SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10214						
Classification	Accident		**Date**	29 August 2022		**Time**	1230Z
Type of Operation	Training (Part 141)						
Location							
Place of Departure	Wonderboom Aerodrome (FAWB), Gauteng Province		Place of Intended Landing		Wonderboom Aerodrome (FAWB), Gauteng Province		
Place of Occurrence	Right-side of a public road, west of FAWB						
GPS Co-ordinates	Latitude	25°39'03.8" S	Longitude	028°12'09.4" E		Elevation	4 012ft
Aircraft Information							
Registration	ZS-SPT						
Make; Model; S/N	Piper PA-28-140 Cherokee, Serial Number: 28-7725021						
Damage to Aircraft	Substantial			Total Aircraft Hours		7375.1	
Pilot-in-command							
Licence Type	Airline Transport Pilot Licence		Gender	Female		Age	41
Licence Valid	Yes	Total Hours	10 107.4	Total Hours on Type			510.0
Total Hours 90 Days	100.0		Total Flying Hours on Type Past 90 Days		27.5		
People On-board	2 + 0	**Injuries** 2	**Fatalities**	0	**Other (on ground)**		0

What Happened

On Monday, 29 August 2022, a flight instructor and a student pilot on-board a Piper PA-28-140 Cherokee aircraft with registration ZS-SPT intended to perform Category 10 and 11 exercises, which comprises slow flying, stall recovery and spin avoidance at Wonderboom Aerodrome (FAWB) general flying (GF) area. Visual meteorological conditions (VMC) by day prevailed at the time of the flight. The flight was conducted under the provisions of Part 141 of the Civil Aviation Regulations 2011 as amended.

The instructor stated that in preparation for the flight, they had a short briefing at the Approved Training Organisation (ATO) facility. The aircraft's flight folio page serial number 02056 showed that 20 litres (l) of Avgas 100LL aviation fuel was uplifted, and the aircraft's fuel tanks were at full capacity (50 US gallons / 189l). Before commencing with the flight, the pair conducted a pre-flight inspection, and no anomalies of the aircraft's systems were detected. Fuel was purged and no contaminants were found. According to the air traffic controller's (ATC) written statement, before the engine was started, the instructor called the tower on the very high frequency (VHF) 120.60-Megahertz (MHz) to inform them of their intention, which was acknowledged. The student pilot selected the fuel selector to the right tank for engine start-up. After the engine instrument indications had stabilised, the student pilot taxied the aircraft to Runway 29 holding point.

Engine run-up and pre-take-off checks were conducted with no indication of abnormal magneto drop on either magneto, and with no evidence of carburettor ice during the carburettor heat check. As part of the pre-take-off checks, the electric fuel pump was switched on and the fuel primer was locked closed. The engine parameters were reported to be in the normal range during the before take-off power check. Thereafter, the instructor called the ATC and requested take-off clearance. After having been cleared, the student pilot switched the fuel tank from the right to the left tank, and lined up on Runway 29. The student pilot then increased the power to 2 500 revolutions per minute (RPM) and the engine indications were within the green arch (normal). The aircraft accelerated along the runway and rotated. At approximately 500 feet (ft) above ground level (AGL) during the initial climb, the instructor noticed a drop in airspeed and instructed the student pilot to lower the aircraft's nose. Again, the instructor noted that the engine RPM had dropped to 2 000 RPM.

The ATC stated that the instructor called and requested to return to FAWB for an emergency landing on either of the intersecting runways (06/24) and, thereafter, took over the control of the aircraft and raised the flaps to reduce drag. The instructor also tried various throttle settings, but was unable to recover the engine power.

The instructor deduced that they would not make it back to the aerodrome and, thus, decided to transmit a Mayday call. She identified a road located west of FAWB and committed to carry out a forced landing on it. After landing, the aircraft struck a streetlamp pole with its right wing before it came to a stop on the right-side of the public road, approximately 2 973 metres (m) from the threshold of Runway 11. The aircraft was substantially damaged whilst the instructor and the student pilot sustained minor injuries. The first responders assisted the instructor and the student pilot to vacate the aircraft through the left-side front window. The crash alarm was activated, and the Aerodrome Rescue and Fire-fighting (ARFF) team was dispatched. On their arrival, they sprayed the aircraft with foam as a precaution because of the amount of fuel that had leaked out. The instructor and the student pilot were transported to the hospital for medical attention.

The accident occurred at a Global Positioning System (GPS) determined to be 25°39'03.8" South 028°12'09.4" East at an elevation of 4 012 feet (ft).

Witness information

Several people at FAWB saw the aircraft when it took off, and their testimony was similar. Some of the witnesses who are aviators from FAWB, reported that the aircraft seemed to be flying slow and low after take-off and it did not appear to be accelerating as expected. Another witness who was located to the west of the aerodrome in the direction of the aircraft's path, reported seeing the wings rocking as the aircraft was struggling to climb. Yet another witness who was also located to the west of the aerodrome in the direction of the aircraft's path stated that his attention was drawn to the aircraft by a sound of a spluttering engine, followed by silence a few seconds later. The aircraft then made a right turn before the pilot executed a forced landing on the road.

Figure 1: The aerodrome layout and the accident site marked by a yellow pin. (Source: Google Earth)

Figure 2: The aircraft at the accident site with the flaps in a retracted position.

Figure 3: The aircraft covered in foam.

The flight instructor

The pilot (a Grade II flight instructor) was initially issued a Private Pilot Licence (PPL) by the South African Civil Aviation Authority (SACAA) on 7 July 2005. The pilot had recently acquired an Airline Transport Pilot Licence (ATPL) that was issued by the SACAA with an expiry date of 31 January 2023. Records indicated that the pilot was certified and qualified for the flight in accordance with (IAW) the existing regulations. The pilot had a Class 2 flight instructor rating that was reissued on 25 December 2020 with an expiry date of 31 December 2023. At the time of the accident flight, the pilot had flown a total of 10 107.5 hours of which 510.0 hours were on the aircraft type. She had flown 100.0 hours during the past 90 days, of which 27.5 hours were on the aircraft type. The pilot had a valid Class 1 aviation medical certificate which was issued on 18 November 2021 with an expiry date of 30 November 2022. The pilot had no restrictions listed on her licence.

The student pilot

The student pilot was issued a Student Pilot Licence (SPL) by the SACAA on 23 June 2022 with an expiry date of 2 June 2023. He had a Class 2 medical certificate with an expiry date of 30 June 2023 with the restriction to wear suitable corrective lenses. The student pilot had accumulated 12 hours at the time of the accident. The student pilot's training file showed that he had passed a technical examination of the aircraft he chose to be trained on. Included in the file were airspace rules and procedures for the student pilot's home aerodrome, as well as flight characteristics of the aircraft.

The aircraft

The Piper PA-28-140 Cherokee is a single-engine, low-wing monoplane aircraft of conventional design and a fixed tricycle landing gear. The aircraft was manufactured by Piper Aircraft Corporation in the United States of America (USA) and was designed for flight training and for personal use. The aircraft has dual control columns which allows it to be flown from either the left or right pilot seat. The flying controls are conventional, with cables operating the control surfaces. The aircraft is powered by a four-cylinder Lycoming O-320-E3D piston engine (Serial number RL-30800-27A) rated at 150 horsepower (HP) at 2700 RPM driving a metal two-bladed fixed pitch Sensenich 74DM6-O-58 model propeller (Serial number A63085).

The Pilot's Operating Handbook (POH) showed that the aircraft was equipped with two 50-US gallons fuel tanks (48 gallon usable) which are secured to the leading-edge structure of each wing by screws and nut plates. Each tank had an individual fuel drain at the bottom inboard corner, which was used to check for water or sediment. The fuel selector valve could be set to off, or either the left or right tank. Each tank was equipped with a single fuel pickup (outlet) on its inboard wall, slightly above the bottom of the tank. From the outlet of each tank, fuel lines are routed through the wings to the fuel selector valve located on the left side panel forward of the pilot's seat. From the fuel selector valve, a line led to the fuel strainer bowl, which was mounted on the front of the engine firewall. The fuel line then is routed from the strainer bowl to the electric fuel pump, engine driven fuel pump, and carburettor. Fuel quantity and pressure are indicated on gauges located in the engine gauge cluster on the left side of the instrument panel. The auxiliary electric pump should be on for all take-offs and landings and when switching tanks.

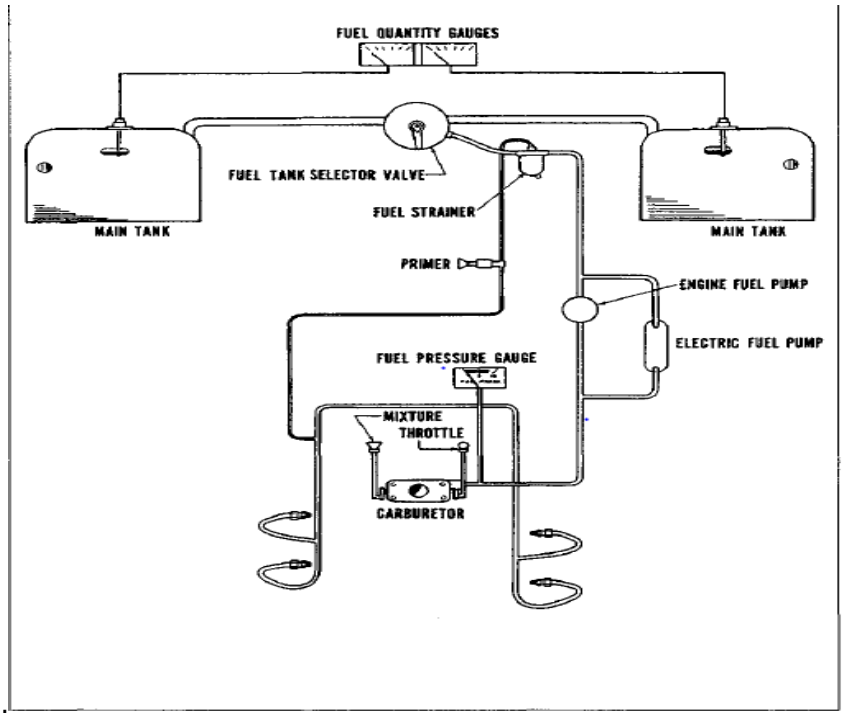

Diagram 1: Aircraft fuel system schematics. (Source: Pilot's Operating Handbook)

The last 100-hour mandatory periodic inspection (MPI) on the aircraft was certified on 30 June 2022 at 7306.8 airframe hours. The aircraft had accumulated 7375.1 total airframe hours at the time of the accident flight. A further 68.3 hours were flown with the aircraft since the inspection. The last 50-hour inspection on the aircraft prior to the accident flight was certified on 15 August 2022 at 7356.8 airframe hours. The aircraft had accumulated 7375.1 total airframe hours at the time of the accident. A further 18.3 hours were flown with the aircraft since the inspection.

The aircraft's Certificate of Airworthiness (CoA) was issued on 25 February 2014 with an expiry date of 25 February 2023. A Certificate of Registration (CoR) was issued to the present owner on 30 June 2022. A Certificate of Release to Service (CRS) was issued on 2 April 2022 with an expiry date of 29 June 2023. The flight folio page serial number 02056 revealed that on the morning of 29 August 2022, the flight instructor conducted a circuit training flight at FAWB on the accident aircraft. Four touch-and-go landings were performed during that flight and approximately 1.1 hours flight time was logged. The airframe hours registered 7373.23 and the aircraft was described by the instructor as serviceable with no defects noted.

Weather information

Presented on the table below is the meteorological aerodrome report (METAR) data for FAWB at 1230Z on 29 August 2022. The weather was appropriate for the flight in VMC.

Wind Direction	300°	Wind Speed	5 knots	Visibility	> 10km
Temperature	27°C	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	5°C	QNH	1019 hPa		

Engines at maximum power settings with the mixture set at FULL RICH are not vulnerable to icing because engine induction temperatures are too high. The temperature was 27°C with a dew point of 5°C; this also would not easily lead to ice build-up in the carburettor. A possibility of the carburettor icing was, therefore, eliminated.

Wonderboom aerodrome (FAWB)

FAWB is a Category 2 aerodrome with licence No: 0019, issued in accordance with (IAW) Part 139 of the Civil Aviation Regulations 2011 as amended. The licence was renewed by the SACAA on 31 July 2022 with a validity period from 1 August 2022 to 31 July 2023. The aerodrome has two runways: the asphalt runway is orientated 29/11 and is 1 828 metres (m) long and 30m wide, whilst the other runway is orientated 24/06 and is 1 280m long and 22m wide. The aerodrome elevation is 4 095ft. Runway 29 was used for take-off. The aerodrome has ARFF service, and the personnel responded to the accident site after the crash alarm was activated by the ATC.

Approved Training Organisation (ATO)

The training organisation was issued an ATO certificate on 23 February 2022 by the SACAA, with an expiry date of 31 January 2023. The aircraft was authorised on the Training Operations Specifications certificate, which was issued by the Regulator with an effective date of 23 February 2022 and an expiry date of 31 January 2023.

Post-accident wreckage examination

Upon arrival at the accident site, the aircraft was found resting on its right-side fuselage with the left wing up and facing the direction at which it (the aircraft) had approached (south). The right wing and main landing gear had separated from the fuselage after impacting a streetlamp pole during the accident sequence. The right fuel tank had also separated from the wing structure. The right tank fuel cap was found in place and the tank contained fuel that was free of contaminants. The fuel tanks, vents and filters were inspected, and no foreign objects or obstructions were found. The fuel selector valve handle was set to the left tank. The left tank was damaged, however, there was sufficient fuel remaining for analysis. The throttle and mixture control levers were found in a closed position and the carburettor heat selector was selected to cold position. The throttle and the mixture control cables were appropriately connected to their respective control levers and were responsive. Fuel samples were taken from the left fuel tank and were analysed for the correct grade and the presence of contaminants, and no anomalies were found.

Examination of the wreckage was conducted by the engineers and the investigator-in-charge (IIC). None of the circuit breakers (CBs) had tripped; the front seats remained secured to their rails. The Emergency Locator Transmitter (ELT) was found transmitting an emergency signal at the accident site. The aircraft's flap operating lever, located on the floor between the front seats was found in its lowest detent, indicating that the flaps were in a retracted position at impact (Figure 2).

Figures 4 and 5: Flap operating lever in its lowest detent (left picture). The fuel selector valve set to the left tank.

Continuity check of the flying controls indicated that they were connected and functioning correctly. The tail and the fuselage area behind the cockpit were intact, with impact damage on the right horizontal stabiliser (Figure 2). The propeller blades were slightly bent rearward but did not have any leading edge or tip damage. The spinner had a big dent from impact but there were no radial score marks, this indicated that the propeller was rotating under power when it struck an obstacle during the accident sequence.

Figures 6 and 7: The propeller as found at the accident site (left picture). The dented spinner (right picture).

Figure 8: The wreckage layout at the accident site.

Post-accident examination of the engine indicated nothing abnormal; it had remained attached to the firewall and its mountings. Engine oil was observed leaking from the dip stick tube. The engine's exhaust system was examined, and no blockages or loose internal baffles were observed. The magnetos and ignition harnesses were properly connected and in a good condition. All the engine air pipes and components, bolts and wire locks were found in place. Fuel was found inside the gascolator (fuel strainer) and the carburettor. The gascolator drain valve was locked closed and showed no evidence of fuel leak. No evidence of a fuel pipe disconnection was noted. The engine was rotated by hand using the propeller, and compression was attained in all four-cylinders.

The aircraft was recovered to the aircraft maintenance organisation (AMO) for further investigation. Fuel records from the operator were examined. Following the accident, the IIC confirmed that the fuel sample from the batch used to refuel ZS-SPT had passed the normal fuel quality examination. The fuel was certified for fuel density, and clear and brightness tests were completed. There were no reports of fuel problems from the operator's aircraft that had refuelled from the same fuel batch before and after the accident aircraft.

Engine test bench run

The engine was removed from the airframe and taken to the SACAA-approved engine overhaul facility. Before the engine was placed on a test bench, a damaged oil dip stick tube and the number 1 cylinder rocker cover were replaced. On 9 September 2022, the engine was started with the mixture at FULL RICH, power was increased in stages until it was evident that it was capable of operating at full power IAW the operator's manual.

Pilot's Operating Handbook (POH)

Emergency procedures, engine power loss in-flight:

If the power loss occurs at low altitude, then the appropriate emergency procedure should be applied, and preparations made for an emergency landing according to the POWER OFF LANDING check-list. Speed should be maintained at least at 80 KIAS, and if the altitude allows it, the following steps should be taken:

1. Fuel selector: switch to a fuel tank containing fuel
2. Electrical fuel pump in ON position
3. Mixture control in RICH position
4. Carburettor heater in ON position
5. Engine indicators on the instrument panel: check for any indication of the cause of the power loss
6. Fuel primer: check that it is not blocked
7. If low fuel pressure is indicated, check the position of the tank selector to make sure the selected tank contains fuel.

If the power returns:

8. Carburettor heater in OFF position
9. Electrical fuel pump in OFF position

If the power does not return, prepare for an emergency landing, and if there is enough time:

a) Activate the Magnet Switch, first to the L position, then to the R position, then return to the BOTH position
b) Gas and mixture control lever: change setting
c) Select another fuel tank

Findings

(i) The instructor had an Airline Transport Pilot Licence (ATPL) that was issued by the SACAA with an expiry date of 31 January 2023. She had a Class 1 medical certificate, which was issued on 18 November 2021 with an expiry date of 30 November 2022.

(ii) The student pilot was issued a Student Pilot Licence (SPL) by the SACAA on 23 June 2022 with an expiry date of 2 June 2023. He had a Class 2 medical certificate with an expiry date of 30 June 2023 with a restriction to wear suitable corrective lenses.

(iii) This flight was conducted under the provisions of Part 141 of the Civil Aviation Regulations 2011 as amended.

(iv) The last 100-hour MPI on the aircraft was certified on 30 June 2022 at 7306.8 airframe hours. The aircraft had accumulated 7375.1 total airframe hours at the time of the accident flight. A further 68.3 hours were flown with the aircraft since the said inspection.

(v) The last 50-hour inspection on the aircraft prior to the accident flight was certified on 15 August 2022 at 7356.8 airframe hours. The aircraft had accumulated 7375.1 total

airframe hours at the time of the accident flight. A further 18.3 hours were flown with the aircraft since the inspection.

(vi) Examination of the aircraft's logbooks showed that the operator had complied with all the applicable Service Bulletins (SBs) and Airworthiness Directives (ADs).

(vii) The Certificate of Release to Service was issued on 2 April 2022 with an expiry date of 29 June 2023.

(viii) The aircraft's Certificate of Airworthiness (CoA) was issued on 25 February 2014 with an expiry date of 25 February 2023.

(ix) The Certificate of Registration (CoR) was issued to the present owner on 30 June 2022.

(x) There were no defects identified which could have had a bearing to this accident.

(xi) The training organisation was issued an ATO certificate on 23 February 2022 by the SACAA, which was valid until 31 January 2023.

(xii) The aircraft was authorised on the Training Operations Specifications certificate, which was issued by the SACAA with an effective date of 23 February 2022 and an expiry date of 31 January 2023.

(xiii) Communication between the aircraft and FAWB ATC was good.

(xiv) Fine weather conditions prevailed at the time of the flight.

(xv) The aircraft sustained substantial damage during the accident sequence.

(xvi) Both occupants sustained minor injuries.

Probable Cause

Loss of engine power during the initial climb which was undetermined, resulting in an unsuccessful forced landing on a public road.

Contributing Factor

It is possible that the loss of engine power was caused by incorrect mixture setting.

Safety Action/s

None.

Safety Message and/or Safety Recommendation/s

None.

About this Report

The decision to conduct a limited investigate 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

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This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa