park Aerodrome with the intention to land at Wavecrest Aerodrome, near East London, in the Eastern Cape province. The flight was planned to be conducted under visual flight rules (VFR) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2. The pilot reported that he conducted a pre-flight check and, thereafter, taxied to Runway 09 (RWY09) for the run-up checks before take-off. During the initial climb, the pilot noticed a gradual loss of engine revolutions per minute (RPM). He then switched tanks and checked if the auxiliary fuel pump was switched on, but the RPM continued to reduce. The pilot then elected to execute a forced landing on the juncture of Runway 04 (RWY04). RWY04 juncture is 500 metres long.

1.1.3. The aircraft touched down mid-RWY04 and overran it. The nose gear collapsed after touchdown and the propeller struck the ground before the aircraft came to a stop at the stopway of RWY04 in a nose-down attitude.

1.1.4. The pilot and the passenger were not injured during the accident sequence; they disembarked from the aircraft without assistance. The aircraft sustained damage to the nose gear and propeller. The flight duration was approximately one minute. The pilot drained approximately 50 litres of fuel from the aircraft post-accident.

1.1.5. The accident occurred during daylight on RWY04 at Wings Park Aerodrome in the Eastern Cape province, at Global Positioning System (GPS) co-ordinates determined to be 32°49’22.63’’S 027°50’05.88’’E at an elevation of 675 feet (ft).

Figure 1: Aerial view of Wings Park Aerodrome. (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. No person was injured during the accident sequence.

1.3. Damage to Aircraft

1.3.1. The aircraft sustained damage to the nose gear and the propeller.

Figure 2: The damage sustained by the aircraft. (Source: Pilot)

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	50
Licence Type	National Pilot Licence (NPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	4 June 2023				
Restrictions	Visual Aid				
Previous Accidents	None				

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

Flying Experience:

Total Hours	434.8
Total Past 24 Hours	6.4
Total Past 7 Days	10.5
Total Past 90 Days	16.9
Total on Type Past 90 Days	16.9
Total on Type	128.3

1.5.1. The pilot was initially issued a National Pilot Licence (NPL) on 12 October 2010. He undertook a competency evaluation on 29 March 2022 and was reissued the licence on the same day with an expiry date of 28 March 2024. The pilot had a Class 4 medical certificate that was issued on 22 June 2021 with an expiry date of 4 June 2023 and with a restriction to wear corrective lenses.

1.6. Aircraft Information

1.6.1. The Cheetah is a two-seat strut-braced high-wing light aircraft with a fixed tricycle undercarriage. The airframe is manufactured from aluminium tubing and Dacron sailcloth fibre material. The aircraft is powered by a Rotax 582 air-cooled flat four-cylinder engine in tractor configuration.

Airframe:

Manufacturer/Model	Rainbow Aircraft Cheetah	
Serial Number	CH057	
Year of Manufacture	2006	
Total Airframe Hours (At Time of Accident)	458.9	
Last Inspection (Date & Hours)	8 June 2021	415.0
Airframe Hours Since Last Inspection	43.9	
CRS Issue Date	8 June 2021	
ATF (Issue Date & Expiry Date)	31 May 2019	31 July 2022
C of R (Issue Date) (Present Owner)	Mogas	
Operating Category	Normal	
Type of Fuel Used	None	
Previous Accidents	None	

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

Engine:

Manufacturer/Model	Rotax 582
Serial Number	6140943
Hours Since New	458.9
Hours Since Overhaul	TBO not reached

1.6.2 The engine manufacturer stated that the engine is meant for use in experimental and non-type certified aircraft, and that it could stop without warning (see Appendix A).

Propeller:

Manufacturer/Model	FEC2G4
Serial Number	N2235
Hours Since New	458.9
Hours Since Overhaul	TBO not reached

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 16 July 2022 at 1100Z, recorded at East London Aerodrome (FALE). FALE is located 12 nautical miles (nm) from the accident site.

Wind Direction	110°	Wind Speed	06kt	Visibility	10 km
Temperature	22°C	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	11°C	QNH	1024 hPa		

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

1.8. Aids to Navigation

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

1.9. Communication

1.9.1. The aircraft 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

Aerodrome Location	Eastern Cape Province
Aerodrome Status	Unlicensed
Aerodrome GPS coordinates	32°49’32.00” South, 027°50’11.00” East
Aerodrome Elevation	675 feet
Runway Headings	09/27 and 04/22
Dimensions of Runway Used	950 x 25 and 500 x metres
Heading of Runway Used	09
Surface of Runway Used	Grass
Approach Facilities	None
Radio Frequency	125.2 MHz

1.11. Flight Recorders

1.11.1. The aircraft 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 aircraft type.

1.12. Wreckage and Impact Information

1.12.1. The aircraft’s engine lost RPM after take-off from RWY09. The pilot aimed to execute a forced landing on the juncture of RWY04, but the aircraft failed to stop and overran the runway. There was insufficient runway surface remaining as the pilot landed mid-RWY04. RWY04 juncture is 500m in length.

1.12.2. The aircraft came to rest on the stopway of RWY04 in a nose-down attitude. It sustained damage to the nose gear and the propeller.

Figure 3: The aircraft post-accident; and the fuel drained from aircraft).
(Source: Pilot)

1.13. Medical and Pathological Information

1.13.1. The pilot and the passenger were not injured during the accident sequence; they disembarked from the aircraft without assistance.

1.14. Fire

1.14.1. There was no evidence of a pre- or post-impact fire.

1.15. Survival Aspects

1.15.1. The accident was considered survivable as there was minimal impact force in the cockpit. Moreover, the two occupants had made use of the aircraft's safety harnesses.

1.16. Tests and Research

1.16.1. Following the accident, the engine was inspected by the approved person (AP) and the following was established:

- Check for water in the fuel – none was found.
- Check in-float bowls for fuel – there was fuel in the float bowls.
- Check for cracks on fuel lines – no cracks found and fuel lines were in good condition.
- Check mechanical fuel pump – found in good condition and fuel pressure was also satisfactory.

- Check carburettors, fuel floats and needles – all were found to be in good condition.
- Check the backup electric fuel pump (Facet: serial number 60245) – the electric battery powered auxiliary fuel pump was not working.
- There were no defects with the wiring and the switches.

1.16.2 The electric auxiliary fuel pump was replaced with a serviceable one. The engine was started and the fuel pressure read good; the engine ran smoothly without further problems.

1.16.3 According to the maintenance manual, the fuel pump must be inspected every 100 hours or every 12 months, and must be replaced every 5 years (see Appendix 2). The aircraft documents did not show any evidence of the replacement of the auxiliary fuel pump.

1.17. Organisational and Management Information

1.17.1. The aircraft was operated privately under the provisions of Part 94 of the CAR 2011 as amended.

1.17.2. The aircraft was maintained by an AP who was in possession of an authorised AP certificate that was issued by the Regulator on 8 January 2020 with an expiry date of 9 January 2022. The certificate was reissued on 10 January 2022 with an expiry date of 9 January 2024.

1.18. Additional Information

1.18.1. The following information is an extract from the Cheetah XLS Pilot's Operating Handbook (POH):

1.18.1.1 BEFORE TAKEOFF

- *Warm up the engine Jabiru warm up at 1300 RPM until 105 F is reached.*
- *Turn On Aux. Fuel Pump,*
- *Turn on Carb Heat.*
- *Verify Fuel selector ON again!*
- *Execute Mag Checks 1700 RPM for Jabiru, RPM Drop less than 50 is ok.*
- *Check windsock for wind direction. Hold aileron down into crosswind (if any).*
- *Check runway for Traffic from all directions.*

1.18.1.2 TAKEOFF

- *Align aircraft with runway center line.*
- *Check compass agrees with runway heading*
- *Strobes on (if fitted)*
- *Check that flaps are on first notch*
- *Take full power. Check that max rpm is being delivered.*
- *Rotate at 45 MPH Revision 0 Dated July 2009 0_0 8-28*
- *Best Angle of Climb VX-58 mph*
- *Best Rate of Climb Vy-64 mph*
- *Hold runway heading. Keep the ball in the middle.*

1.18.1.3 AFTER TAKEOFF

- *At 50 feet slowly retract flaps*
- *Establish climb speed required*
- *Check engine instruments*
- *Aux Fuel pump off.*

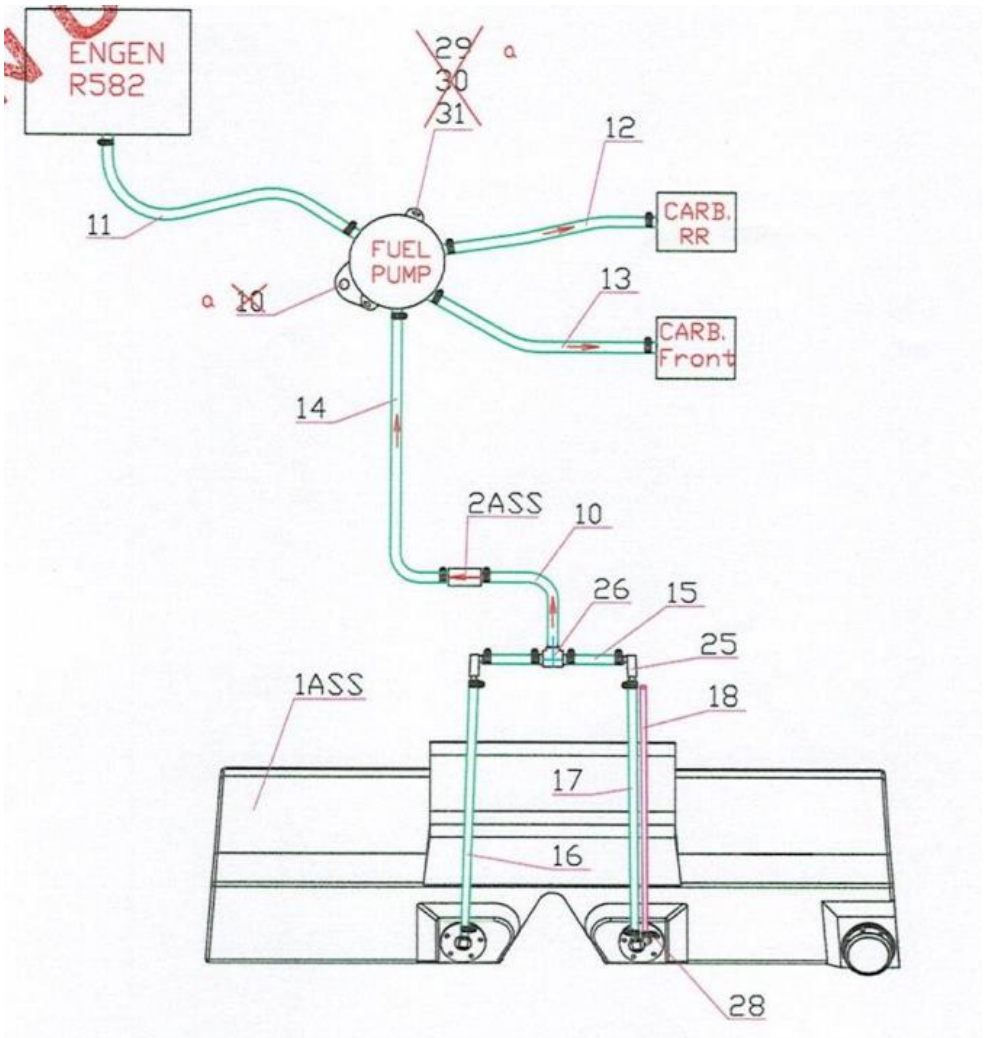

Diagram 4: The fuel system illustration for Cheetah 582R. (Source: Rainbow SkyReach)

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 properly licensed for the flight. He had a total of 434.8 hours of flight time, of which 128.3 hours were on the aircraft type. The pilot had a Class 4 medical certificate with the restriction to wear corrective lenses.

2.2.2. The aircraft had an Authority to Fly (ATF) which was issued on 31 May 2019 with an expiry date of 31 July 2022. The Certificate of Release to Service (CRS) was issued on 8 June 2021 with an expiry date of 7 June 2022. However, there was no evidence that the auxiliary fuel pump was replaced in the past five years as prescribed in the flight manual.

2.2.3. The weather conditions at the time of the flight were as follows: temperature was 17°C, dew point was 11°C, wind direction was 110°, wind speed was 6 knots, visibility was 10 kilometres, and both cloud cover and cloud base were CAVOK. The weather did not contribute to this accident.

2.2.4. The pilot reported that he conducted a pre-flight check on the aircraft and found no anomalies. He then took off from RWY09 at Wings Park Aerodrome with the intention to land at Wavecrest Aerodrome in the Eastern Cape province. The engine RPM dropped shortly after take-off during the initial climb. Attempts to restore engine power, including switching fuel tanks and checking the auxiliary fuel pump, were unsuccessful. The pilot then aimed to execute a forced landing on the juncture of RWY04. RWY04 juncture is approximately 500m in length. The aircraft came to a stop at the stopway of RWY04 in a nose-down attitude.

2.2.5. The pilot and the passenger were not injured. The aircraft sustained damage to the nose gear and the propeller. The total flight duration was approximately one minute. Post-flight inspection by the AP revealed that the auxiliary fuel pump was unserviceable.

2.2.6. The investigation established that the engine RPM dropped shortly after take-off, which resulted in power loss. The cause of engine power loss was a defective auxiliary fuel pump which boosts the fuel pressure system during take-off. According to the engine maintenance manual, the auxiliary fuel pump must be replaced every five years. The aircraft documents had no evidence of the auxiliary fuel pump being replaced before the accident. After the accident, the auxiliary fuel pump was replaced, and the engine operated as expected.

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 was initially issued a National Pilot Licence (NPL) on 12 October 2010. The pilot undertook a competency evaluation on 29 March 2022 and was reissued the licence on the same day with an expiry date of 28 March 2024. The pilot had a Class 4 medical certificate that was issued on 22 June 2021 with an expiry date of 4 June 2023 and with a restriction to wear corrective lenses.

3.2.2. The aircraft was maintained by an AP who was in possession of an authorised AP certificate that was issued by the Regulator on 8 January 2020 with an expiry date of 9 January 2022. The certificate was reissued on 10 January 2022 with an expiry date of 9 January 2024.

3.2.3. The aircraft was issued a Certificate of Registration (C of R) on 3 November 2020. The aircraft's Authority to Fly (ATF) was issued on 31 May 2019 with an expiry date of 31 July 2022. The last mandatory periodic inspection (MPI) on the aircraft was carried out on 8 June 2021 at 415.0 hours. The aircraft was flown a further 43.9 hours after the MPI.

3.2.4 The flight was conducted under VFR by day and under the provisions of Part 94 of the CAR 2011 as amended. The weather conditions at the time of the flight were as follows: temperature was 17°C, dew point was 11°C, wind direction was 110°, wind speed was 6 knots, visibility was 10 kilometres, and both cloud cover and cloud base were CAVOK. The weather conditions did not contribute to this accident. The aircraft was forced-landed following loss of engine power shortly after take-off. The pilot intended to force-land the aircraft on the juncture of RWY04, but the aircraft overshot the runway and came to a stop at the stopway. The pilot and the passenger were not injured; the aircraft sustained damage to the nose gear and the propeller.

3.2.5 The investigation established that the engine RPM dropped shortly after take-off which resulted in power loss. The pilot verified and confirmed that the auxiliary fuel pump was switched on, however, the aircraft continued to lose altitude. The cause of the engine power loss was attributed to an auxiliary fuel pump which boosts the fuel pressure system during take-off. Following the accident, the auxiliary fuel pump was replaced, and the engine operated as expected.

3.2.6 There was no evidence that the auxiliary fuel pump was replaced in the past five years as prescribed in the flight manual.

3.3. Probable Cause

3.3.1. The pilot performed an unsuccessful forced landing following engine power loss after take-off. The cause of engine power loss was attributed to a defective auxiliary fuel pump which boosts fuel pressure system during take-off.

3.4. Contributory Factor

3.4.1. Non-replacement of the auxiliary fuel pump after five years in operation.

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. Appendix A: Disclaimer from engine maintenance manual.
5.2. Appendix B: Extract from the Rotax maintenance manual.

This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa

Appendix A

BRP-Rotax
MAINTENANCE MANUAL

USE FOR INTENDED PURPOSE

⚠ WARNING

Explosion hazard.
Flying components can cause serious injuries.
Never run an engine without propeller.

Use

The engine ROTAX® 582 UL DCDI mod. 99 / mod. 17 is intended for use in uncertified aircraft. In case of doubt the regulations of the national authorities or the respective sportive federations have to be observed.

Never run the engine without propeller, this inevitably causes engine damage and hazard of explosion.

Uncertified engines

The engine ROTAX® 582 UL DCDI mod. 99 / mod. 17 is uncertified. These engines have not received any safety or durability testing, and conform to no aircraft standards. These engines are meant for use in experimental, uncertified aircraft and vehicles only, in which an engine failure will not compromise safety.

Engine stoppage

In using the engine the operator assumes all risk of use and acknowledges that he/she knows this engine is subject to sudden stoppage.

Maintenance and repair conditions

Use for intended purpose also includes observation of the operational, maintenance and repair conditions prescribed by the manufacturer. This is a crucial factor concerning the reliability of the engine and can increase the durability of the engine.

Appendix B

2.1) Time limit for rubber parts

General note

NOTICE This time limit must be followed **independently** and **in addition** to the visual inspections (see chap. 05-20-00 section: 5.1)) of the respective components.

Time limit

The following components and systems must be replaced every 5 years:

- venting hose of the carburetors	
- all rubber hoses of the cooling system	
- all rubber hoses of the fuel system (incl. teflon hoses)	Fuel pump and insulating flange, if this is fixed with fuel hoses.
- venting hose of the fuel pump	
- all rubber hoses of the lubrication system which are part of the engine supply volume and if they are not in the maintenance schedule of aircraft manufacturer	
- carburetor sockets	
- connecting hose of the air intake system	
- diaphragm on both carburetors	
- rubber hoses on compensating tube	
- V-belt	

2.2) Time limit for fuel pump

General note

The fuel pump must be replaced every 5 years.

2.3) Time limit for the coolant

General note

Coolant must be replaced as per manufacturers instructions, at the latest during overhaul or when the engine is replaced.

2.4) Annual inspection

General note

A 100 hr. inspection is to be carried out periodically after every 100 hours of operation **or every 12 months**, whichever comes first.
See chap. 05-10-00 section: 2).