SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED ACCIDENT INVESTIGATION

Reference Number	CA18/2/3/10135										
Classification	Accident	**Date**	12 March 2022	**Time**	1130Z						
Type of Operation	Private (Part 94)										
Location											
Place of Departure	Warmbaths Aerodrome (FAWA), Limpopo Province	Place of Intended Landing	Warmbaths Aerodrome (FAWA), Limpopo Province								
Place of Accident	Zingela Nature Reserve in Tolwe, Limpopo Province										
GPS Co-ordinates	Latitude	S 23°00'03.44"	Longitude	E 028°39'50.51"	Elevation	2 575 feet					
Aircraft Information											
Registration	ZU-ING										
Model/Make	Kitplanes Safari LSA (Serial Number: 034-09-17SAF3)										
Damage to Aircraft	Destroyed	Total Aircraft Hours	±32								
Pilot-in-command											
Licence Type	Private Pilot Licence (PPL)	Gender	Male	Age: 58							
Licence Valid	Yes										
Total Hours on Type	±20	Total Flying Hours	3 943								
People On-board	1 + 1	Injuries	2	Fatalities	0	Other (on ground)	0				
What Happened											

On Saturday, 12 March 2022, a pilot and a passenger on-board a Safari LSA aircraft were engaged on a private flight from Warmbaths Aerodrome (FAWA) in Limpopo province with the intention to fly around Alldays and, thereafter, meander the Limpopo River back to FAWA. Visual meteorological conditions (VMC) by day prevailed at the time of the flight and no flight plan was filed. The flight was conducted under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot stated that the aircraft was refuelled with 120 litres of Avgas 100LL, inclusive of ferry tanks, during the pre-flight stage. The uplifted fuel translated to a total endurance of 6 hours of flight time. The pilot stated that the entire flight was uneventful and, approximately 1 hour and 30 minutes into the flight whilst overhead Zingela Nature Reserve in Tolwe, Limpopo Province, and at approximately 3000 feet above ground level (AGL) the passenger felt 'wetness' under her feet; this was followed by an engine stoppage.

The pilot stated that he switched on the auxiliary fuel pump and attempted to restart the engine, but without success. The pair saw fuel on the windshield, which led the pilot to switch off the fuel

selector and the auxiliary fuel pump. He then scanned the area and identified an open field ahead on which to execute a forced landing. Just before touchdown, the pilot stated that he spotted power lines running across his flight path. He then turned the aircraft slightly to the left and landed between the trees. However, during landing, the aircraft's left-wing collided and severed a tree stem, followed by an impact with the ground. Thereafter, a fuel-fed fire erupted. The aircraft spun 180 degrees anti-clockwise and came to rest approximately 7 metres (m) from the impacted tree. The propeller had no rotation signatures, an indication that the engine was not producing power at the time of the accident.

The pilot exited the aircraft and assisted the passenger out of the aircraft, which was already ablaze. The aircraft was destroyed by impact forces and a post-impact fuel-fed fire. Both occupants sustained serious burn injuries; they were airlifted to the hospital for medical treatment.

Figure 1: The wreckage at the accident site.

Figure 2: A file picture of the aircraft prior to the accident. (Source: Aircraft file)

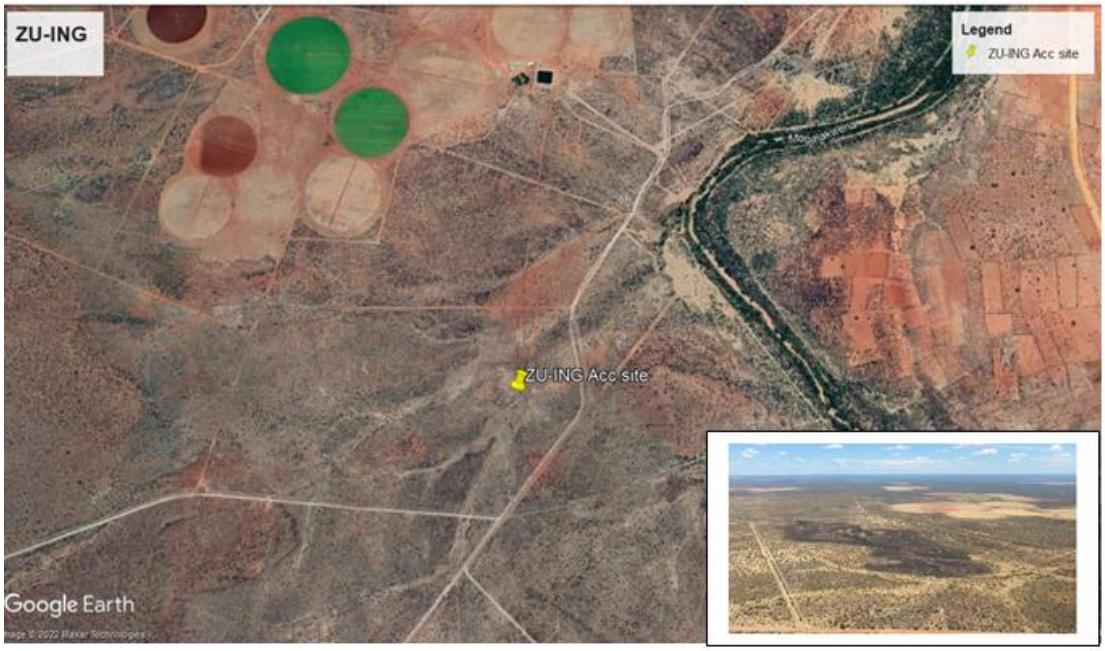

Figure 3: The accident site. (Source: Google Earth)

What was found:

- The pilot was initially issued a Private Pilot Licence (PPL) Aeroplane on 24 May 1996. The pilot completed his skills test on 2 September 2021 and was reissued a PPL on 14 September 2021 with an expiry date of 30 September 2023. The pilot had a Grade 2 test pilot rating, and the aircraft type was endorsed on his licence. The pilot's Class 2 medical certificate was issued on 21 October 2021 with an expiry date of 21 October 2022, and with a restriction to wear suitable corrective lenses.

- The aircraft was initially issued a Certificate of Release to Service (CRS) at zero hours with an expiry date of 28 June 2022 or at 25 airframe hours proving flight, whichever occurs first. The aircraft was subjected to a few test flights and, after 25 hours of flight time, an annual inspection was carried out. The aircraft was reissued a CRS on 22 November 2021 with an expiry date of 22 November 2022 or at 100.0 hours of flight time, whichever occurs first unless the aircraft is involved in an accident or becomes unserviceable.

- The aircraft was issued an Authority to Fly on 21 January 2022 with an expiry date of 20 January 2023.

- The aircraft fuel consumption was 20 litres per hour and the flight duration was approximately 1 hour 30 minutes.

  Note: *Source: Engine failure at altitude: Pilot's Operating Handbook (POH):*

  Best glide, 55-60kts. Fuel starvation is the most likely cause of engine stoppage. Check tank selection and select fullest tank. Switch emergency backup switch on, switch backup fuel pump ON. Restart. If engine starts land as soon as practical.

- Post-accident investigation:

  - Examination of the fuel system showed no evidence of loose clamps/fittings or ruptured fuel lines. All 16 clamps were accounted for and found relative to their installed positions. A burst fuel line is highly unlikely due to the 300 pounds per square inch (psi) (20.68bar) maximum working pressure rating and 150 degrees Celsius (°C) maximum working temperature range of the installed fuel lines. The maximum pressure of the Rotax fuel system is 5-bar with a working pressure of between 2.2 and 3.2 bars.

Figure 4: Serviceable fuel pump assembly, similar to the one that was fitted on the accident aircraft. (Source: AMO)

- The fuel pump assembly was removed from the firewall and disassembled. The fuel pump housing is installed on the right-side of the engine firewall. All components seemed to be in place except for the outlet fuel supply line of the high-pressure side of the auxiliary fuel pump. The outlet nipple, with a clamp and a short hose, was found loose inside the pump housing. A closer examination of the outlet nipple showed that the nipple detached during the accident sequence, however, the bottom half showed evidence of nicks/cracks. It was evident that it was not completely attached at the time the fire erupted.

Figure 5: Opened fuel pump assembly at the accident site - SN 19.5057 (Source: AMO)

- The fuel hose in the same area showed signs of fuel blown outwards under pressure as the fuel hose missed parts, and there was what looked like a channel which was burnt outwards from the nipple. It seemed, from the evidence, that the fuel outlet nipple and the hose might have sustained damage due to an overtight crimp or a manufacturing flaw of the plastic outlet, which subsequently failed during the long flight due to consistent pressure and high heat in the engine compartment.

Figure 6: Fuel outlet nipple in the auxiliary pump showing a cracked area, and the yellow line indicates the deformation of the nipple housing. (Source: AMO)

- In conclusion, it is highly likely that the fuel pump high pressure outlet had a crack or was damaged and, thus, failed. This caused the fuel to leak in the engine bay, hence, the subsequent fuel starvation and engine failure. The fuel leak was exacerbated by the fact that the pilot attempted to re-start the engine by switching the engine control unit (ECU) and the auxiliary fuel pump (2) on.

Probable cause

The fuel pump high pressure outlet had a crack, causing fuel to leak in the engine bay and, hence, the subsequent fuel starvation which caused the engine stoppage and the resultant forced landing. During the forced landing, it is likely that the hot engine surface came into contact with the leaked fuel, which led to post-impact fire that consumed the aircraft.

Contributing factor

It is possible that during assembly of the fuel pump, the pressure outlet pipe was not supported when it was tightened, and this caused it to crack, resulting in fuel leakage.

Safety Action/s

None.

Safety Message

It is recommended that the manufacturer, during assembly, exercise extra care when tightening pipes with rubber hoses to prevent any damage that might occur when nuts are fastened.

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****.*

About this Report
This report provides an opportunity to share safety message/s in the absence of an investigation. *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.*
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Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa