SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10472						
Classification	Accident	**Date**	15 July 2024		**Time**	1334Z	
Type of Operation	Private (Part 94)						
Location							
Place of Departure	Tedderfield Aerodrome (FATA), Gauteng Province	Place of Intended Landing	Rand Aerodrome (FAGM), Gauteng Province				
Place of Occurrence	About 2 kilometres (km) west of Runway 29 threshold at Tedderfield Aerodrome (FATA)						
GPS Co-ordinates	Latitude	29°39´03.06" "S	Longitude	28°2´48.48" E	Elevation	5 200ft	
Aircraft Information							
Registration	ZU-PBL						
Make; Model; S/N	Sling Aircraft; Sling 4 TSI (Serial Number: 329s)						
Damage to Aircraft	Substantial	Total Aircraft Hours	465.4				
Pilot-in-command							
Licence Type	Private Pilot Licence (PPL)	Gender	Male	Age	44		
Licence Valid	Yes	Total Hours	278.5	Total Hours on Type	147.8		
Total Hours 30 Days	6.5	Total Flying on Type Past 90 days	25.2				
People On-board	1+1	**Injuries**	0	**Fatalities**	0	**Other (on ground)**	0

What Happened

On Monday morning, 15 July 2024, a pilot and a passenger on-board a Sling 4 TSI aircraft with registration ZU-PBL took off on a private flight from Tedderfield Aerodrome (FATA) to Rand Aerodrome (FAGM), both located in Gauteng province. 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 stated that he conducted a pre-flight inspection of the aircraft and no anomalies were found. The aircraft had a total of 80 litres (L) of Avgas 100LL in the tanks. *According to the Sling 4 TSI Pilot's Operating Handbook (POH), the aircraft's fuel capacity is 198L of which 4L is unusable*. The pilot selected the right-side tank on take-off and opted to seat on the right-side seat of the aircraft (*the Sling TSI 4 permits operation from the right- or left-side seats as stated in the Pilot's Operating Handbook [POH]*). During the climb phase at approximately 500 feet (ft) above ground level (AGL) whilst conducting the take-off checks, the right-side door of the aircraft opened. As the pilot attempted to close the door, the aircraft banked more than 60 degrees to the right, yawed and sideslipped; thereafter, the engine surged before it stopped. This was due to the interruption of the fuel supply to the engine. As a result, this led to fuel starvation and, subsequently, engine stoppage. The pilot opted

to perform a forced landing on an open space near an informal settlement. The aircraft sustained substantial damage, and the pilot and the passenger vacated the aircraft unharmed.

Sideslip *(Source: FAA-H-8083-3A, Airplane Flying Handbook)*

A "sideslip" is entered by lowering a wing and applying just enough opposite rudder to prevent a turn. In a sideslip, the airplane's longitudinal axis remains parallel to the original flight path, but the airplane no longer flies straight ahead. Instead, the horizontal component of wing lift forces the airplane also to move somewhat sideways toward the low wing.

Risk

- ***Fuel Starvation****:*

In some aircraft, prolonged sideslips can cause fuel to move away from the fuel pickup, potentially leading to engine stoppage.

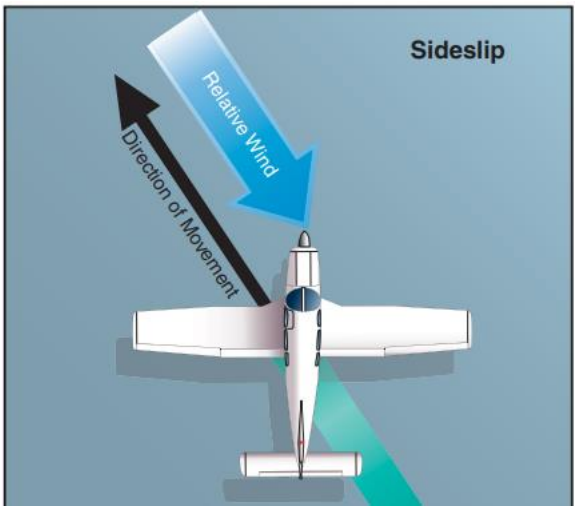


Figure 1: Illustration of a sideslip. (Source: FAA-H-8083-3A, Airplane Flying Handbook)

A 60-degree bank to the right is a manoeuvre in which an aircraft banks at a 60-degree angle to the horizon, as specified in the Sling TSI 4 POH. *This may cause fuel to migrate from the right inboard side to the right wingtip area.* The POH states *that the fuel tank pickup point is situated at the bottom of the inboard wall of the wing. In normal operation, the dihedral of the wing ensures fuel is always present at the pickup point. The aircraft should never be subjected to a sustained sideslip if the fuel tank from which fuel is drawn is nearly empty*.

Figure 2: Aerial view of FATA, the direction of take-off, and the accident site. (Source: Google Earth)

Figure 3: The aircraft at the accident site. (Source: Pilot)

Marks on the ground at the accident site indicated that the aircraft first impacted the ground with its left main landing gear, followed by the right main landing gear. A few metres (m) further, the nose gear contacted the ground and bounced back into the air. Upon the second impact, the nose gear collapsed which caused the propeller blades to contact the ground; as a result, they bent backwards. The aircraft skidded on its nose section for about 5m before it stopped approximately 90 degrees to the left from the first point of impact.

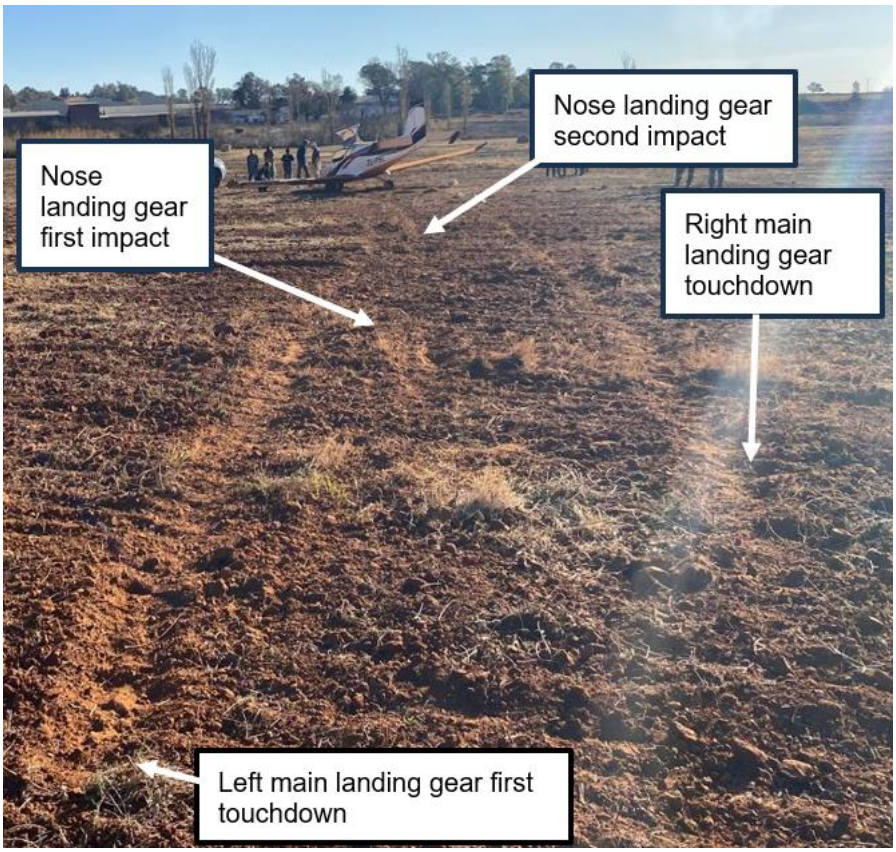


Figure 4: Marks on the ground during the touch down.

In the afternoon post-accident, the aircraft maintenance engineers (AMEs) recovered the aircraft to the approved aircraft maintenance organisation (AMO) facility at FATA. The aircraft had about 38.5 litres of fuel which remained in each tank; the fuel was free of contaminants. In the presence of the investigator, the engineers inspected the engine, a 4-cylinder Rotax 915 with serial number 9134109; no anomalies were found. The engine started swiftly and power was increased in stages; it operated within all specified parameters as outlined in the operator's manual.

The aircraft was equipped with dual Electronic Flight Information System (EFIS) and dual control sticks which allowed for it to be flown from either the left or right side. Fuel supply could also be selected from either the left or right tank. The pilot had selected the right tank (see Figure 6) for the flight and was seated on the right seat.

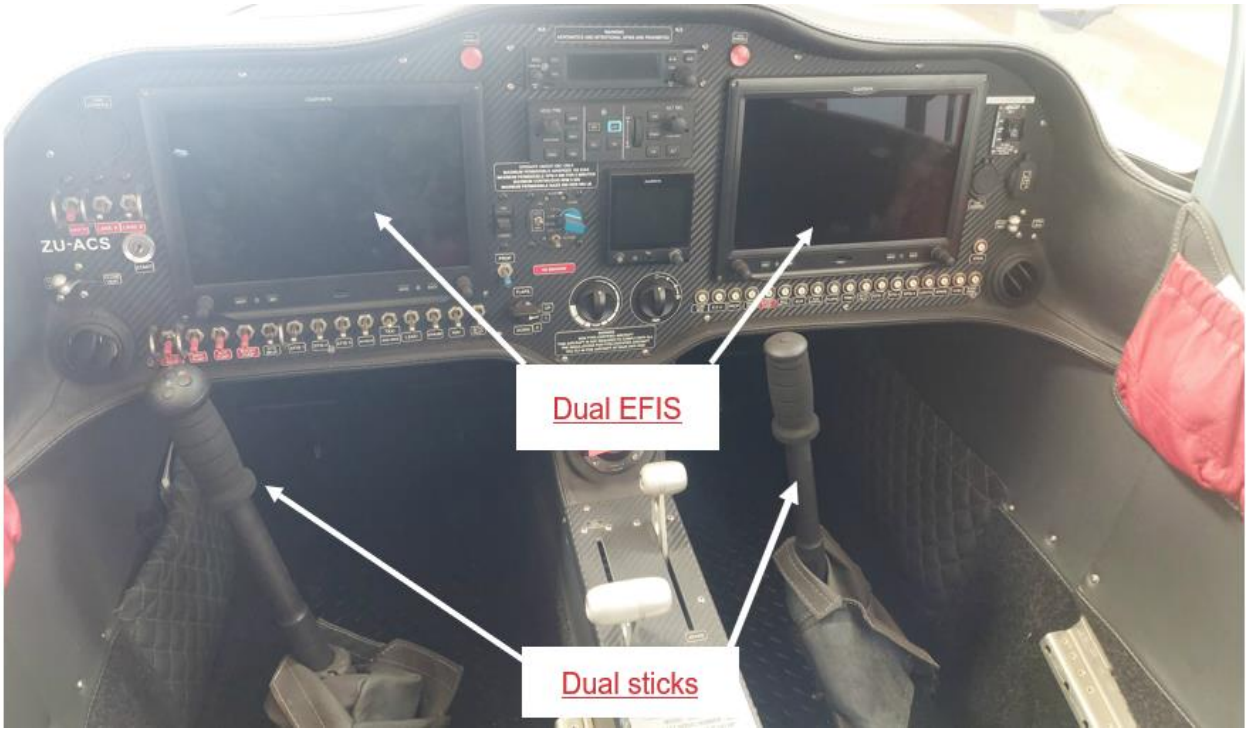


Figure 5: The cockpit layout.

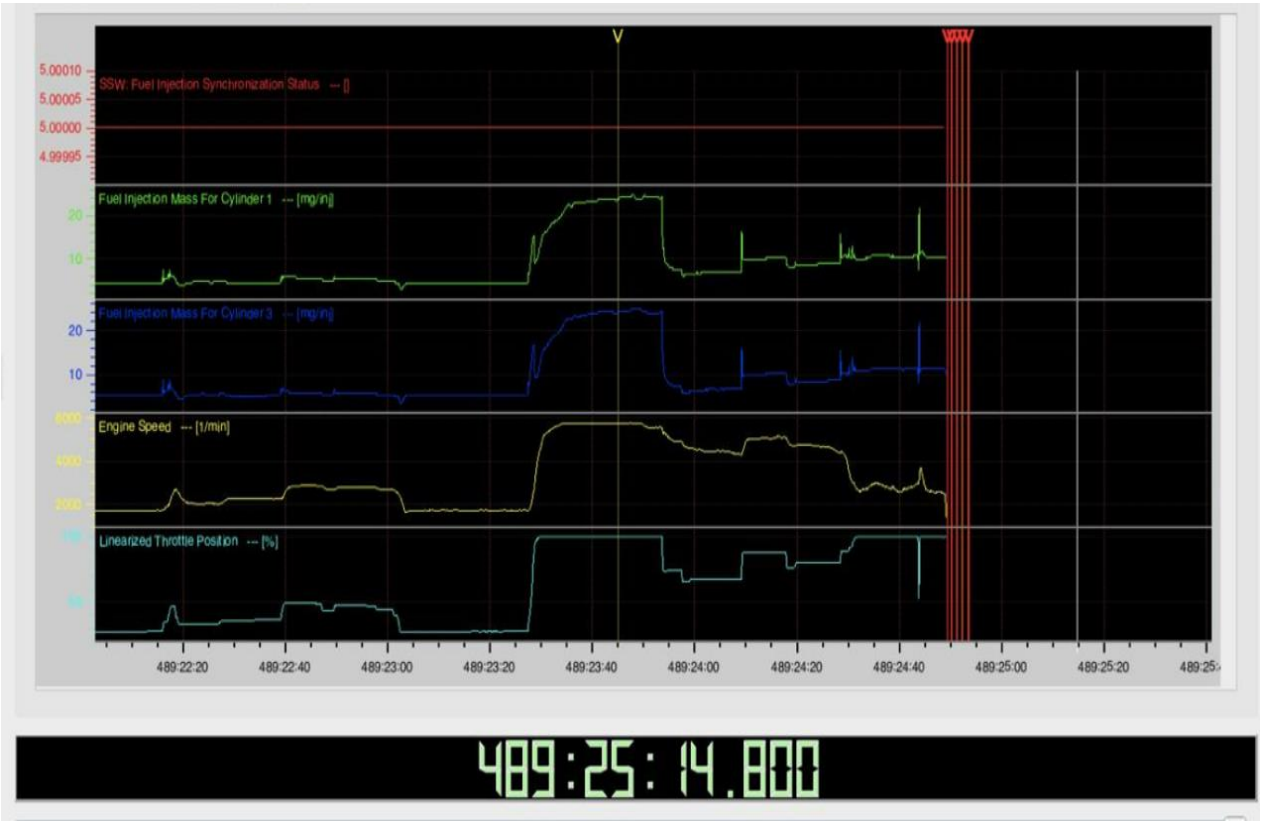
Figure 6: Fuel selection.

The engine control unit (ECU) serial number 225267 was removed from the aircraft and was sent to the manufacturer for a detailed data download and analysis after the accident. This process involved retrieving recorded parameters stored in the ECU that could provide critical insight into the engine's performance and condition at the time of the accident.

The following key operational parameters are an extract from the ECU data, offering information regarding the engine's power settings, fuel flow, fuel synchronisation, engine speed, time and other essential metrics leading up to the impact:

- *The fuel* synchronisation *showed 0, indicating one tank was selected.*
- *The fuel flow showed that it was constant during the take-off roll, approximately 2 minutes after take-off, the fuel supply fluctuated (engine surged) and cut off.*

  During the take-off roll, the engine revolutions per minute (RPM) gradually increased from an initial 2000 RPM. However, shortly after take-off, the engine RPM began to fluctuate, indicating possible instability in engine performance. Eventually, the RPM dropped to zero, signalling a complete engine stoppage. The data showed that the power lever was set to 99%, indicating full power at the moment when the fuel supply cut off.



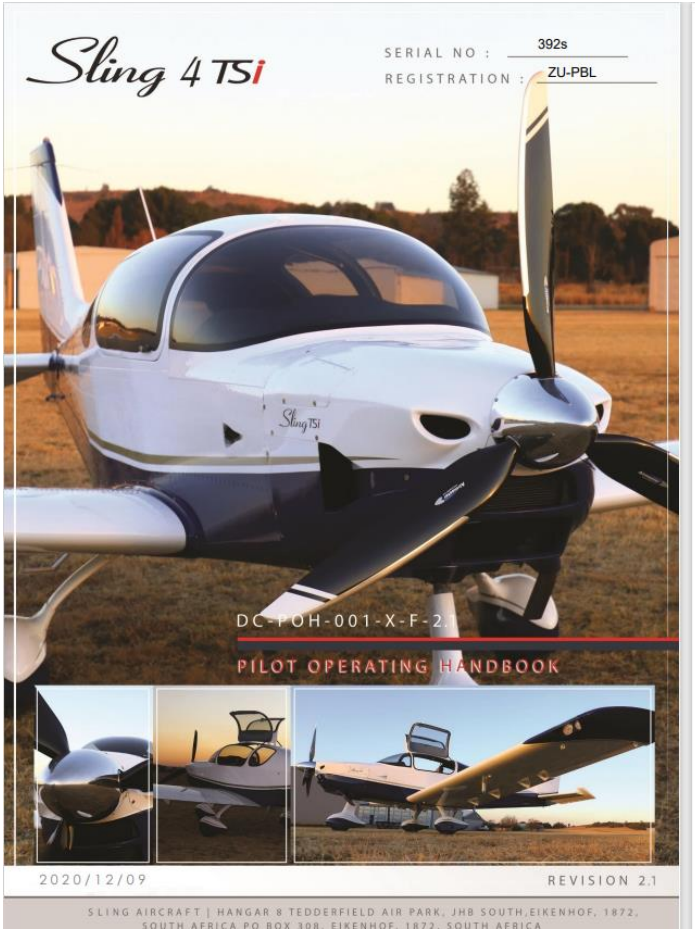
Graph 1: The downloaded parameters. (Source: Manufacturer)

Weather Information

The weather information in the table below was sourced from the pilot's questionnaire dated 15 July 2024 at FATA.

Wind Direction	330°	Wind Speed	12kts	Visibility	9999m
Temperature	17°C	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	M05°C	QNH	1015hPa		

Aircraft Information: (Source: Sling 4 TSI POH)



Sling 4 TSi
Pilot Operating Handbook

Aircraft model:	**Sling 4 TSi**
Manufacturer:	**Sling Aircraft (Pty) Ltd**
Aircraft Serial Number:	392S
Date of Construction:	01/03/2022
Registration:	ZU-PBL
Issue Date:	**2020/12/09**

PLEASE ADVISE SLING AIRCRAFT ON CHANGE OF OWNERSHIP OF THE AIRCRAFT

This aircraft must be operated in compliance with information and limitations contained herein. This pilot's operating handbook must be available on board the aircraft at all times.

Fuel System

The aircraft has two fuel tanks, one located in the inside leading edge of each wing. Volume of wing tanks: 2 x 88 (23.25 US gallons) litres (176 litres (46.49 US gallons) total, 172 (45.44 US gallons) litres useable). OR Volume of wing tanks: 2 x 99 (26.15 US gallons) litres (198 litres (52.31 US gallons) total, 194 (51.25 US gallons) litres useable). Each tank is equipped with a vent outlet. A drain valve is located in the lowest point of each tank. A tank outlet/fuel pick-up is located at the lowest point of the inboard sidewall of each tank. A finger screen is fitted to each fuel pick-up. The fuel selector valve is mounted on the lower centre instrument panel (in the cockpit, refer to paragraph 7.13). Fuel feed is through the facet posi-flow electrical boost pump and Rotax fuel pump. The facet posi-flow has a parallel in-line check valve and is activated with one signal switch mounted on the instrument panel. The Rotax fuel pump has a parallel installed check valve (NRV) across each pump. Fuel return lines return excess fuel supplied by the fuel pump(s) to the fuel tank in use.

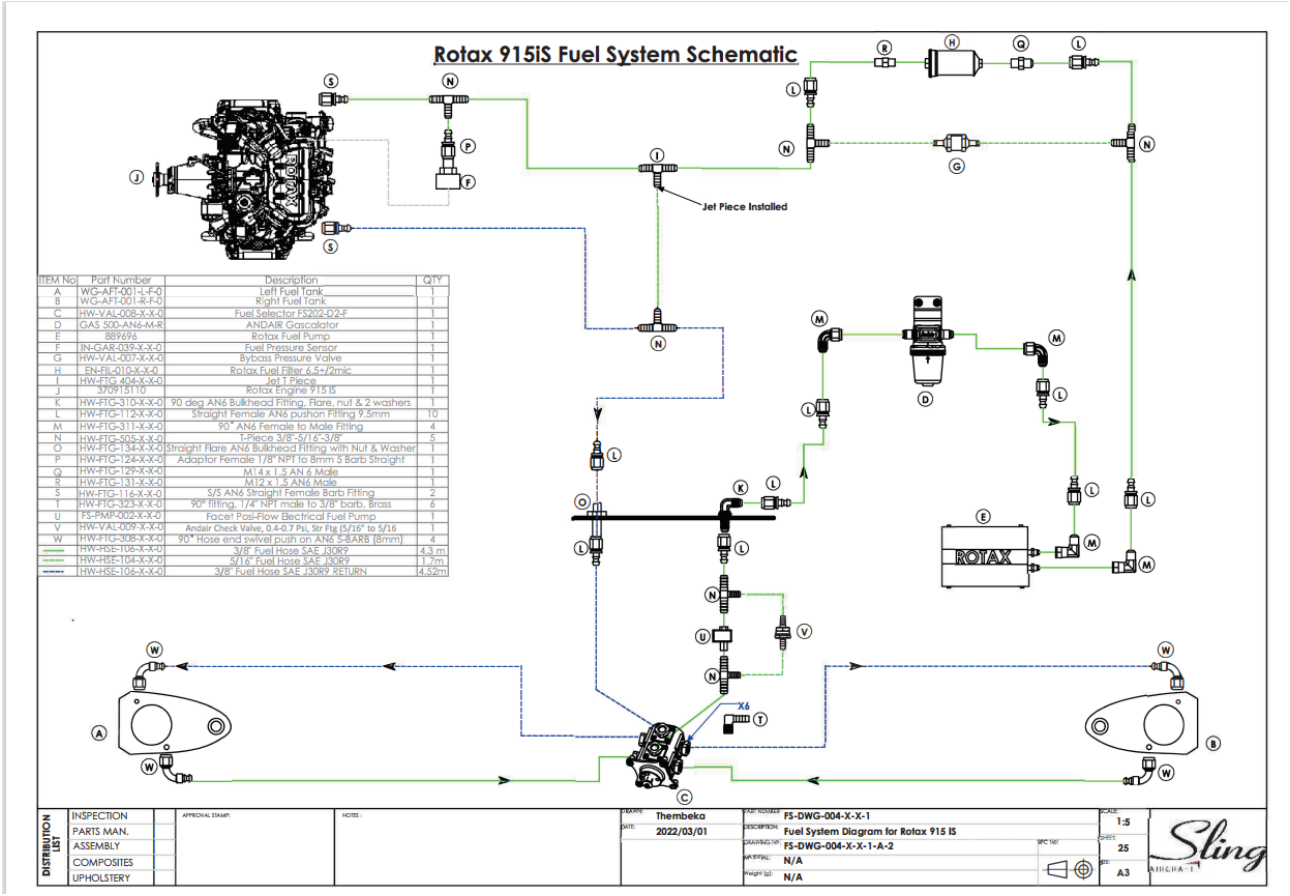
Warning

The fuel lift pipe in each tank is situated adjacent to the lower inside wall of the tank. The aircraft should at no time be subjected to a sustained side slip towards a near-empty fuel tank. (i.e. wing

with near-empty tank down) as, despite the baffling, this may lead to fuel running towards the outer edge of the tank and exposing the fuel lift pipe to suck air, thereby starving the engine of fuel and leading to an engine failure. This poses a particular threat when at low altitude, typically prior to landing.

Warning

If a fuel lift pipe is exposed to air, the pump will suck air into the engine (from the empty tank) and engine failure will result. When a tank is empty\, close to empty, the fuel selector valve should be switched to the fullest tank.



ITEM No	Part Number	Description	QTY
A	WG-AFT-001-L-F-0	Left Fuel Tank	1
B	WG-AFT-001-R-F-0	Right Fuel Tank	1
C	HW-VAL-008-X-X-0	Fuel Selector FS202-D2-F	1
D	GAS 500-AN6-M-R	ANDAIR Gascalator	1
E	889696	Rotax Fuel Pump	1
F	IN-GAR-039-X-X-0	Fuel Pressure Sensor	1
G	HW-VAL-007-X-X-0	Bybass Pressure Valve	1
H	EN-FIL-010-X-X-0	Rotax Fuel Filter 4.5+/2mic	1
I	HW-FTG-404-X-X-0	Jet T Piece	1
J	370915110	Rotax Engine 915 IS	1
K	HW-FTG-310-X-X-0	90 deg AN6 Bulkhead Fitting, Flare, nut & 2 washers	1
L	HW-FTG-112-X-X-0	Straight Female AN6 pushon Fitting 9.5mm	10
M	HW-FTG-311-X-X-0	90° AN6 Female to Male Fitting	4
N	HW-FTG-505-X-X-0	T-Piece 3/8"-5/16"-3/8"	5
O	HW-FTG-134-X-X-0	Straight Flare AN6 Bulkhead Fitting with Nut & Washer	1
P	HW-FTG-124-X-X-0	Adaptor Female 1/8" NPT to 8mm S Barb Straight	1
Q	HW-FTG-129-X-X-0	M14 x 1.5 AN 6 Male	1
R	HW-FTG-131-X-X-0	M12 x 1.5 AN6 Male	1
S	HW-FTG-116-X-X-0	S/S AN6 Straight Female Barb Fitting	2
T	HW-FTG-323-X-X-0	90° fitting, 1/4" NPT male to 3/8" barb, Brass	6
U	FS-PMP-002-X-X-0	Facet Posi-Flow Electrical Fuel Pump	1
V	HW-VAL-009-X-X-0	Andair Check Valve, 0.4-0.7 Psi, Str Fig (5/16" to 5/16	1
W	HW-FTG-308-X-X-0	90° Hose end swivel push on AN6 5-BARB (8mm)	4
	HW-HSE-106-X-X-0	3/8" Fuel Hose SAE J30R9	4.3 m
	HW-HSE-104-X-X-0	5/16" Fuel Hose SAE J30R9	1.7m
	HW-HSE-106-X-X-0	3/8" Fuel Hose SAE J30R9 RETURN	4.52m

Illustration 1: Schematic diagram of the fuel system. (Source: POH)

Canopy

The aircraft is equipped with two gullwing doors. External access to the cabin is from either side. Operating levers for the door latching mechanisms are provided on the inside and outside of the doors (in the centre of the bottom edge of each door).

Warning

Ensure that the canopy doors are securely latched into position before operating the aircraft.

1) During take-off, the improperly latched door made it possible for the airflow to push the outer handle backward which caused the door to open (see Figures 7 and 8).

Figure 7: Improperly latched interior door handle.

Figure 8: Improperly latched exterior door handle.

Figure 9: Correctly latched interior door handle.

Figure 10: Correctly latched exterior door handle.

The interior door handle is within the pilot's reach whilst seated inside the aircraft.

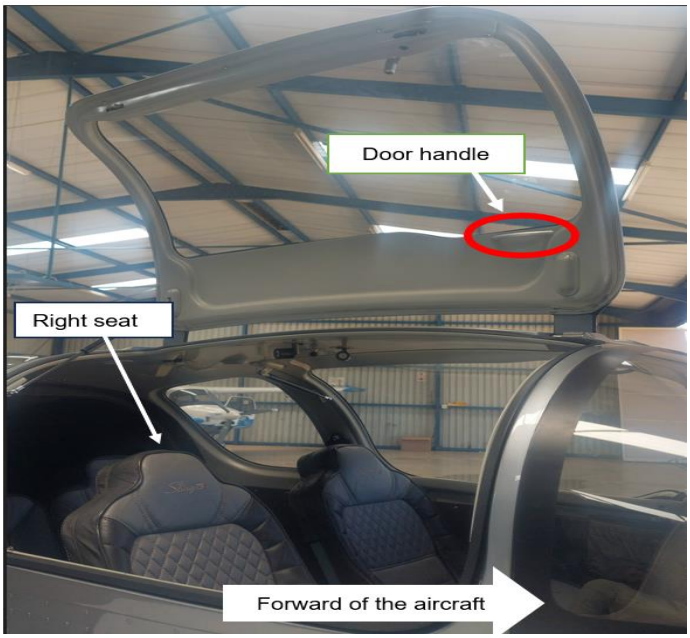


Figure 11: Interior layout of the aircraft.

The Sling 4 TSI Before Take-off Checklist (Source: Pilot Operating Handbook (POH)

Page | 4-15 DC-POH-001-X-F-2.1 Revision: 2.1

Canopy: *Closed and latched (both doors)*

The POH also states:

In case of emergency, the pilot should remember the following priorities:

- *Keep control of and continue to fly the aircraft.*

  The Sling 4 TSi is approved for normal manoeuvres including the following:
- *Steep turns not exceeding 60° bank.*

Findings

The Pilot

1) The pilot was initially issued a Private Pilot Licence (PPL) on 22 March 2012. His licence was reissued on 31 March 2024 with an expiry date of 31 March 2025. The aircraft type was endorsed on the pilot's licence. A Class 1 medical certificate was issued to the pilot on 5 May 2024 with an expiry date of 31 May 2024. The pilot was qualified and medically fit to conduct the flight.

The Aircraft

2) The aircraft's Certificate of Registration (C of R) was issued to the current owner on 1 September 2022. The Authority-to-fly (ATF) Certificate was initially issued on 15 December 2022. The latest ATF Certificate was issued on 24 November 2023 with an expiry date of 14 December 2024.

3) The last annual inspection was certified on 14 May 2024 at 404.8 total airframe hours. At the time of the accident, the aircraft had a total of 465.4 airframe hours. The aircraft had accrued 24.54 hours since the last inspection.

4) The aircraft was issued a Certificate of Release to Service (CRS) on 14 May 2024 at 404.8 airframe hours with an expiry date of 14 May February 2025 or at 504.8 airframe hours, whichever occurs first. The aircraft was airworthy when it was dispatched for the flight.

5) There were no defects recorded in the flight folio at the time of the flight.

6) The weather was not a factor in this accident.

7) The pilot inadvertently pushed the control stick to the right whilst attempting to close the door although the door could be reached without interfering with the controls. This caused the aircraft to roll more than 60 degrees to the right which caused fuel to migrate from the supply pipe to the wingtip. This resulted in fuel starvation as the right tank was selected.

8) The aircraft inadvertently rolled to the right, past its approved roll angle of 60 degrees during an attempt to close the right-side door.

9) The engine stopped during take-off due to fuel starvation; this was supported by the downloaded data.

10) There were no reported mechanical defects with the door during the pre-flight and take-off checks.

11) It is likely that the door was not properly latched during take-off, and this resulted in the door opening in-flight.

Probable Cause(s)

The engine stopped due to fuel starvation which was caused by the inadvertent roll of the aircraft whilst the pilot attempted to close the right-side door which had opened during the climb. The pilot executed an unsuccessful forced landing on an open field after the engine had stopped.

Contributing Factor(s)

- The right-side door was not properly latched, and it opened in-flight.
- Excessive roll angle beyond the limit specified in the POH.

Safety Action(s)

None.

Safety Message

In the interest of safety, pilots must ensure that doors are properly latched after taxi and line-up on the runway prior to take-off.

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 to apportion blame or liability.

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