

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:		CA18/2/3/10249	
Aircraft Registration	ZS-PNC	Date of Accident	13 January 2023		Time of Accident	0950Z	
Type of Aircraft	Ayres S2R-T34		Type of Operation		Crop-spraying (Part 137)		
Pilot-in-command Licence Type	Commercial Pilot Licence (CPL)		Age	53	Licence Valid	Yes	
Pilot-in-command Flying Experience	Total Flying Hours		7762.5		Hours on Type	1000.5	
Last Point of Departure	Langfontein Private Airstrip, Mpumalanga Province						
Next Point of Intended Landing	Langfontein Private Airstrip, Mpumalanga Province						
Damage to Aircraft	Substantial						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
On a private farm in Jantjieshoek at Global Positioning System (GPS) co-ordinates determined to be 27°15'09.1" South 030°07'22.1" East, at an elevation of 6022ft							
Meteorological Information	Wind: 020° at 5kt, Temperature: 29°C, Dew Point: 9°C, CAVOK, QNH: 1022 hPa						
Number of People On-board	1 + 0	Number of People Injured	0	Number of People Killed	0	Other (On Ground)	0
Synopsis							
On 13 January 2023, a pilot on-board an Ayres S2R-T34 aircraft with registration ZS-PNC was engaged in a crop-spraying operation on a private farm in Jantjieshoek, Mpumalanga province, when the accident occurred. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 137 of the Civil Aviation Regulations (CAR) 2011 as amended. The pilot stated that he had been spraying fungicide on the field and, during a turn to the right at approximately 700 feet (ft) above ground level (AGL) the engine flamed out, followed by the interstage turbine temperature (ITT) decrease and a change in engine sound. The pilot levelled the aircraft, configured it for a forced landing and feathered the propeller to increase the gliding distance. He then attempted to restart the engine by switching on the igniters and engaging the starter. On short finals, the engine restarted but the propeller blades were still feathered. The aircraft touched down on uneven terrain and, approximately 300 metres (m) after touch down, it impacted a large rock and bounced back into the air. Upon touch down again, the main gear struts broke off, which caused the main gears to bend backwards and the propeller blades to strike the ground. After the aircraft came to rest, the pilot shut down the engine and disembarked from the aircraft. The pilot was not injured during the accident sequence; however, the aircraft was substantially damaged.							
Probable Cause/s and/or Contributory Factors							
In-flight engine failure due to fuel exhaustion which resulted in an unsuccessful forced landing due to unsuitable terrain on which the aircraft landed.							
Contributory Factor: Improper flight planning.							
SRP Date	8 August 2023		Publication Date	21 August 2023			

Occurrence Details

Reference Number	: CA18/2/3/10249
Occurrence Category	: Category 2
Type of Operation	: Crop-spraying (Part 137)
Name of Owner	: Orsmond Aerial Spray (PTY) LTD
Aircraft Make and Model	: Ayres S2R-T34
Nationality	: South African
Registration Marks	: ZS-PNC
Place	: Private farm in Jantjieshoek, Mpumalanga Province
Date and Time	: 13 January 2023, 0950Z
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 involving an Ayres S2R-T34 which occurred at a private farm in Jantjieshoek, Mpumalanga province, on 13 January 2023 at 0950Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and ICAO STD Annex 13 definitions. Notifications were sent to the State of Registry and Engine Manufacturer in accordance with the CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The State of Engine Manufacturer had appointed an advisor. The investigator did not dispatch to the accident site for this accident.

Notes:

- 1. Whenever the following words are mentioned in this report, they shall mean the following:
Accident — this investigated accident.
Aircraft— the Ayres S2R-T34 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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Table of Contents

Executive Summary	1
Occurrence Details	2
Disclaimer	2
Contents Page	3
Abbreviations	4
1. FACTUAL INFORMATION	6
1.1. History of Flight	6
1.2. Injuries to Persons	7
1.3. Damage to Aircraft	7
1.4. Other Damage	8
1.5. Personnel Information	8
1.6. Aircraft Information	9
1.7. Meteorological Information	11
1.8. Aids to Navigation	12
1.9. Communication	12
1.10. Aerodrome Information	12
1.11. Flight Recorders	12
1.12. Wreckage and Impact Information	12
1.13. Medical and Pathological Information	14
1.14. Fire	14
1.15. Survival Aspects	14
1.16. Tests and Research	14
1.17. Organisational and Management Information	17
1.18. Additional Information	17
1.19. Useful or Effective Investigation Techniques	18
2. ANALYSIS	18
3. CONCLUSION	19
3.1. General	19
3.2. Findings	20
3.3. Probable Cause/s	20
3.4. Contributory Factor/s	20
4. SAFETY RECOMMENDATIONS	21
5. APPENDICES	21

Abbreviation	Description
°	Degrees
°C	Degrees Celsius
AGL	Above Ground Level
AIID	Accident and Incident Investigations Division
AMO	Aircraft Maintenance Organisation
AOC	Air Operator Certificate
CAR	Civil Aviation Regulations
CAVOK	Cloud and Visibility OK
CMM	Component Maintenance Manual
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CPL	Commercial Pilot Licence
CRS	Certificate of Release to Service
CT	Compressor Turbine
CVR	Cockpit Voice Recorder
FANC	Newcastle Airfield
FCU	Fuel Control Unit
FDR	Flight Data Recorder
FOD	Foreign Object Damage
ft	Feet
GPS	Global Positioning System
hPa	Hectopascal
ICAO	International Civil Aviation Organisation
in	Inch
ITT	Interstage Turbine Temperature
kts	Knots
lbs	Pounds
LTD	Limited
m	Metres
METAR	Meteorological Aerodrome Report
MHz	Megahertz
MPI	Mandatory Periodic Inspection
NM	Nautical miles
NOSIG	No Significant Change
POH	Pilot Operating Handbook
PT	Power Turbine
PTY	Proprietary
QNH	Barometric Pressure Adjusted to Sea Level (Query Nautical Height)
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
TBO	Time Between Overhaul
USG	United States Gallons

UTC	Co-ordinated 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 13 January 2023, a pilot on-board an Ayres S2R-T34 aircraft with registration ZS-PNC was engaged in a crop-spraying operation on a private farm in Jantjieshoek, Mpumalanga province, when the accident occurred. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 137 of the Civil Aviation Regulations (CAR) 2011 as amended.
- 1.1.2 The pilot stated that he lifted off from Langfontein Private Airstrip and flew 2.2 nautical miles (nm) south-west to the crop field. He completed a few swathes on which he sprayed fungicides before flying back to Langfontein Private Airfield to reload. He stated that whilst he was on the fourth flight of the morning, he turned right at approximately 700 feet (ft) above ground level (AGL) to complete the last swathe, but the aircraft lost power. This was followed by the interstage turbine temperature (ITT) decrease and a change in engine sound. The pilot then levelled the aircraft and configured it for a forced landing and feathered the propeller to increase the gliding distance. He then restarted the engine by switching on the igniters and engaging the starter. On short finals, the engine restarted but the propeller blades were still feathered, therefore, could not produce the required revolutions per minute (RPM). The aircraft touched down on uneven terrain and, after a few metres, it impacted a fence and flattened it whilst still rolling. Approximately 300 metres (m) after touch down, the undercarriage impacted a large rock which resulted in the spray pump and the gate box being severed. Thereafter, the aircraft bounced back into the air and, upon touch down again, the main landing gear struts broke off, which caused the main landing gears to bend and the propeller blades to strike the ground. After the aircraft came to rest, the pilot shut down the engine and disembarked from it. The pilot was not injured during the accident sequence; the aircraft was substantially damaged.



Figure 1: Aerial view indicating the private airstrip and the crop-sprayed field.
(Source: Google Earth)

1.1.3 The accident occurred during daylight at Global Positioning System (GPS) co-ordinates determined to be 27°15'09.1" South 030°07'22.1" East, at an elevation of 6 022ft.

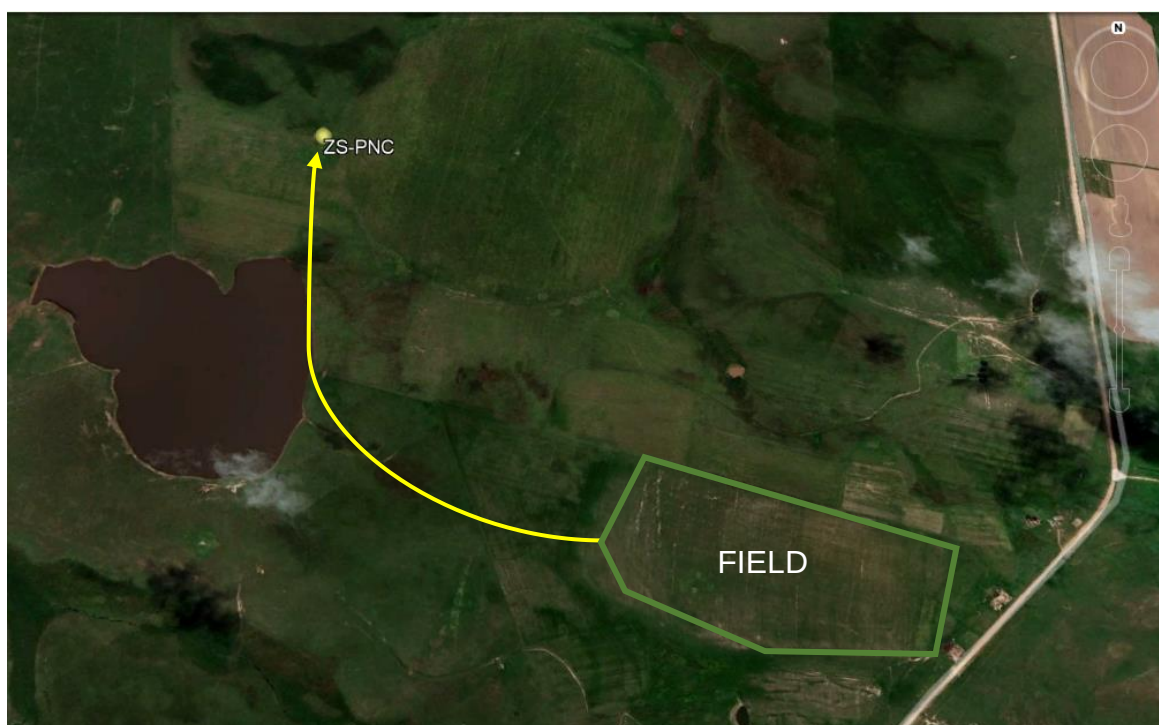


Figure 2: The yellow line indicates the flight path of the aircraft when it experienced power loss.
(Source: Google Earth)

1.2. Injuries to Persons

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

Note: Other means people on the ground.

1.3. Damage to Aircraft

1.3.1. The aircraft sustained substantial damage to the propeller and the main undercarriage.



Figure 3: The aircraft post-accident. (Source: Operator)

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	53
Licence Type	Commercial Pilot Licence (CPL) Aeroplane				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night, Instrument, Instructor Grade 3 and Agricultural				
Medical Expiry Date	31 May 2023				
Restrictions	Corrective Lenses and Hearing 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	7762.5
Total Past 24 Hours	4.4
Total Past 7 Days	24.8
Total Past 90 Days	117.0
Total on Type Past 90 Days	99.1
Total on Type	1000.5

1.5.1. The pilot was issued a Commercial Pilot Licence (CPL) Aeroplane on 9 May 2022 with an expiry date of 30 June 2023. The pilot's hours in the above table are as per the hours submitted by the pilot through the pilot questionnaire and logbook.

- 1.5.2. The pilot was issued a Class 1 medical certificate on 6 May 2022 with an expiry date of 31 May 2023, with corrective lenses and hearing aid restrictions.
- 1.5.3. The pilot was issued an Ayres S2R aircraft rating on 21 December 2020 to act as a pilot-in-command.

1.6. Aircraft Information

1.6.1. The Ayres/Thrush (Source: thrushaircraft.com)

The Ayres/Thrush, formerly the Snow S-2 Aero Commander Ag Commander, and Rockwell Thrush Commander, is an American agricultural aircraft produced by Ayres Corporation and, more recently, by Thrush Aircraft. It is one of the most successful and long-lived agricultural application aircraft types in the world. Typical of agricultural aircraft, it is a single-seat monoplane of conventional taildragger configuration. Originally powered by a radial piston engine, most examples produced since the 1980s have been turboprop-powered. The S-2R-T turboprop powered versions are equipped with Pratt & Whitney Canada PT6A.

Airframe:

Manufacturer/Model	Ayres/Thrush Corporation, S2R-T34	
Serial Number	T27-031	
Year of Manufacture	1992	
Total Airframe Hours (At Time of Accident)	6302.9	
Last Inspection (Date & Hours)	7 December 2022	6222.0
Hours Since Last Inspection	80.9	
CRS Issue Date	7 December 2022	
C of A (Issue Date & Expiry Date)	12 May 2022	30 May 2023
C of R (Issue Date) Present Owner	22 April 2005	
Type of Fuel Used	Jet A1	
Operating Category	Part 137	
Previous Accidents	None	

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

- 1.6.2 The aircraft was registered to the present owner on 22 April 2005. The Certificate of Airworthiness (C of A) was initially issued on 12 May 2011 with an expiry date of 30 May 2023.
- 1.6.3 Based on the aircraft's flight folio and airframe logbook, the last mandatory periodic inspection (MPI) was conducted on 7 December 2022 at 6222.0 airframe hours. The aircraft had accumulated an additional 80.9 airframe hours since the last inspection, and no major defects were recorded. The aircraft was reissued a Certificate of Release to Service (CRS) on 7 December 2022 with an expiry date of 6 December 2023 or at 6322.0 airframe hours, whichever occurs.

Engine:

Manufacturer/Model	Pratt & Whitney/ PT6A-34AG
Serial Number	PCE-PH0046
Hours Since New	6399.6
Hours Since Overhaul	2628.6

Propeller:

Manufacturer/Model	Hartzell/ HC-B3TN-3D
Serial Number	BUA32118
Hours Since New	1644.7
Hours Since Overhaul	538.6

1.6.4 Fuel Related Information:**1.6.4.1 Fuel System (Source: Model S2R-T34 Turbo Thrush Aircraft Maintenance Manual)**

A 230-gallon fuel supply is available for the Turbo Thrush. In each wing, fuel is contained inside integral wing tanks (wet wing fuel tanks) just outboard of the centre section subwings. The left wing and right wing fuel tanks are interconnected through a 5 U.S. gallon header tank that is located in the fuselage. The fuel supply lines, to the engine, are routed from the header tanks outlet finger screen through a fuel shutoff (on/off) valve to an electric driven fuel boost pump. The electric driven fuel boost pump discharge is then routed through a 25-micron main fuel filter to an engine driven fuel boost pump. The electric driven fuel boost pump serves two purposes, first as a backup system to provide continuous fuel pressure to the engines high pressure fuel pump in case the engine driven fuel boost pump fails and secondly to provide boosted fuel pressure to the engines high pressure fuel pumps during engine starting. The aircraft's fuel system is equipped with two fuel filters, a quarter inch mesh finger strainer is installed in the outlet fitting from the header tank and a 25-micron, airframe supplied, main fuel filter located on the forward left hand side of the firewall. Fuel from the aircraft fuel system enters the engines high pressure fuel pump which has two fuel filters, a 74-micron inlet filter and a 10-micron discharge filter. The fuel tank vent system is designed to keep the fuel spillage to a minimum. The fuel tanks are vented through tubing connected at both the inboard and outboard ends of the individual fuel tanks to the centrally located vent system in the fuselage.

The fuel quantity gauge is located on the lower left instrument panel. The fuel quantity indicating system consists of two transmitters, one indicator gauge, and a L/H or R/H tank fuel quantity selector switch. A transmitter, installed in each wing tank transmits an electrical signal to the single fuel quantity indicator. The instrument reads both the left and right fuel tanks singularly as chosen by the electrical control switch, adjacent to the fuel quantity indicator gauge on the instrument panel. The two fuel tanks are serviced through filler ports located on the top of both wings. The filler ports incorporate security chains to prevent the loss of the fuel caps.

1.6.4.2 According to the flight folio page 94633 dated 13 January 2023, the aircraft was last refuelled with 797 litres (l) [210.55 United States Gallons (USG)] of Jet A1, and the flight duration was documented as 3.5 hours. The fuel flow is approximately 52 USG per hour, which equates to an endurance of 4.0 hours. Therefore, the aircraft should have had 0.5 hours endurance remaining at shut down after the forced landing. The flight folio page stated that there were two engine start and two flights completed.

1.6.4.3 According to the pilot's questionnaire, there was 2.5 hours fuel endurance at take-off and 0.5 hours fuel endurance after the forced landing. A signed fuel declaration by the pilot indicated that the pilot had carried out a fuel inspection on 13 January 2023, and no water or other contaminants were found in the fuel. The pilot also provided the investigation team with a weight and balance sheet for the flight; it was noted that the fuel on the weight and balance table was recorded as 870 lbs (129.85 USG).

Weight and Balance, ZS-PNC			
ITEM	WEIGHT (lbs)	ARM (in)	MOMENT
Empty weight	4949	24.5	121273.1
Pilot	220	89	19580
Fuel	870	38.5	33495
Hopper	3432	29.9	102616.8
Total	9471	29.24	276964.9

As per last W & B

Figure 4: The weight and balance table for the flight. (Source: Pilot)

1.6.4.4 The ground crew responsible for recovering the aircraft from the accident site stated: *"We inspected both fuel tanks via the filler cap and no fuel was observed in both tanks. We then raised the aircraft onto its undercarriage, opened the fuel drains and no fuel was present. There was also no visible evidence of fuel that had spilled around the wreckage."*

1.6.4.5 Engine Flame Out (Source: S2R-T34 Flight Manual)

The symptoms of an engine flame-out will be a drop in the interstage turbine temperature, torque meter pressure and RPM. The flame-out may result from the engine running out of fuel, or possibly may be caused by unstable engine operation. Once the fuel supply has been restored to the engine or the cause of the unstable operation eliminated, the engine may be restarted in the manner described under Air Starts.

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), recorded on 13 January 2023 at 1000Z at Newcastle Airfield (FANC), which is located 25 nautical miles (nm) from the accident site. FANC 131000Z AUTO 02005KT CAVOK 29/09 Q1022=

Wind Direction	020°	Wind Speed	5 kts	Visibility	9999m
Temperature	29°C	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	9°C	QNH	1022hPa		

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 navigation system was unserviceable prior to the flight.

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 flight.

1.10 Aerodrome Information

- 1.10.1 There was no aerodrome within a 10 nautical miles (nm) radius of the accident site.

1.11 Flight Recorders

- 1.11.1 The aircraft 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 aircraft type.

1.12 Wreckage and Impact Information

- 1.12.1 The aircraft touched down on uneven terrain and, after a few metres, it impacted a fence and flattened it whilst still rolling. Thereafter, the aircraft impacted a large rock on the ground and bounced back into the air. Upon touch down again, the wheel support struts broke off, which caused the main undercarriage to collapse and the propeller blades to strike the ground.



Figure 5: An aerial view showing the aircraft's ground roll after the forced landing. (Source: Operator)

1.12.2 Approximately 300m after the aircraft touched down, the undercarriage impacted a large rock, which resulted in the spray pump and the gate box being severed. The spray pump was found behind the aircraft among rocks that the aircraft initially impacted.

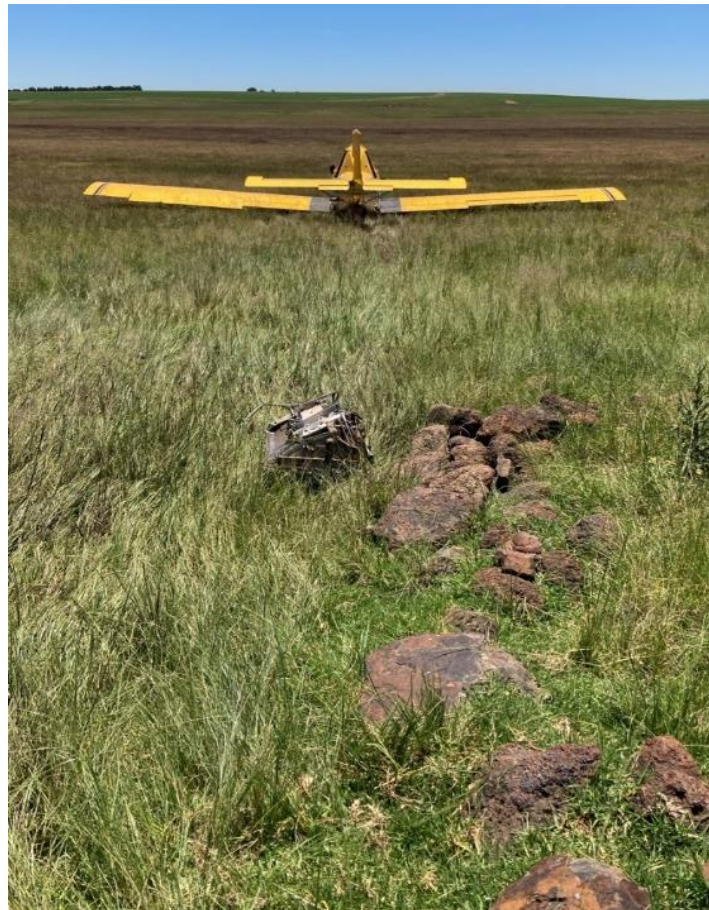


Figure 6: Rocky terrain and the spray pump and the gate box. (Source: Operator)

- 1.12.3 All three propeller blades bent backwards, which indicated that there was some power (the aircraft restarted) when the aircraft impacted the ground after it bounced.



Figure 7: The damaged propeller (left) and main undercarriage (right). (Source: Operator)

1.13 Medical and Pathological Information

- 1.13.1 Not applicable.

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 survivable as the cabin structure was still intact. The pilot was also safely harnessed during the flight.

1.16 Tests and Research

- 1.16.1 The post-accident inspection of the fuel system and the engine borescope was conducted on the engine with serial number PCE-PH0046 on 19 January 2023 by the aircraft maintenance organisation (AMO). The battery was connected, the starter engaged, and the engine spooled up normally. The oil pressure rose normally, and the rundown time was 42 seconds which indicated that the compressor rotated freely.

1.16.2 Post-accident Fuel System Inspection:

- Both fuel tank inspection covers were removed, and both tanks were dry.
- The rear and front fuel tank outlets for both wings were unobstructed.
- The fuel lines to the header tank were unobstructed.
- Both fuel cap sealing and the O-rings were in good condition.
- Both fuel cap locking mechanisms were functioning correctly.
- Both fuel tank drains were found clear and functioning correctly.
- The header tank drain was removed and there were no contaminants found.
- Both vent lines were physically blown, and no obstructions were found.
- The fuel control unit (FCU) fuel filter bowl was removed, and fuel was found inside. No abnormalities were observed.



Figure 8: The right fuel tank and the right fuel tank outlet. (Source: AMO)



Figure 9: The left fuel tank and the left fuel tank outlet. (Source: AMO)

1.16.3 Engine Borescope

- *First stage inlet blades found in good condition with no FOD (foreign object damage).*
- *First stage stator found in good condition with no FOD.*



Figure 10: First stage rotor and the stator inlet blades. (Source: AMO)

- Compressor turbine (CT) blades and the vane ring were inspected, and no blades were broken nor had FOD. A blue discolouration was observed which is indicative of a high temperature associated with overtemperatures or a hot start.



Figure 11: CT blades and the vane ring showing discolouration. (Source: AMO)

- Power Turbine (PT) blades and PT vane were found in a good condition and had no damage.
- Combustion chamber was found with evidence of heat discolouration on the small exit duct surface.

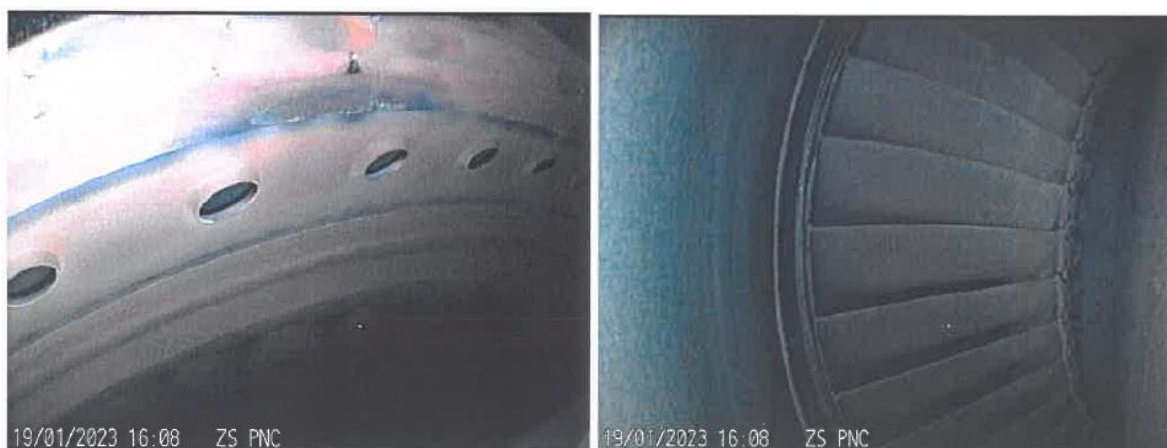


Figure 12: Combustion chamber on the left and PT blades on the right. (Source: AMO)

1.16.4 Fuel Control Unit (FCU) Report

The investigation of the FCU with serial number B32126 was conducted on 23 February 2023 at the engine manufacturer's service investigation facility in Canada, in accordance with the component maintenance manual (CMM) 73-20-43. (Source: Engine manufacturer)

- *The FCU was installed on a test bench and tested for air leakage. The fuel flow output was monitored for 5 minutes, and no variations were observed.*
- *The drive section was separated from the flow body for examination and all measurements were within the limits as per the CMM.*
- *The flow body was disassembled, and the governor bellows were satisfactorily leak tested.*
- *There were no indications of any mechanical anomalies to the FCU that would have precluded normal engine operation.*

1.17 Organisational and Management Information

1.17.1 The flight was conducted under the provisions of Part 137 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.17.2 The operator was issued an Air Operating Certificate (AOC) with an endorsement of Part 137 by the Regulator (SACAA) on 10 November 2022 with an expiry date of 30 November 2023. The operator of the aircraft had a Class G5 (agricultural spraying) certificate in accordance with the CAR 2011.

1.17.3 The AMO which carried out the last annual inspection prior to the accident flight was in possession of an approved AMO certificate that was issued by the SACAA on 17 August 2022 with an expiry date of 31 August 2023.

1.18 Additional Information

1.18.1 Starvation vs. Exhaustion (Source: skybrary.aero)

Fuel starvation and fuel exhaustion share the same possible outcomes: engine failure, forced landing, controlled flight into terrain (CFIT).

The difference is that in the exhaustion case there is no fuel remaining on-board (for whatever reason) while with starvation there is (sometimes enough) fuel but for some reason it cannot reach the engine. It is therefore possible in some cases to re-establish the flow of fuel and to regain engine power.

1.18.2 Avoiding Fuel Exhaustion (Source: aopa.com)

And when required gear (suitcases, survival kit) and passengers are non-negotiable, pilots often turn to fuel to come out below gross. But sometimes, we push it too far—fuel exhaustion accidents continue to occur every year. Of all the factors that lead to aircraft accidents, fuel is one of the easiest to address. If you know your fuel system, verify that you have the right type and quantity of fuel, lean your engine properly, and stay alert to changing conditions, the odds of a fuel-related incident are virtually non-existent. Here are some tips to avoid fuel exhaustion:

- *Be present every time your aircraft is fuelled. Verify fuel grade, quantity, and tanks to be filled.*
- *Check for water or contaminants.*
- *Secure fuel caps after you check the tank and double-check them before engine start.*
- *Determine available fuel in hours and minutes instead of gallons and pounds, and plan to land with at least an hour of usable fuel.*
- *Lean the mixture to achieve the best performance, range, and endurance.*
- *Recalculate range and endurance hourly to maintain adequate reserves.*
- *Understand how and when to use boost pumps, auxiliary tanks, and fuel transfer pumps, and switch tanks before reaching pattern altitude.*
- *Use a timer to remind you to switch tanks during flight.*

If you do become low on fuel, land as soon as possible, and if you get close to running out, do not be shy or embarrassed—declare a fuel emergency with ATC to get priority handling. These tips may seem overly basic, but even experienced pilots make mistakes, sometimes with severe consequences.

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. Weather

Fine weather conditions prevailed at the time of the flight; therefore, the weather was not a contributory factor.

2.2.2. Pilot

The pilot was certified to act as a pilot-in-command for the aircraft type and had a valid Commercial Pilot Licence (CPL), Class 1 medical certificate and agricultural rating; therefore, the pilot was qualified for the crop-spraying flight. Although the pilot conducted a fuel inspection prior to the flight and was aware how much fuel was on-board, he did not check fuel quantity during the flight, and the aircraft suffered fuel exhaustion on the last flight (swathe).

2.2.3. Aircraft

During the flight whilst the aircraft was turning right, the engine flamed out, followed by a drop in ITT, torque and RPM which are symptoms of an engine power loss. The cause of engine flameout was attributed to fuel exhaustion, which meant that the aircraft was flown until it ran out of fuel. After realising that the engine had lost power, the pilot levelled the aircraft from a right turn to force land it. On short finals whilst at wings level, the pilot was able to restart the engine by switching on the igniters and engaging the starter. The engine did not spool up timeously at the start due to the pilot omitting to select the propeller control lever to maximum, which caused drag and increased ITT, thus, the discolouration in the PT disc and blades.

Due to low height and the drag induced by the feathered propeller, the aircraft rapidly lost height and, thus, the pilot opted to force land the aircraft. All three propeller blades were bent backwards, which indicated that they were rotating at a low speed when the aircraft impacted the ground.

The pilot stated via the pilot questionnaire that the aircraft still had 0.5 hours of fuel endurance remaining after the forced landing. The ground crew that was responsible for recovering the aircraft from the accident site found no fuel in both tanks after inspecting both fuel tanks via the filler cap. They also did not observe fuel around the wreckage. Moreover, the tanks did not leak or rupture during the accident sequence.

The aircraft was recovered to an AMO where both fuel tank covers were removed, and they were found dry. All other fuel-related systems/parts were recovered with no anomalies detected. The FCU fuel filter bowl was removed, and fuel was found inside with no contaminants observed. The FCU was shipped to the manufacturer for further investigation, and there were no indications of any mechanical anomalies that could have caused the engine to lose power during flight.

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 reissued a Commercial Pilot Licence (CPL) Aeroplane on 9 May 2022 with an expiry date of 30 June 2023. The pilot's Class 1 medical certificate was issued on 2 March 2022 with an expiry date of 31 March 2023 with corrective lenses and hearing aid restrictions.
- 3.2.2 The pilot had the agricultural rating and the aircraft type endorsed on his licence.
- 3.2.3 The flight was conducted under the provisions of Part 137 of the CAR 2011 as amended and under VMC by day. Fine weather conditions prevailed at the time of the flight.
- 3.2.4 The aircraft was originally issued a C of A on 12 May 2011 with an expiry date of 30 May 2023.
- 3.2.5 The Certificate of Registration (C of R) was issued to the present owner on 22 April 2005.
- 3.2.6 The last mandatory periodic inspection (MPI) was carried out on 7 December 2022 at 6222.0 airframe hours. The aircraft had accumulated an additional 80.9 airframe hours in operation since the last inspection, and no major defects were recorded. The aircraft was reissued a Certificate of Release to Service (CRS) on 7 December 2022 with an expiry date of 6 December 2023 or at 6322.0 airframe hours, whichever occurs first.
- 3.2.7 A borescope of the engine, a visual inspection of the fuel system and an FCU test indicated that the engine had no mechanical anomalies. Upon recovery of the aircraft, no fuel remained in both tanks but there was fuel in the header tank. The engine flamed out due to fuel exhaustion and probably due to improper flight planning.
- 3.2.8 A forced landing was performed which was unsuccessful due to unsuitable terrain on which the aircraft was landed.

3.3. Probable Cause

- 3.3.1. In-flight engine failure due to fuel exhaustion which led to an unsuccessful forced landing as a result of unsuitable terrain on which the aircraft landed.

3.4. Contributory Factor/s

- 3.4.1. Improper flight planning.

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**

