SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division Accident and Incident Investigations Division Form Number: CA 12-57

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10573						
Classification	Accident	**Date**	1 April 2025		**Time**	0928Z	
Type of Operation	Agricultural Operations (Part 137)						
Location							
Place of Departure	Private Airstrip, Komatipoort, Mpumalanga Province	Place of Intended Landing	Private Airstrip, Komatipoort, Mpumalanga Province				
Place of Occurrence	On a field approximately 4 nautical miles north-east of Komati Sugar Mill, Mpumalanga Province						
GPS Co-ordinates	Latitude	S25°35'33.7"	Longitude	E31°56'20.6"	Elevation	3 938 feet	
Aircraft Information							
Registration	ZS-IOG						
Make; Model; S/N	Thrush; S2R-H80 (Serial Number: H80-157)						
Damage to Aircraft	Substantial		Total Aircraft Hours		3 774.9 (Tachometer)		
Pilot-in-command							
Licence Type	Commercial Pilot Licence		Gender	Male	Age	56	
Licence Valid	Yes	Total Hours	16 185.2	Total Hours on Type		13 546.2	
Total Hours Past 30 Days	45.0		Total Hours on Type Past 90 Days	227.3			
People On-board	1 + 0	**Injuries**	0	**Fatalities**	0	**Other (on ground)**	0

What Happened

On Tuesday, 1 April 2025, a pilot on-board a Thrush S2R-H80 aircraft with registration ZS-IOG was engaged in a crop-spraying flight from a private airstrip near Komati Sugar Mill in Komatipoort, 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 137 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot stated that the aircraft had 432 litres (L) of Jet-A1 fuel in the tanks during the pre-flight inspection. Moreover, the hopper (located behind the engine fire wall) contained 510 gallons (4 000 pounds) of insecticide. The weather information sourced by the pilot from a website indicated a visibility of more than 10 kilometres (km) and scattered clouds at 4 000 feet (ft) at the time of the flight. After a briefing with the farm owner about the crops to be sprayed, the pilot taxied the aircraft to the threshold of the gravel runway, which was 1 300 metres (m) in length, and completed the pre-departure checks. The pilot confirmed that the engine indications were within the normal operating range. He then selected the flaps to first (15°) notch. At 0840Z, the pilot advanced the throttle to maximum power and achieved 92% engine torque. The aircraft commenced with the take-off run and rotated; thereafter, the aircraft climbed to 1 000 feet (ft) above ground level (AGL) and cruised at 140 miles per hour (mph).

The pilot stated that the aircraft routed easterly in the direction of the sugar cane farm to be sprayed, approximately 4 nautical miles (nm) north-east of the departure airstrip. Upon arrival at the sugar cane farm, he circled the area to scan for potential obstacles and hazards. Thereafter, he completed about 50 spray-run applications. During the right-side turn in preparation for the last spray-run (51) application at bout 80ft AGL, he noticed a decrease in engine power and a significant loss of thrust. He instantly pushed the throttle to full forward to regain maximum power, but the engine power did not improve. He then jettisoned the remaining chemical load and performed a forced landing on the grass-covered area outside the sugar cane farm. The tail gear assembly broke off during the accident sequence, and the aircraft came to rest in an upright position; it faced south when it rested. The overall damage to aircraft was substantial. The pilot turned off the master and fuel switches and vacated the aircraft unassisted; he was not injured. He later contacted his employer on his mobile phone and notified him of the accident.

The accident occurred during daylight at Global Positioning System (GPS) co-ordinates determined to be 25°35'33.7” South 31°56'20.6" East, at an elevation of 3 938 feet (ft).

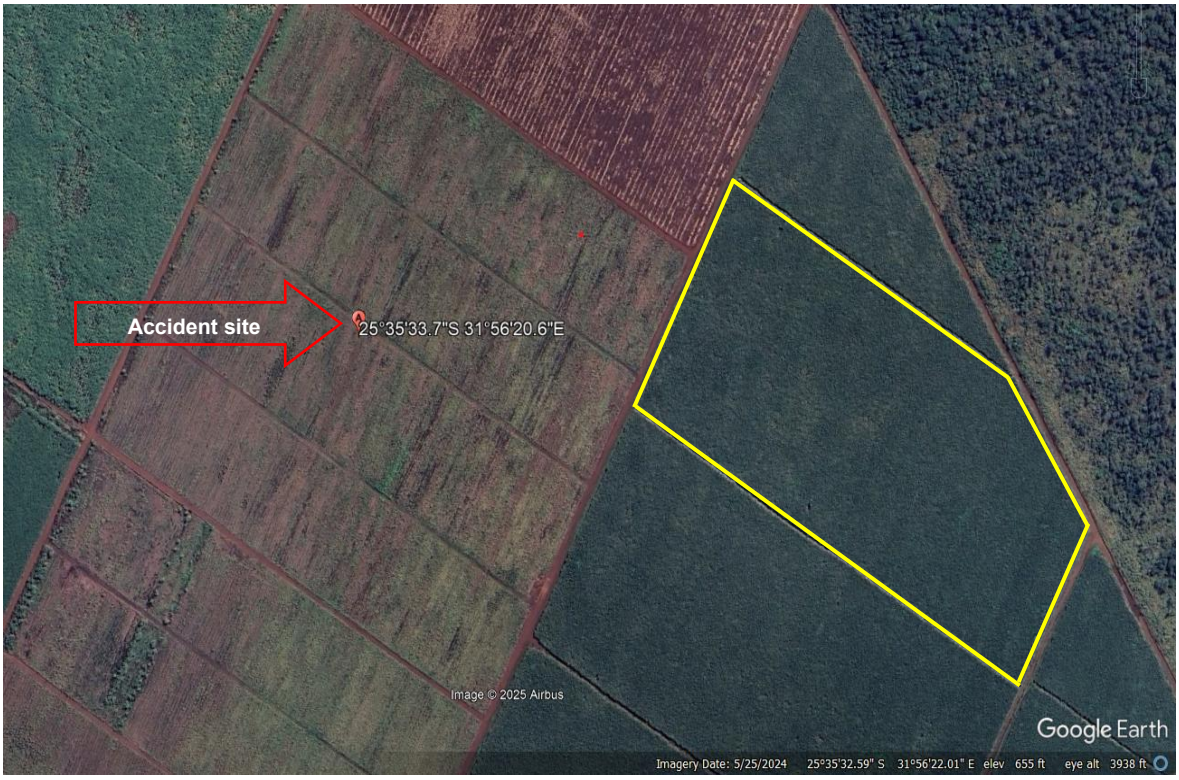

Figure 1: Aerial view of accident site and the sugar cane field that was sprayed (marked in yellow). (Source: Google Earth)

Figure 2: The aircraft at the accident site. (Source: Pilot)

Thrush S2R-H80 Aircraft Description (Source: Pilot's Operating Handbook [POH])

The Thrush S2R-H80 is a single seat, low wing, fixed gear agricultural aircraft designed for crop-dusting and aerial spraying. Each wing contains integral wing tanks (wet wing fuel tanks) just outboard of the fuselage. The left wing and right-wing fuel tanks are interconnected through a header tank. The published fuel system's capacity is 228 U.S gallons (863L). The aircraft's fuel system is equipped with a 1/4-inch mesh finger strainer installed in the outlet fitting from the header tank. The fuel supply line to the engine is routed from the header tank, located in the fuselage, through a fuel shut off valve, an emergency electric driven fuel pump, and then directed to the main electric driven fuel pump. The fuel supply line exits the main pump and passes through a 10-micron nominal main fuel filter. The fuel line then goes through the fuel pressure sensor, which is located before the firewall. The fuel line is then passed through the forward firewall to the fuel flow meter and then enters the engine's fuel pump. The emergency electric-driven fuel pump is a backup system to provide continuous fuel pressure in case the main electric fuel pump fails. The main fuel pump and the emergency fuel pump are not to be operated simultaneously. Fuel quantity is displayed individually on the cockpit panel display.

The weather information entered in the table below was provided by the pilot through the pilot questionnaire.

Wind Direction	360º	Wind Speed	5 knots	Visibility	9999 m
Temperature	30ºC	Cloud Cover	Scattered	Cloud Base	4 000ft
Dew Point	19ºC	QNH	Unknown		

Post-accident Examination of the Aircraft

Engineers from the operator's facility arrived at the accident site on Wednesday, 2 April 2025, to inspect the aircraft. They found the engine and propeller undamaged with no evidence of engine oil or fuel leak. About 260 Jet-A1 fuel was drained from the wing ports at the accident site, 115L on the left tank and 145L on the right tank. Visual inspection found no evidence of fuel contamination, no metal particles in the oils screens, and no broken or loose linkages in the fuel control unit (FCU) or propeller governor. All components were found intact and without any surface defects, damage or leaks.

Later, the engineers removed the wings from the aircraft's fuselage for ease of recovery. The aircraft was then loaded on to a trailer and recovered to the aircraft maintenance organisation (AMO) facility at Bethlehem Aerodrome (FABM) in the Free State for further investigation. Upon arrival at FABM, the engineers removed the airframe fuel filter and inspected it; they drained less than average fuel which indicated that there was insufficient fuel. Attempts were made to drain fuel from the FCU; however, nothing came out of it (it was empty). A fuel sample extracted from the airframe filter bowl was tested using the Hum-Bug test method and no sign of water or bacteria growth was found after 48 hours.

Figure 3: The Hum-Bug test came up negative for water or bacterial growth. (Source: Operator)

The engine fuel filter was removed and visually inspected; it was found dry which indicated the absence of fuel in the system. The fuel that was initially drained from the aircraft tanks at the accident site was used for the engine ground run tests at the operator's facility. The FCU was bled, and evidence of air was present during the bleeding process from all four bleeding ports of the engine. The engine was started and all the parameters (as shown on the MVP-50T display screens below) were normal at take-off, cruise power and during emergency circuit engagement in accordance with (IAW) the maintenance manual (MM).

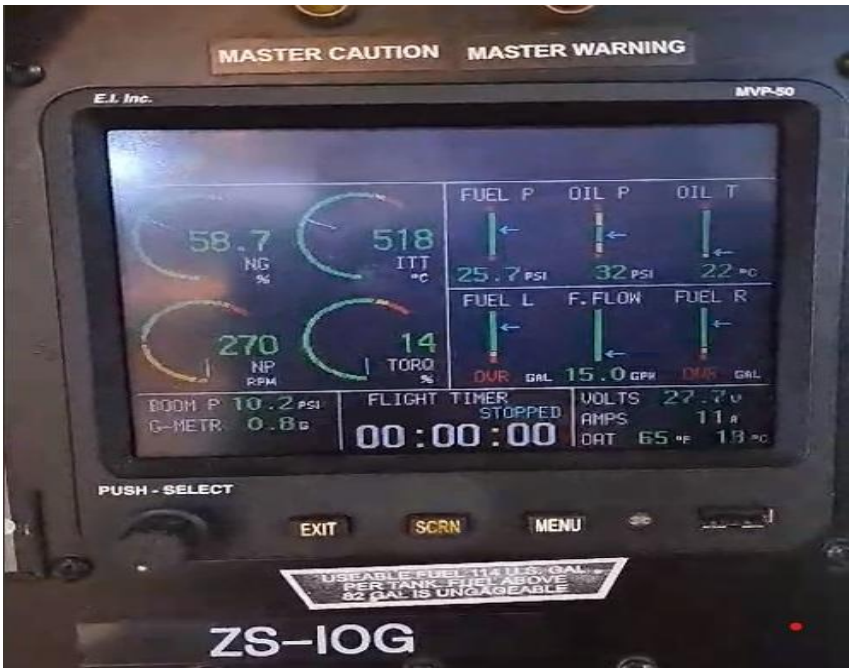

Figure 4: The MVP-50T screen indicates the engine parameters at idle: Normal start and the engine idled at 58.7%, prop revolutions per minute (RPM) at 270, torque at 14 pound per square inch (psi), fuel pressure at 25.7psi, oil pressure at 32psi, fuel flow at 15 gallons per hour (gph) and oil temperature at 22° (degrees) Celsius; all parameters were within limits. (Source: Operator)

Figure 5: The MVP-50T screen indicates the engine parameters on take-off: interstage turbine temperature (ITT) at 716, prop RPM at 2 060, torque at 96psi, fuel pressure at 19.5psi, oil pressure at 36psi, fuel flow at 66.3gph and oil temperature at 64° Celsius; all parameters were within limits. (Source: Operator)

Figure 6: The MVP-50T screen indicates the engine parameters at cruise: ITT at 632, prop RPM at 1 900, torque at 74psi, fuel pressure at 22.2psi, oil pressure at 35psi, fuel flow at 51.4gph and oil temperature at 65° Celsius; all parameters were within limits. (Source: Operator)

Figure 7: The MVP-50T screen indicates the engine parameters during emergency: ITT at 708, prop RPM at 2 050, torque at 94psi, fuel pressure at 19.5psi, oil pressure at 36psi, fuel flow at 65 gph and oil temperature at 65° Celsius; all parameters were within limits. (Source: Operator)

The engine shutdown was normal, which indicated a positive fuel cut off on the FCU. Rundown time was 28 seconds, indicating no binding within the engine compressor section.

The investigation determined that the remaining 115L of fuel in the left tank would have been expected to feed normally during a co-ordinated right turn. However, during the skidding right turn, the fuel would have moved outboard, away from one or both fuel supply line pick-ups/outlet ports in the left-wing tank, which would have caused the fuel pump in the wing to cavitate, thus, sucking air into the system. In this case, air was introduced into the FCU and caused it to malfunction upon which it delayed throttle inputs and a rollback to idle condition.

Examination of the technical records indicated that there were no outstanding snags or defects on the aircraft before it was dispatched to perform the spray-run application. The last 100-hour mandatory periodic inspection (MPI) was conducted at FABM on 19 March 2025 at 3 702.5 Tachometer hours. Records showed that all the required and scheduled maintenance had been performed, and all the applicable Airworthiness Directives (ADs) and Service Bulletins (SBs) had been complied with.

Findings

1. <u>Personnel Information</u>

1.1 The pilot had a Commercial Pilot Licence (CPL) that was issued by the Regulator (SACAA) on 3 December 1993. The licence was reissued on 3 July 2024 with an expiry date of 30

June 2025. The pilot had flown a total of 16 185.2 hours of which 13 546.2 hours were on the aircraft type.

1.2 The pilot had a Class 1 aviation medical certificate that was issued on 18 October 2024 with an expiry date of 31 October 2025. A limitation was endorsed on the pilot's certificate that he should wear correction for defective near-vision lenses.

1.3 The pilot had the aircraft type and the agricultural crop-spray application ratings endorsed on his licence.

2. Aircraft Information

2.1 The last 100-hour mandatory periodic inspection (MPI) of the aircraft was certified on 19 March 2025 at 3 702.5 Tachometer hours. The aircraft had accrued 72.4 hours since the last inspection.

2.2 The aircraft maintenance organisation (AMO) that carried out the last inspection was issued the AMO Certificate on 29 August 2024 with an expiry date of 31 September 2025.

2.3 The operator was issued an Operation Specification Certificate on 29 January 2025. The Thrush S2R H80 aircraft with registration ZS-IOG was listed on the certificate.

2.5 The aircraft's Certificate of Registration (C of R) was issued to the present owner on 25 April 2019.

2.6 The aircraft had the Certificate of Airworthiness (C of A) that was initially issued by the Regulator (SACAA) on 22 January 2015. The latest C of A had an expiry date of 31 January 2026.

2.7 The aircraft had a Certificate of Release to Service that was issued on 19 March 2025 with an expiry date of 11 March 2026 or at 3 833.6 Tachometer hours, whichever comes first.

2.8 Post-accident engine ground runs at the operator's facility indicated that the engine starved from fuel during the crop-spray application flight.

3. Meteorological Information

3.1 Based on the weather information provided by the pilot, fine weather conditions prevailed at the time of the flight; the weather had no bearing on this accident.

Probable Cause
The engine power loss was due to fuel starvation following a skidding right turn, which resulted in fuel flowing away from the supply line pick-ups in the left tank. This caused the fuel pump to cavitate and suck air into the system and, thus, the subsequent loss of engine power, followed by an unsuccessful forced landing on the grass-covered area.
Contributing Factors
None.
Safety Action(s)
None.
Safety Recommendation
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/s and organisation/s 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/s 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 apportion blame or liability.
Disclaimer
This report is produced without prejudice to the rights of the AIID, which are reserved.

This report is issued by:

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