SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10218						
Classification	Accident		**Date**	9 September 2022		**Time**	0900Z
Type of Operation	Private (Part 94)						
Location							
Place of Departure	Lindberg Lodge Airstrip, North West Province		Place of Intended Landing	Eagle's Creek Aerodrome, Gauteng Province			
Place of Occurrence	On the side of the active runway at Carletonville Aerodrome (FACR), Gauteng Province						
GPS Co-ordinates	Latitude	26° 22' 05" S	Longitude	027° 20' 28" E		Elevation	4990 ft
Aircraft Information							
Registration	ZU-EKI						
Make; Model; S/N	Jora Spol S.R.O; Jora UA2 (Serial Number: C147)						
Damage to Aircraft	Substantial		Total Aircraft Hours	948			
Pilot-in-command							
Licence Type	National Pilot Licence (NPL)		Gender	Male		Age	62
Licence Valid	Yes	Total Hours	1835.5	Total Hours on Type			879
Total Hours 30 Days	7.3		Total Flying on Type Past 90 Days	15.9			
People On-board	1+1	**Injuries** 0	**Fatalities**	0	**Other (on ground)**		0

What Happened

On 9 September 2022 at approximately 0830Z, a pilot and a passenger on-board a Jora UA2 aircraft with registration ZU-EKI took off on a private flight from Lindberg Lodge Airstrip in the North West province, with the intention to land at Eagle's Creek Aerodrome in Gauteng province. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

According to the pilot, whilst he was en-route to Eagle's Creek and about 5 minutes to Carletonville Aerodrome (FACR), the passenger had an urgent need to use a bathroom. The pilot decided to divert to FACR. Approximately 15 minutes later, the pilot and the passenger were ready to continue to their intended destination. The pilot opted to use Runway (RWY) 31 which was a downhill take-off with a slight crosswind from the right-side.

During the take-off roll and after lift-off, all the engine instrument indications were normal. The aircraft's rate of climb was 300 feet per minute (ft/min) at an airspeed of 55 miles per hour (mph). Whilst heading towards the end of the runway threshold at a height of approximately 250 feet (ft) above ground level (AGL), the pilot raised the flaps to one (1) notch. As the aircraft passed the threshold at 65 miles per hour (mph), the engine lost power but did not stop completely; it operated at about 20% power which was close to idle power. The pilot immediately lowered the flaps to one notch and conducted the cockpit instrument checks and verified the fuel pump setting.

The pilot assessed his surroundings and noticed electrical power lines, the railway line overhead cables and a populated residential area. There was no suitable area for the aircraft to land; the only option was to turn back towards FACR. He then initiated a right turn and maintained the best glide at 55mph until the aircraft was facing the direction of the aerodrome, but it (aircraft) was gradually losing height. The aircraft touched down diagonally to the active runway at about 30° (degrees), crossed over the runway and collided with the sand wall that ran

along the runway. The aircraft sustained substantial damage to the nose and main landing gear struts, the propeller blades and the right-wing tip. The aircraft had approximately 40 litres (l) of fuel remaining on-board at the time of the accident. The occupants were not injured.

The accident occurred during day light at Global Positioning System (GPS) co-ordinates determine to be S 26º 22' 05", E 027º 20' 28" at a field elevation of 4990ft.

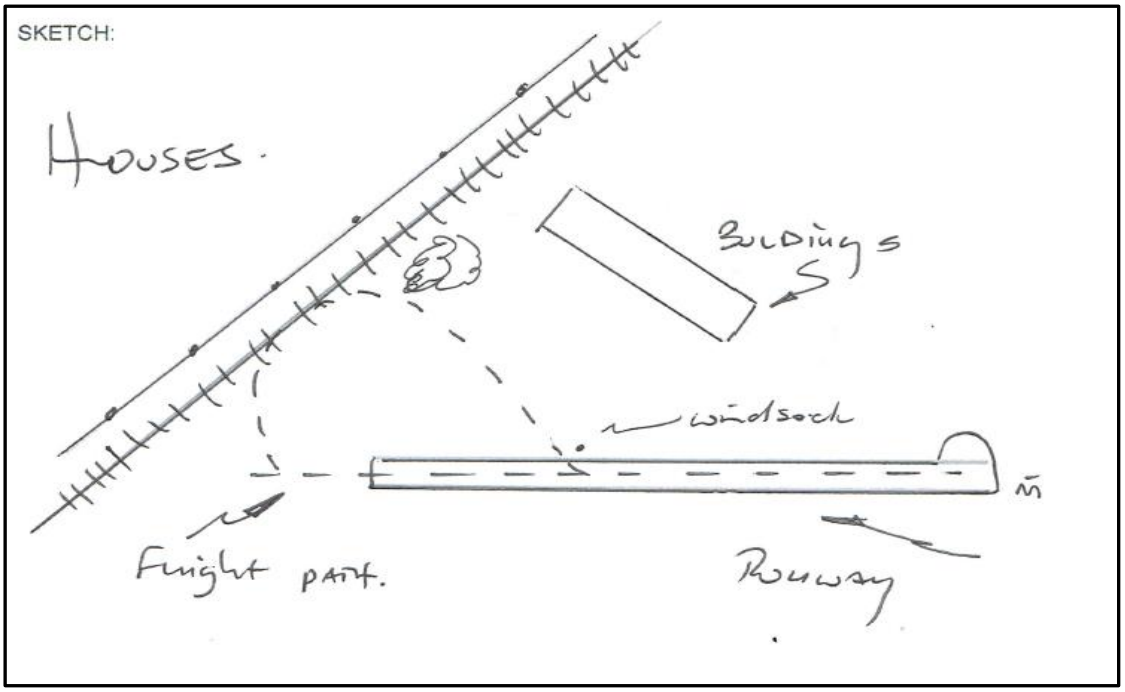

Diagram 1: The pilot's sketch of the return flight path to FACR. (Source: Pilot)

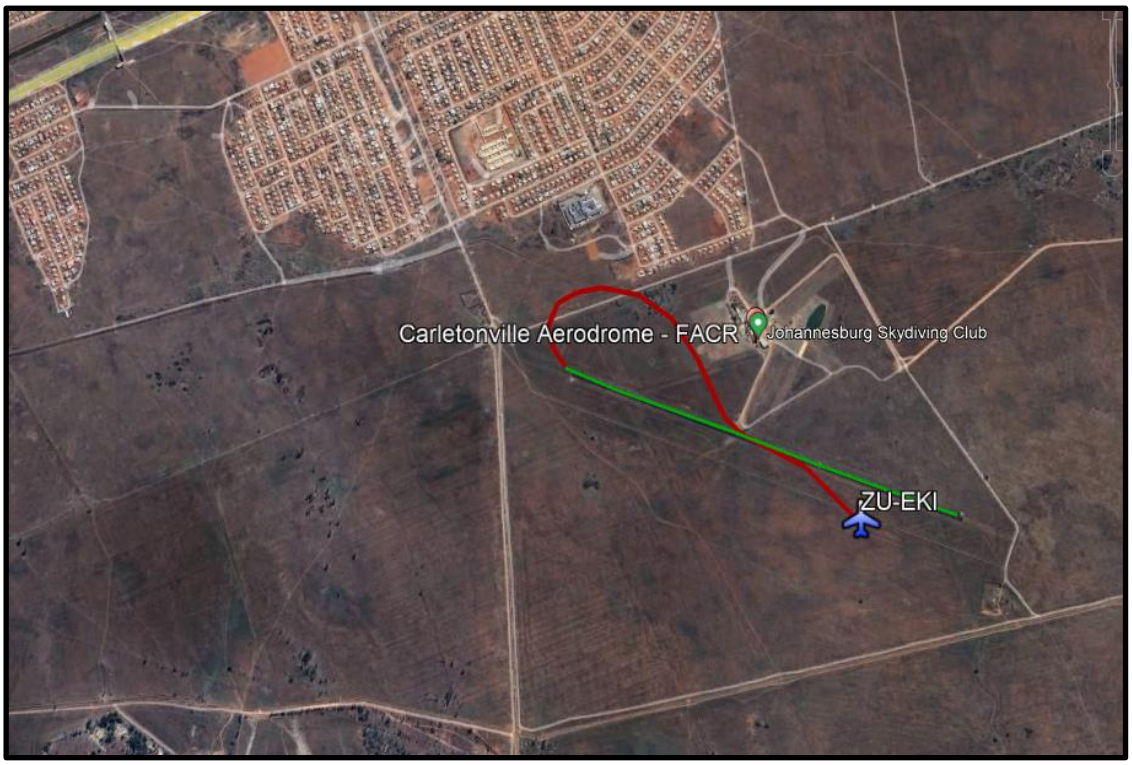

Figure 1: The accident site and the flight path of the aircraft. (Source: Google Earth)

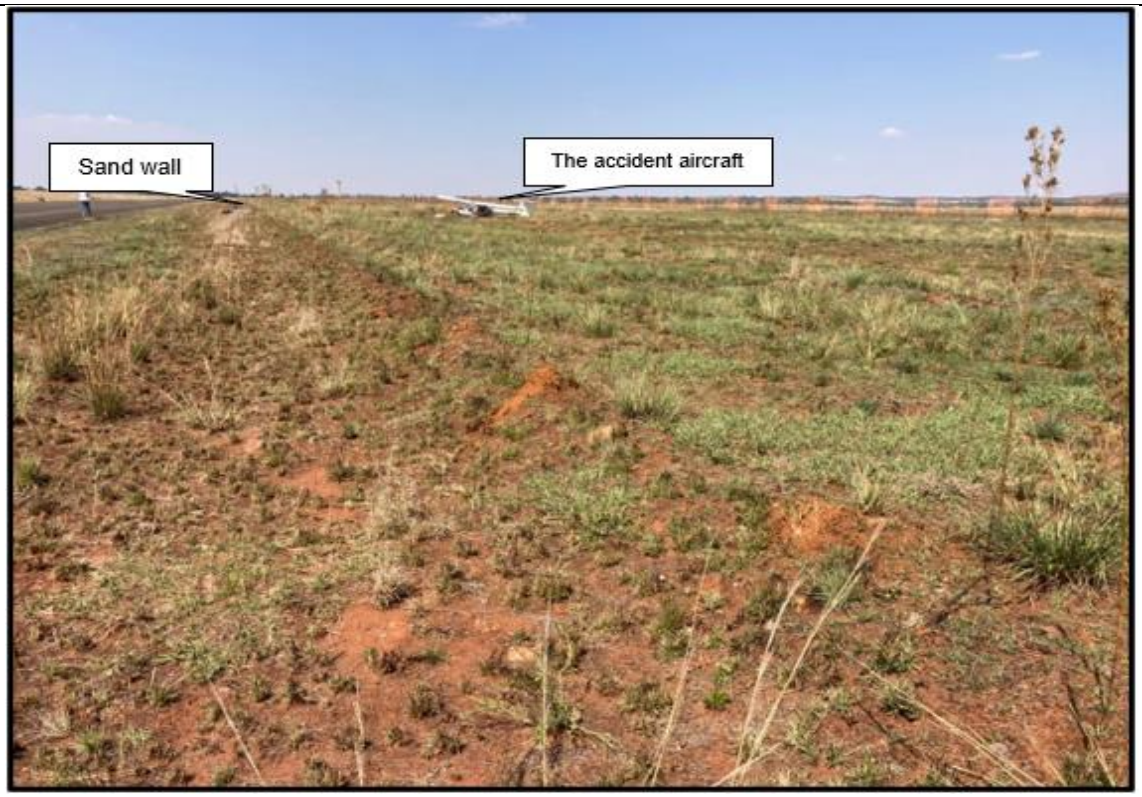

Figure 2: The sand wall and the uneven surface at the accident site.

Figure 3: The aircraft at rest. The inset picture shows the damage on the right-wing tip.

How an aircraft magneto works:

The information below is an extract from an article by Kinsley Welding Inc. (KWI), posted on 15 April 2021 and titled: All about aircraft magnetos
(Source: kinsleyexhaust.com/blog/all-about-)

An aircraft magneto has a permanent magnet on a rotor that spins next to a high-output coil. The spinning magnets generate electricity that reaches up to 20,000 to 30,000 volts. When this value is achieved, a

distributor transfers the electricity to the spark plug that ignites the fuel-air mixture inside the engine. When you turn the key inside the cockpit, your plane's engine just suddenly starts running. But that's because of the magnetos. Here's exactly how they work.

As the magneto's magnet spins, it produces a magnetic flux that passes through a high output coil with two separate windings. The primary winding is made of heavy copper, while the secondary winding is made of a finer wire with an exponentially high number of turns. A magnetic field created by the spinning magnet passes through the primary winding. The magnetic field induces a small amount of current in the primary winding. A switch breaks the flow of current in the primary winding when it reaches the maximum, causing a voltage spike. However, this amount is not enough. The secondary winding, which generally has about 100 times more turns than the primary, amplifies the voltage to the desired value ranging from 20,000 to 30,000 volts. This voltage is then fed to the spark plug to ignite the fuel-air mixture.

Magnetos are often found in pairs, left and right. Each one fires one spark plug per cylinder. This arrangement ensures redundancy. Whenever one fails, the engine will continue to run, albeit less efficient. Aircraft magnetos are essential parts of the engine that allows it to run. So, you'll want your plane's magnetos to work as they should.

The information below is an extract from the Rotax 852 engine type Maintenance Manual*:*

According to the engine maintenance manual, the engine type with serial numbers from S/N 5305902 up to S/N 9619115 inclusive requires time between overhaul (TBO) of 300 hours or five years whichever comes first.

There was no evidence in the maintenance records of TBO carried out at any intervals as specified above. However, the inspection post-accident determined that there was nothing wrong with the engine. Also, during the 50 hours interval, the electric starter gear and the ignition system for every 25 hours interval should be carried out. This includes starter motor, spark plugs condition, distributor cables, magnetos and electrical wires continuity.

What was found:

Post-accident, an engine inspection was conducted, and nothing amiss was found. It was later determined that the aircraft's ignition switch was faulty and, thus, caused one of the magnetos to switch off automatically during the flight. The ignition switch was opened and three of the key log springs were found out of position and loose. The ignition system works as follows: the starter ignition switch controls the starter motor which turns the engine, this allows the magnetos to turn and generate the electrical charge which ignites the spark plugs to start the engine.

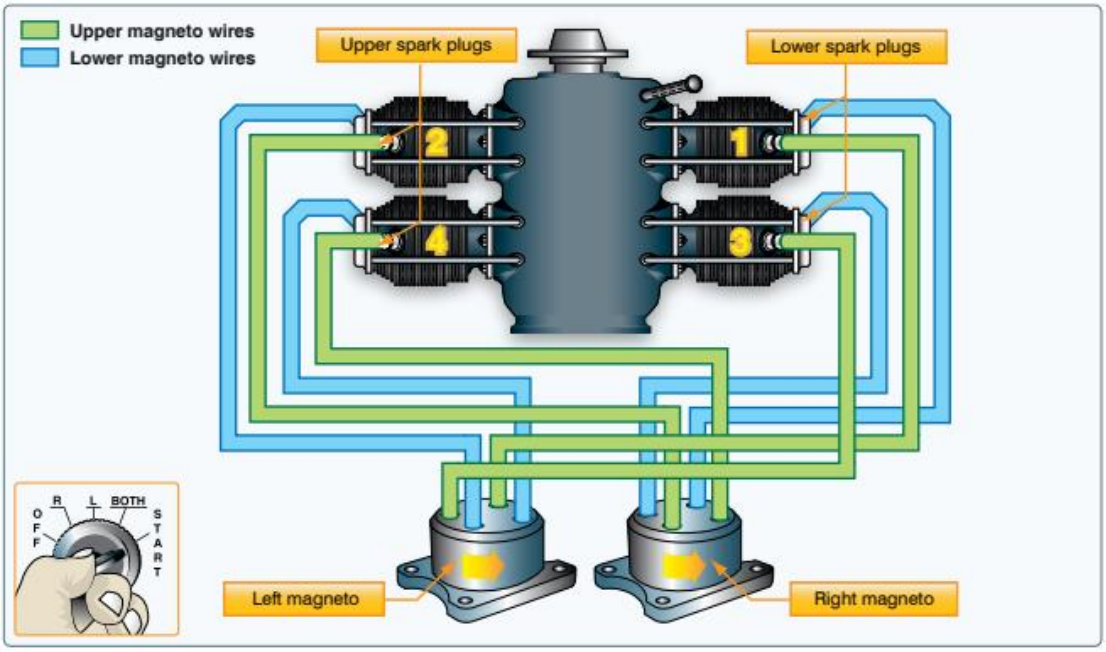

Diagram 2: Ignition system. (Source: https://www.cfinotebook.net/notebook/operation-of-aircraft-systems/ignition)

The above picture shows an ignition system with a similar starter ignition switch to that of the accident aircraft.

*The switch has five positions (Refer to **Diagram 2** bottom left-hand corner)*

OFF: Aircraft starter ignition switch position is on Off (No ignition/ switched Off/ No electrical flow to start the engine)
R: When the key is switched to the position R it allows only the right-hand side magneto to be active to provide electricity when the engine is turning/running.
L: When the key is switched to the position L it allows only the left-hand side magneto to be active to provide electricity.
BOTH: When the key is at the position it allows both magnetos to provide electricity.
START: When the key is turned to the position, the aircraft engine will start, and the key will recoil back to position BOTH, allowing both magnetos to provide electricity during engine operation.

Findings

- The pilot was initially issued a National Pilot Licence (NPL) by the Regulator (SACAA) on 24 April 2003. His licence currency renewal was issued on 28 October 2021 with an expiry date of 31 October 2023 following a competency acquisition on 16 October 2021.

- The pilot's Class 4 medical certificate was issued on 30 November 2021 with an expiry date of 30 November 2023, with a restriction to wear corrective lenses.

- The aircraft was issued an Authority to Fly (ATF) by the Regulator (SACAA) on 27 January 2022 with an expiry date of 28 February 2023.

- The aircraft was issued a Certificate of Release to Service (CRS) on 27 January 2022 with an expiry date of 27 January 2023.

- The annual mandatory periodic inspection (MPI) that was carried out on the aircraft prior to the accident flight was certified on 27 January 2022 at 927 airframe hours, with an expiry date of 27 January 2023 or at 1027 airframe hours, whichever comes first unless the aircraft is involved in an accident and is rendered unserviceable. The aircraft had a total of 948 airframe hours at the time of the accident.

- The approved person (AP) who maintained the aircraft was issued an Approved Person Certificate (APC) by the Regulator on 6 October 2020 with an expiry date of 5 October 2022.

- Fine weather conditions prevailed at the time of the flight. The weather did not contribute to this accident.

- There were no other recorded defects in the aircraft maintenance records relating to the aircraft system that could have contributed to this accident.

- The accident occurred during a precautionary landing on the side of the runway after the engine lost power during take-off.

- The aircraft sustained substantial damage to the nose and main landing gear struts, the propeller blades and the right-wing tip.

- Nothing amiss was found with the engine after inspection. Although there was nothing wrong with the engine, a review of the engine maintenance manual and the maintenance records established that the engine was not maintained in accordance with the manufacturer's recommendations as specified in the engine maintenance manual for 300-hour intervals or five years for overhaul.

- It was determined that the aircraft's starter ignition switch was faulty with the key log springs found off position and loose. This resulted in the key recoiling from position "BOTH" back to the "L" position, which caused one of the magnetos (R) to switch off automatically during flight.

Probable Cause

A faulty aircraft ignition system caused the engine to lose power, which led to the pilot executing an unsuccessful emergency landing.

Contributing Factor

The starter ignition switch log springs were found off position and loose.

Safety Action(s)

None.

Safety Message and/or Safety Recommendation/s

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 desk top enquiries 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.

Disclaimer

This report is issued by:

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