AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:			CA18/2/3/10248	
Aircraft Registration	ZS-EAW	**Date of Accident**	15 January 2023		**Time of Accident**		0605Z
Type of Aircraft	Piper PA-30-160 Twin Comanche			**Type of Operation**	Training (Part 141)		
Pilot-in-command Licence Type	Commercial Pilot Licence (CPL) Aeroplane		**Age**	28	**Licence Valid**		Yes
Pilot-in-command Flying Experience	**Total Flying Hours**	539.4		**Hours on Type**			55.0
Last Point of Departure	Grand Central (FAGC) Aerodrome, Gauteng Province						
Next Point of Intended Landing	Grand Central (FAGC) Aerodrome, Gauteng Province						
Damage to Aircraft	Destroyed						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Crown Mines dump site near National Recreation Centre (NASREC) at Global Positioning System (GPS) co-ordinates determined to be 26°14'05.5'' South 027°58'24.0'' East, at an elevation of 5600 feet (ft)							
Meteorological Information	Wind velocity: 030° at 2KT; Temperature: 20°C; Dew Point: 0°C; Visibility: ≥10000m; Cloud: CAVOK; QNH: 1025 hPa						
Number of People On-board	2 + 0	**Number of People Injured**	0	**Number of People Killed**	2	**Other (On Ground)**	0

Synopsis

On Sunday morning, 15 January 2023 at approximately 0605Z, a flight instructor and a pilot on-board a Piper PA-30-160 aircraft with registration ZS-EAW were involved in an accident after they had engaged in a multi-engine aircraft conversion training at Grand Central Aerodrome (FAGC) in Gauteng province. A flight plan was filed for the flight which was conducted under visual meteorological conditions by day and under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.

As per the FAGC air traffic control officer (ATCO) voice recordings during the flight, after completing three circuits at FAGC, the crew requested permission to redirect towards Johannesburg South General Flying Area (GFA), which was granted. Once authorised, the crew navigated towards the GFA. An eyewitness near National Recreation Centre (Nasrec) observed the aircraft flying southward at an altitude of approximately 600 feet (ft) above ground level (AGL). The eyewitness noted a cessation of the aircraft's engines and observed it rapidly descend until it impacted the base of the mine dump at Crown Mines near Nasrec. The impact resulted in the destruction of the aircraft, and both occupants were fatally injured. Post-accident investigation revealed no evidence of fuel remaining in the aircraft, and there was no evidence of a post-impact fire.

Probable Cause/s and/or Contributory Factors

The aircraft was operated with insufficient fuel on-board which led to in-flight engine stoppage of both engines due to fuel exhaustion; this resulted in loss of control of the aircraft and the subsequent crash.

SRP Date	13 February 2024	Publication Date	14 February 2024

Occurrence Details

Reference Number	**:** CA18/2/3/10248
Occurrence Category	**:** Category 1
Type of Operation	**:** Training (Part 141)
Name of Operator	**:** Flight Training Services (FTS)
Aircraft Registration	**:** ZS-EAW
Aircraft Make and Model	**:** Piper PA-30-160 Twin Comanche
Nationality	**:** South African
Place	**:** Crown Mines dump site near Nasrec, Gauteng Province
Date and Time	**:** 15 January 2023 at 0605Z
Injuries	**:** Two fatalities
Damage	**:** Destroyed

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.

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.

Investigation Process

The Accident and Incident Investigations Division (AIID) of the South African Civil Aviation Authority (SACAA) was notified of the accident which occurred on 15 January 2023 at 0605Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and the International Civil Aviation Organisation (ICAO) STD Annex 13 definitions. Notification were sent to the State of Registry, Operator, Design and Manufacturer in accordance with the CAR 2011 Part 12 and the ICAO Annex 13 Chapter 4. The State of Design and Manufacturer did not appoint an accredited representative and/or advisor. The AIID investigators had dispatched to the accident site.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Accident — this investigated accident
   Aircraft — the Piper PA-30-160 involved in this accident
   Investigation — the investigation into the circumstances of this accident
   Pilot — the pilot involved in this accident
   Report — this accident report

2. *Photos and figures used in this report were taken from different sources and may have been adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows, or lines.*

Disclaimer

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Abbreviation	Description
°	Degrees
°C	Degrees Celsius
AGL	Above Ground Level
AIID	Accident and Incident Investigations Division
AMO	Aircraft Maintenance Organisation
AMSL	Above Mean Sea Level
ARFF	Aircraft Rescue and Fire Fighting
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
CAA	Civil Aviation Authority
CAR	Civil Aviation Regulations
CAVOK	Ceiling and Visibility OK
CVR	Cockpit Voice Recorder
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
E	East
ELEV	Elevator
FAGC	Grand Central Aerodrome
FAGM	Rand Airport
FAJB	Johannesburg Botanical Gardens
FAOR	O.R. Tambo International Airport
FAWI	Witbank Aerodrome
FDR	Flight Data Recorder
FNB	First National Bank
ft	Feet
GPS	Global Positioning System
hPa	Hectopascal
IIC	Investigator-in-charge
IOC	Investigator-on-call
KM	Kilometres(s)
Kts	Knot(s)
L	Litre
m	Metre
METAR	Meteorological Aerodrome Terminal Air Report
MHz	Megahertz
MPH	Miles per Hour
MPI	Mandatory Periodic Inspection
N/A	Not Applicable
NASREC	National Recreation Centre
nm	Nautical Mile
Q	Quart(s)
QNH	Query: Nautical Height
RWY	Runway
S	South
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
TL	Technical Logbook
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
Z	Zulu (Term for Universal Co-ordinated Time – Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On Sunday morning, 15 January 2023, a Grade II flight instructor and a pilot with a Private Pilot Licence (PPL) on-board a Piper PA-30-160 Twin Comanche aircraft with registration ZS-EAW took off on a multi-engine type conversion training flight from Grand Central Aerodrome (FAGC) in Gauteng province with the intention to land back at the same aerodrome. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended. Clear weather conditions prevailed at the time of the flight.

1.1.2. The recording of the close circuit television (CCTV) footage at FAGC apron captured the pilot walking towards the aircraft and conducting what seemed like a pre-flight check before the commencement of the flight. Later, the instructor was seen boarding the aircraft to join the pilot for their intended flight.

1.1.3. According to the FAGC air traffic control officer (ATCO) voice recordings, at approximately 0506Z, the crew made their first radio transmission to the air traffic control (ATC) and reported that they were two on-board with fuel endurance of 5.5 hours; they requested permission to taxi the aircraft to the runway threshold for take-off for their intended training with an estimated time of 1 hour. At 0507Z, the ATCO advised ZS-EAW that query nautical height (QNH) was 1026 (Hpa) and that they should taxi, then report when ready for take-off at the holding point of Runway (RWY) 35. At 0517Z, ZS-EAW reported ready for departure from RWY 35 holding point. The ATCO cleared the aircraft for take-off with a surface wind of 030° at 5 knots (kt) and to report next when on left downwind RWY 35 at a height of 6800 feet (ft) above mean sea level (AMSL). The pilot made the initial radio communication, thereafter, the instructor took over the radio communications.

1.1.4. At 0522Z, ZS-EAW reported on left downwind RWY 35 and the ATCO instructed ZS-EAW to report on final approach and that they (ZS-EAW) were number two behind a Cessna 172 (C172) which was turning base in the circuit. ZS-EAW reported that they have visual of C172. At 0523Z, ZS-EAW reported turning base and requested to conduct a neutral circuit at 6800 ft AMSL and to report left downwind RWY 35. The ATCO approved the request with an early left (turn). At 0536Z, ZS-EAW reported left downwind, and ATCO instructed ZS-EAW to report when on final approach and that they are number one in the circuit with the surface wind of 030° at 8 kt. The ATCO cleared ZS-EAW for a touch-and-go on RWY 35 and requested that they report when on left downwind RWY 35.

1.1.5. At 0541Z, ZS-EAW reported at left downwind RWY 35 and the ATCO instructed ZS-EAW that they are number one in the circuit and to report on final approach. ZS-EAW read back and further requested to route to Johannesburg South General Flying Area (GFA) for 15 minutes after the touch-and-go circuit before returning to FAGC, and the ATCO granted them permission. At 0544Z, the ATCO enquired if ZS-EAW was initiating a go-around and ZS-EAW responded affirmative. The ATCO instructed ZS-EAW to climb to 6800 ft and to report outbound to the south. At 0548Z, ZS-EAW reported outbound to the south and ATCO advised ZS-EAW to broadcast their intentions on frequency 125.8-Megahertz (MHz). ZS-EAW read back the instruction and that was their last radio transmission to the ATC FAGC. The three circuits lasted approximately 33 minutes.

1.1.6. A flight plan was filed with O.R. Tambo International Airport (FAOR) before the flight with the intention to follow a direct flight path to the east from FAGC routing via the following co-ordinates :2555S02183E, 2555S02189E and 2547S02833E to Witbank Aerodrome (FAWI) as indicated by the red line in Figure 1. The flight plan further indicated the two crew on-board and a fuel endurance of 5 hours. The pilots, however, elected to conduct two touch-and-go landings and, during the third circuit, they requested to route to the Johannesburg South GFA. The flight crew deviated from the flight plan as filed which did not include the touch-and-go landings prior to proceeding to the GFA.

1.1.7. The first eyewitness who was travelling on the National road (N1) towards the north in the vicinity of the accident site stated that "*It was approximately 0600Z when I saw a white aircraft flying slowly at a low altitude; the aircraft flew straight up as if it is doing aerobatics, then suddenly stalled and went down [descended], spiralling with the nose pointing down" [sic]*. A written statement from a second eyewitness who was at her dwelling, approximately 3 kilometres north-east of the accident site stated: "*At approximately 0605Z my attention was attracted by the idling/running rough sound of the engine of the aircraft which went on and off, and suddenly stopped. I observed the plane flying low and the engine stopped and finally when I stood up on my toes, I saw it going down with the nose down and disappeared in the bush" [sic]*.

1.1.8. The third eyewitness who was approximately 500 metres from the crash site was the one who immediately notified the South African Police Service (SAPS) after witnessing the crash. The SAPS notified the Emergency Medical Services (EMS), the Aircraft Rescue and Fire Fighting (ARFF) officials and the South African Search and Rescue (SASAR) personnel. The SASAR then notified the Accident and Incident Investigations Division (AIID), and the investigators were dispatched to the accident site.

1.1.9. The wreckage was located at the mine dump in Crown Mines near Nasrec. Both occupants were fatally injured during the accident sequence, and the aircraft was destroyed.

1.1.10. The accident occurred during daylight at the mine dump in Crown Mines near Nasrec at Global Positioning System (GPS) position determined to be 26°14'05.5'' South and 027°58'24.0'' East at an elevation of 5600 feet (ft).

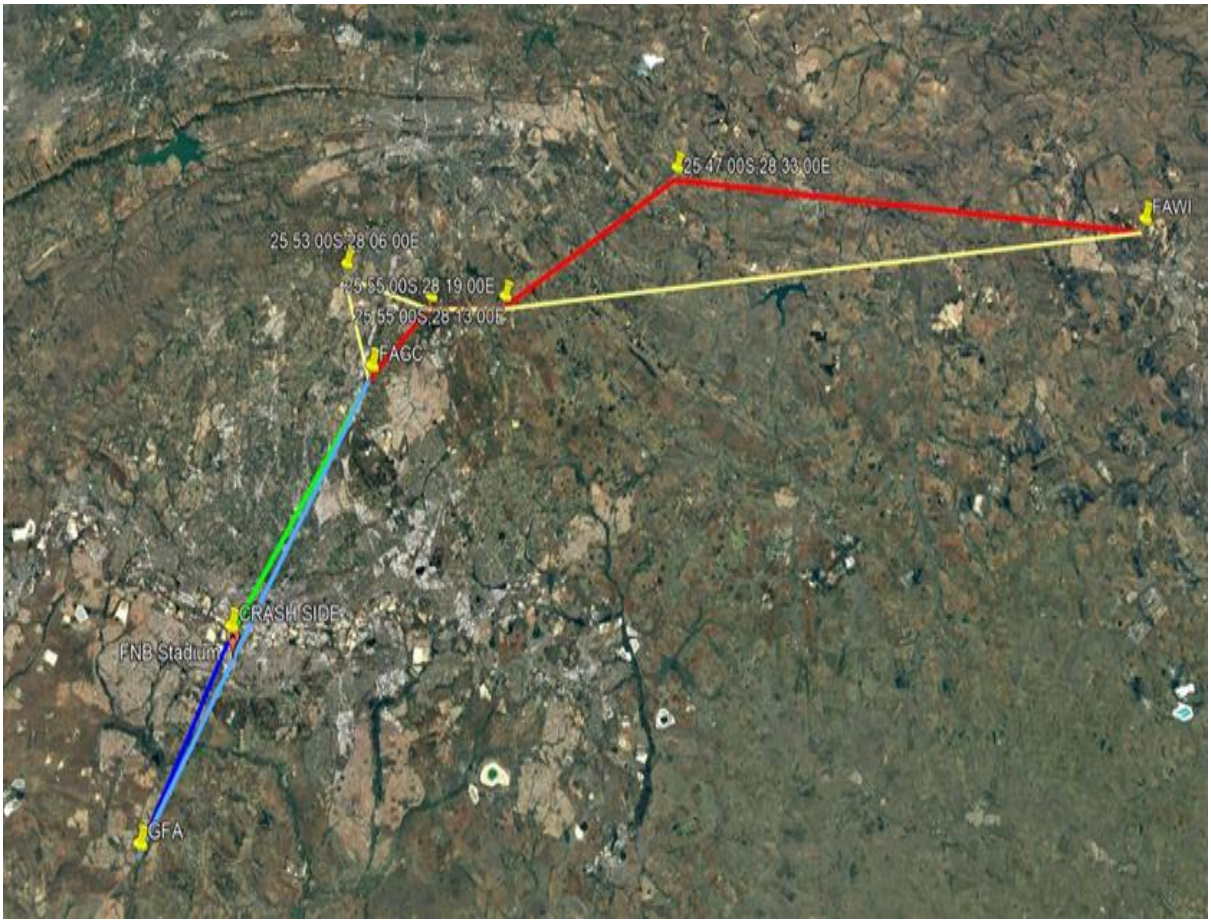


Figure 1: The red line indicates the filed flight path (departure path), the yellow line indicates the filed return path, the green line indicates the actual path flown from FAGC to the crash site, the dark blue line indicates the remaining path from the crash site to the GFA, and the light blue line indicates the direct route from FAGC to the GFA. (Source: Google Earth)

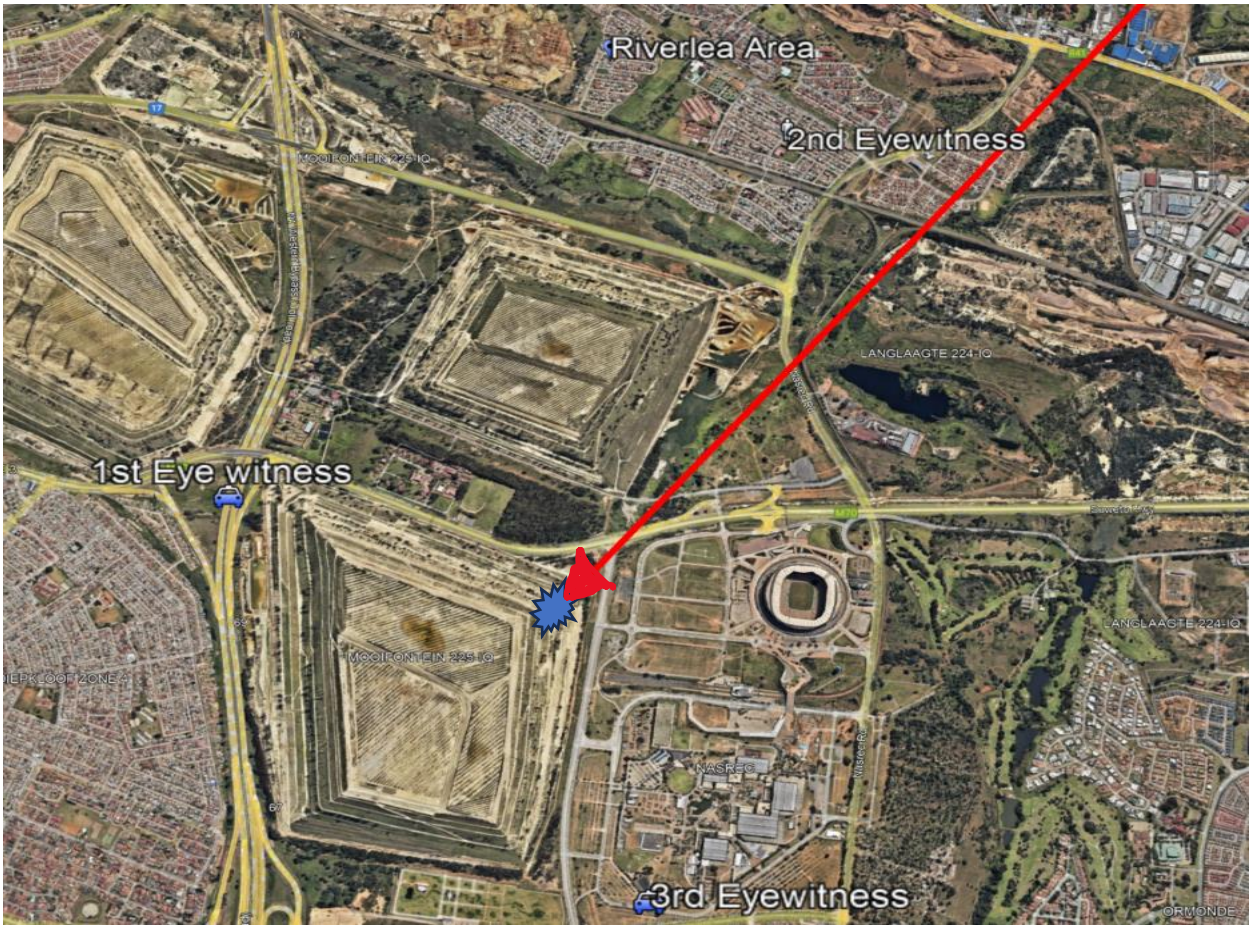


Figure 2: The arrow indicates the direction of flight, the position of the witnesses and the crash site. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	2	-	-	2	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	-	-	-	-	-
Total	2	-	-	2	-

Note: Other means people on the ground.

1.2.1. Both occupants were fatally injured during the accident sequence, and no persons on the ground were injured.

1.3. Damage to Aircraft

1.3.1. The aircraft was destroyed by impact forces at the base of the mine dump during the accident.

Figure 3: The wreckage at the accident site. (Source: ARFF)

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Flight Instructor

Nationality	Iranian	Gender	Male	Age	28
Licence Type	Commercial Pilot Licence (CPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instruments, Instructor Grade II, and Night rating				
Medical Expiry Date	31 July 2023				
Restrictions	None				
Previous Accidents	None				

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

Total Hours	539.4
Total Past 24 Hours	0.8
Total Past 7 Days	13.7

Total Past 90 Days	84
Total on Type Past 90 Days	8.4
Total on Type	55

1.5.1. The instructor pilot was a Grade II instructor with a Commercial Pilot Licence (CPL) which was initially issued on 20 August 2020 by the SACAA. The last validation was conducted on 10 July 2022 and the licence was re-issued with an expiry date of 31 July 2023. The aircraft type was endorsed on his licence.

1.5.2. The instructor was issued a Class 1 aviation medical certificate on 25 July 2022 with an expiry date of 31 July 2023 in accordance with Part 67 of the Civil Aviation Regulations (CAR) 2011.

Pilot

Nationality	Nepalese	Gender	Male	Age	19
Licence Type	Private Pilot Licence				
Licence Valid	Yes	Type Endorsed	No		
Ratings	Night rating				
Medical Expiry Date	31 May 2023				
Restrictions	None				
Previous Accidents	Unknown				

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

Total Hours	172
Total Past 24 Hours	0.8
Total Past 7 Days	5.1
Total Past 90 Days	20.5
Total on Type Past 90 Days	5.1
Total on Type	5.1

1.5.3 The pilot was initially issued a Private Pilot Licence (PPL) on 1 May 2022 with an expiry date of 31 May 2023 by the SACAA. The pilot had flown 20.5 hours of which 5.1 were on the accident aircraft type in the preceding three months.

1.5.4 The pilot was issued a Class 2 aviation medical certificate on 1 May 2022 with an expiry date of 31 May 2023 in accordance with Part 67 of the Civil Aviation Regulations (CAR) 2011.

1.6. Aircraft Information

1.6.1. The information below is an extract from the Pilot's Operating Handbook (POH):

The Piper PA-30 Twin Comanche was designed and manufactured by Piper Aircraft as a twin-engine cabin monoplane. The Piper PA-30 Twin Comanche can accommodate four to six people in-flight. It has an exterior length of 7.67 metres, an exterior height of 1.6 metres, and a fuselage diameter of 1.2 metres. The tail height is 2.51 metres. The low-wing cantilever monoplane has a wingspan of 11.21 metres including tip tanks and a wing area of 16.54 square metres. The retractable landing gear has a wheelbase of 2.3 metres. The aircraft has an empty weight of 1030 kilograms (kg) and a maximum take-off weight of 1690 kg. It has a

maximum payload of 310 kg and a fuel tank capacity of 120 United States (US) gallons with tip tanks and 90 US gallons without tip tanks. The PA-30 is powered by a twin Lycoming IO-320-B1A naturally aspirated, air-cooled, four-cylinder, direct-drive engine piston engine. It has an injector offset toward the engine's fore and aft centreline. Each engine produces a maximum take-off thrust of 160 horsepower and drives a two-bladed Hartzell HC-E2YL-27663-4 counter-rotating propeller. The aircraft has a maximum speed of 178 knots, a long-range cruise speed of 155 knots, a stall speed of 61 knots with flaps down and power off, and a never to exceed speed of 236 knots. The standard travel range is 1000 nautical miles. The PA-30 can fly up to 20000 feet and can climb at a rate of 1460 feet per minute. The take-off run to 50 feet is 470 metres while the landing run is 570 metres.

Airframe:

Manufacturer/Model	Piper Aircraft Corporation/PA-30-160 Twin Comanche	
Serial Number	30-0663	
Year of Manufacture	1965	
Total Airframe Hours (At Time of Accident)	10 390.07	
Last Inspection (Date & Hours)	20 October 2022	20 October 2022
Airframe Hours Since Last Inspection	16.92	
CRS Issue Date	26 August 2022	
C of A (Issue Date & Expiry Date)	21 March 2022	31 March 2023
C of R (Issue Date) (Present Owner)	8 March 2007	
Operating Category	Avgas 100LL	
Type of Fuel Used	Training (Part 141)	
Previous Accidents	None	

Note: Previous accidents refer to past accidents the aircraft was involved in, when relevant to this accident.

Engine 1:

Manufacturer/Model	Lycoming I0-320-B1A
Serial Number	L-1488-55A
Part Number	10-51360-37
Hours Since New	10373.15
Hours Since Overhaul	1071.95

Propeller 1:

Manufacturer/Model	Hartzell/ HC-EZYL-2BSF
Serial Number	BG4467
Part Number	F7663-4
Hours Since New	6116.8
Hours Since Overhaul	1120.30

Engine 2:

Manufacturer/Model	Lycoming I0-320-B1A
Serial Number	L-3516-55A
Part Number	10-51360-37
Hours Since New	10373.15
Hours Since Overhaul	1414.12

Propeller 2:

Manufacturer/Model	Hartzell/ HC-EZYL-2BSF
Serial Number	BG4478
Part Number	F7663-4
Hours Since New	6262.17
Hours Since Overhaul	1120.34

1.6.2 The aircraft was registered to the current owner on 8 March 2007. According to the technical logbook (TL 36), at the time of the accident the aircraft had accrued approximately 10 390.07 total airframe hours. The last 50-hour mandatory periodic inspection (MPI) was conducted on 20 October 2022 at 10 373.15 airframe hours. The aircraft was flown a total of 16.92 airframe hours since the last MPI. The aircraft was reissued a Certificate of Release to Service (CRS) on 26 August 2022 with an expiry date of 25 August 2023 or at 10 395.84 airframe hours, whichever occurs first.

1.6.3 The filed flight plan stated the fuel endurance of 5 hours. Before this flight, the pilot communicated with ATCO that the aircraft had a fuel endurance of 5.5 hours. The total time from the start of the flight to the crash was approximately 45 minutes (this includes the three circuits and the flight leg leading to the crash). The aircraft's total fuel capacity is 90 United States (US) gallons (341 litres) with 5.8 gallons (22 litres) unusable fuel; which means that at full capacity, the aircraft would have 319 litres of usable fuel and an endurance of 7 hours. There was no fuel in the aircraft after the accident, and no evidence of fuel spillage at the accident site.

1.6.4 Evidence found on the flight authorisation sheet dated 13 January 2023 with booking number #131866 for the previous flight (authorised by the accident flight instructor) under mass and balance section indicated that the total fuel was 229 pounds, which equated to 38.2 gallons of fuel; and the flight time was 2.3 hours which translated to 26.8 gallons of fuel used on that flight. As there was no evidence of the aircraft being refuelled after this flight, the accident flight was initiated with 11.4 gallons of fuel on-board with an endurance of approximately 50 minutes of flight time.

1.6.5 The fuel requirement stipulated in the CAR 2011 Part 91, subpart 7:

Source: Part 91
Civil Aviation Regulations, 2011
General Aviation and Operating Flight Rules
SUBPART 7:

91.07.12 *(1) A pilot-in-command of an aircraft shall not commence a flight unless he or she is satisfied that the aircraft is carrying sufficient amount of usable fuel and sufficient oil to complete the planned flight safely and to allow for deviations from the planned operation.*
(2) The pilot-in-command shall ensure that the amount of useable fuel to be carried shall, as a minimum, be based on—

(a) the following data—

(i)current aircraft-specific data derived from a fuel consumption monitoring system, if available; or
(ii)if current aircraft-specific data is not available, data provided by the aeroplane manufacturer; and

(b) the operator conditions for the planned flight including—

(i)anticipated aeroplane mass;
(ii)notices to Airmen;
(iii)current meteorological reports or a combination of current reports and forecasts;
(iv)air traffic services procedures, restrictions and anticipated delays; and
(v)the effects of deferred maintenance items and/or configuration deviations.
(3) The pre-flight calculation of usable fuel required shall include—

(a) Taxi fuel, which shall be the amount of fuel expected to be consumed before take-off; taking into account local conditions at the departure aerodrome and auxiliary power unit (APU) fuel consumption;

(b) Trip fuel, Which shall be the amount of fuel required to enable the aeroplane to fly from take-off or the point of in-flight re-planning until landing at the destination aerodrome taking into account the operating conditions of paragraph (b) of sub-regulation 91.07.12 (2);

(c) Contingency fuel, which shall be the amount of fuel required to compensate for unforeseen factors. It shall be 5 per cent of the planned trip fuel or of the fuel required from the point of in-flight re-planning based on the consumption rate used to plan the trip fuel but in any case shall, in the case of aeroplanes, shall not be lower than the amount required to fly for 5 minutes at holding speed at 1 500 ft above the destination aerodrome in standard conditions;

Note.*—Unforeseen factors are those factors that could have an influence on the fuel consumption to the destination aerodrome, such as deviations of an individual aeroplane from the expected fuel consumption data, deviations from forecast meteorological conditions, extended delays.*

(c) Destination alternate fuel, which shall be—

(i) where a destination alternate aerodrome is required, the amount of fuel required to enable the aeroplane to—
(aa) perform a missed approach at the destination aerodrome;
(bb) climb to the expected cruising altitude;
(cc) fly the expected routing;
(dd)descend to the point where expected approach is initiated; and

(ee) conduct the approach and landing at the destination alternate aerodrome; or

(ii)where two destination alternate aerodromes are required, the amount of fuel, as calculated in sub-regulation 91.07.12 (3), required to enable the aeroplane to proceed to the destination alternate aerodrome which requires the greater amount of alternate fuel; or
(iii)where a flight is operated without a destination alternate aerodrome, the amount of fuel required to enable the aeroplane to fly for 15 minutes at holding speed at 1 500 ft above the destination aerodrome elevation in standard conditions; or
(iv)Where the aerodrome of intended landing is an isolated aerodrome—
(aa) for a reciprocating engine aeroplane, the amount of fuel required to fly for 45 minutes plus 15 per cent of the flight time planned to be spent at cruising level, including final reserve fuel, or two hours, whichever is less; or
(bb) for a turbine engine aeroplane, the amount of fuel required to fly for two hours at normal cruise consumption above the destination aerodrome, including final reserve fuel;

(e) Final reserve fuel, which shall be the amount of fuel calculated using the estimated mass on arrival at the destination alternate aerodrome or the destination aerodrome, when no destination alternate aerodrome is required—
(i)for a reciprocating engine aeroplane, the amount of fuel required to fly for 45 minutes, under speed and altitude conditions specified by the Director;
(ii)for a turbine engine aeroplane, the amount of fuel required to fly for 30 minutes at holding speed at 1 500 ft above aerodrome elevation in standard conditions;

(f) Additional fuel, which shall be the supplementary amount of fuel required if the minimum fuel calculated in accordance with sub-regulations 91.07.12 (a), (b), (c), (d) or (e) is not sufficient to—
(i)allow the aeroplane to descend as necessary and proceed to an alternate aerodrome in the event of engine failure or loss of pressurisation, whichever requires the greater amount of fuel based on the assumption that such a failure occurs at the most critical point along the route;
(aa) fly for 15 minutes at holding speed at 1 500 ft above aerodrome elevation in standard conditions; and
(bb) Make an approach and landing;

(ii)allow an aeroplane engaged in EDTO to comply with the EDTO critical fuel scenario as established by
the Director.
(iii)meet additional requirements not covered above;

(g) Discretionary fuel, which shall be the extra amount of fuel to be carried at the discretion of the pilot-in-command.
(4) Operators shall determine one final reserve fuel value for each aeroplane type and variant owned or operated rounded up to an easily recalled figure.
(5) An aeroplane shall not take off or continue from the point of in-flight re-planning unless the usable fuel on board meets the requirements prescribed in paragraphs (b), (d), (e) or (f) of sub-regulation 91.07.12 (3), if applicable.
(6) The pilot-in-command shall continually ensure that the amount of usable fuel remaining on board is not less than the fuel required to proceed to an aerodrome where a safe landing can be made with the planned final reserve fuel remaining upon landing.

(6A) The use of fuel after flight commencement for purposes other than originally intended during pre-flight planning shall require a re-analysis and, if applicable, adjustment of the planned operation.

***Note**.—Guidance on procedures for in-flight fuel management including re-analysis, adjustment and/or re-planning considerations when a flight begins to consume contingency fuel before take-off is contained in the In-Flight Fuel Management TGM on the CAA website.*

(7) The pilot-in-command shall request delay information from ATC when unanticipated circumstances may result in landing at the destination aerodrome with less than the final reserve fuel plus any fuel required to proceed to an alternate aerodrome or the fuel required to operate to an isolated aerodrome.

(8) The pilot-in-command shall advise ATC of a minimum fuel state by declaring MINIMUM FUEL when, having committed to land at a specific aerodrome, the pilot calculates that any change to the existing clearance to that aerodrome may result in landing with less than planned final reserve fuel.

***Note.**—The declaration of MINIMUM FUEL informs ATC that all planned aerodrome options have been reduced to a specific aerodrome of intended landing and any change to the existing clearance may result in landing with less than the planned final reserve fuel. This is not an emergency situation but an indication that an emergency situation is possible should any additional delay occur.*

(9) The pilot-in-command shall declare a situation of fuel emergency by broadcasting MAYDAY MAYDAY MAYDAY FUEL, when the calculated usable fuel predicted to be available upon landing at the nearest aerodrome where a safe landing can be made is less than the planned final reserve fuel.

(10) Notwithstanding the provisions in paragraphs (a), (b), (c), (d), and (f) of sub-regulation 91.07.12(3), the Director may, based on the results of a specific safety risk assessment conducted by the operator which demonstrates how an equivalent level of safety will be maintained, approve variations to the pre-flight fuel calculation of taxi fuel, trip fuel, contingency fuel, destination alternate fuel, and additional fuel. The specific safety risk assessment shall include at least the—

(a) flight fuel calculations;

(b) capabilities of the operator include—

(aa) a data-driven method that includes a fuel consumption monitoring programme; and/or

(bb) The advanced use of alternate aerodromes; and

(c) specific mitigation measures.

1.7. Meteorological Information

1.7.1. The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS), recorded at Johannesburg Botanical Gardens (FAJB) on 15 January 2023 at 0600Z. FAJB is located 10 kilometres from the accident site.

Wind Direction	030°	Wind Speed	02 kt	Visibility	9999 m
Temperature	20°C	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	0°C	QNH	1025 hPa		

1.8. Aids to Navigation

1.8.1. The aircraft was equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no records indicating that the navigational equipment was unserviceable prior to the flight.

1.9. Communication

1.9.1. The aircraft was equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system prior to the flight.

1.10. Aerodrome Information

1.10.1. The accident did not occur at or near an aerodrome. The accident occurred during daylight at Crown Mines dump site at GPS position determined to be 26°14’05.5’’ South and 027°58’24.0’’ East, at an elevation of 5600 ft. The nearest airfield to the accident site is Rand Airport (FAGM).

Aerodrome Location	Rand Airport (FAGM), Gauteng Province
Aerodrome Status	Licensed
Aerodrome GPS coordinates	26°14'31" South, 028°09'05" East.
Aerodrome Elevation	5 483 Feet
Runway Headings	11/29 ; 17/35
Dimensions of Runway Used	1343 m x 20 m
Heading of Runway Used	N/A
Surface of Runway Used	N/A
Approach Facilities	None
Radio Frequency	118.7 MHz

1.11. Flight Recorders

1.11.1. The aircraft was neither equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by regulation to be fitted to the aircraft type.

1.12. Wreckage and Impact Information

1.12.1. The aircraft struck the ground at a high speed at the mine dump site in Crown Mines, located south-west of Johannesburg central business district (CBD). The aircraft impacted the ground with its left-side and bounced approximately 4 metres, it then hit the ground the second time and bounced again approximately 6 metres. It finally impacted a hillock and flipped over. Fragments of the left engine were found scattered on the hillock. A piece of the left-wing tip was found approximately 4 metres on the left side of the main wreckage.

1.12.2. The pilot's body was found approximately 2 metres from the wreckage, whilst the flight instructor's body was found under the wreckage. The aircraft was crushed from the midsection to the nose section.

1.12.3. The left main gear and the nose gear were found in an extended position, whilst the right main gear was in a retracted position. The landing gears were found selected to the "down" position. The rudder and the right elevator were still intact whilst the left elevator was bent towards the tip. The flight controls (rudder and the elevator) were checked for movement, which was confirmed. Also, the cables were checked for continuity, and they were found to be intact with damage attributed to the accident impact forces.

Figure 4: The wreckage post-accident.

1.12.4 During the on-site inspection of the instrument panels, both the left-side engine magneto switches were in the 'off' position and the instrument indications were damaged by impact forces.

Figure 5: The cockpit instrument with the left-side magneto switch in the 'off' position.

Figure 6: The damaged instruments.

1.12.5 Following the accident, the aircraft console's:

- Left- and right-side engine power levers were towards the "closed" position.
- Left- and right-side propeller levers were feathered.
- Left- and right-side mixture control levers were at full rich.
- Levers were bent and hard to move (forward or backward).

Figure 7: The console showing the position of the power levers.

1.12.6 During the on-site examination of the engines, the right-side engine was still intact with no impact damage, whilst the left-side engine was damaged on impact with the ground. Both engines' crankshafts were rotated by hand, and they turned freely with evidence of compression. There was a significant oil leak from both engines which was attributed to the impact forces.

1.12.7 The inspection of the airframe, engine and propeller indicated that there was no pre-impact failure, and all damage was attributed to the impact forces. The propeller damage had minimal rotation force during impact, indicative of no significant engine power. Both engines were subjected to a teardown inspection and no anomalies were noted.

Figure 8: The bent propellers.

1.12.8 The right tank switch was in the “auxiliary” (Aux) position whilst the left tank switch was in the “off” position. The aircraft’s main fuel bladder tanks had raptured, and some fuel leaked to the ground. The exact fuel contents leak could not be determined. There was no indication of fuel pooling around the accident site.

Figure 9: The raptured fuel tank bladder and the right main gear in a retracted position.

1.13. Medical and Pathological Information

1.13.1 The medical and pathological reports were still outstanding at the time of completion of this report. However, should any of the results have a bearing on the circumstances leading to this accident, they will be treated as new evidence which will necessitate the re-opening of this investigation.

1.14. Fire

1.14.1. There was no evidence of a pre- or post-impact fire.

1.15. Survival Aspects

1.15 The accident was considered not survivable due to damage in the cockpit and cabin area.

1.16. Tests and Research

1.16.1. The aircraft engines were taken in for a teardown inspection on 3 February 2023 in the presence of the AIID investigators, and no anomalies relating to the overall mechanical functionality of the engine were noted from engine components. The report determined that the engines were not turning at the time of impact; all damage to the engines was as a result of the accident, and the cause of the engines not operating could not be determined.

1.17. Organisational and Management Information

1.17.1. The flight was conducted in accordance with the provisions of Part 141 of the CAR 2011 as amended.

1.17.2. The ATO had an approved ATO operation certificate that was issued on 1 November 2021 with an expiry date of 31 October 2026. The ATO certificate was issued in terms of Part 141 of the CAR 2011 as amended. The ATO also had an approved operations manual.

1.17.3. The aircraft was maintained by an approved aircraft maintenance organisation (AMO). The AMO's certificate was issued on 12 July 2022 with an expiry date of 31 July 2023.

1.18. Additional Information

1.18.1. None.

1.19. Useful or Effective Investigation Techniques

1.19.1. None.

2. ANALYSIS

2.1. General

From the available evidence, the following analysis was made with respect to this accident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2. Analysis

2.2.1. Both the instructor pilot and the pilot were licensed and had the correct ratings to conduct the flight; the licences and ratings were still valid (not expired) at the time of the flight. The instructor pilot had a Class 1 medical certificate and the pilot had a Class 2 medical certificates.

2.2.2. Records indicated that the aircraft was properly maintained in accordance with the regulation and the manufacturer's prescriptions, and it was in an airworthy condition.

2.2.3. Records indicated that the ATO and the AMO had the correct approvals with all appropriate ratings and could operate within the scope of their approvals.

2.2.4. It was noted from the filed flight plan that the pilots misrepresented the fuel endurance before the flight and during communication with the ATC that the aircraft had a fuel endurance of 5.5 hours. The aircraft's fuel capacity is 341 litres with 22 litres being unusable; this translates to 319 litres of usable fuel and an endurance of 7 hours.

2.2.5 Evidence found on the flight authorisation sheet dated 13 January 2023 with booking number #131866 for the previous flight (authorised by the accident flight instructor) under mass and balance section indicated that the total fuel was 229 pounds which equates to 38.2 US gallons and the flight time was 2.3 hours; this translates to 26.8 US gallons of fuel used during the flight. As there was no evidence of the aircraft being refuelled after this flight, the accident flight was initiated with 11.4 US gallons of fuel on-board with an endurance of approximately 50 minutes of flight time. The total time from the start of the flight to the crash was approximately 45 minutes (this includes the three circuits and the flight leg leading to the crash), consistent with the remaining 11.4 gallons from the previous flight. There was no fuel remaining in the aircraft post-accident and there was no evidence of fuel spillage at the accident site; therefore, engine stoppage was as a result of fuel exhaustion.

2.2.6 It is probable that the flight instructor, with the knowledge that the aircraft was not refuelled following the flight he authorised as stated in paragraph 2.2.5, deviated from the submitted flight plan and elected to conduct touch-and-go landings at FAGC before routing to the Johannesburg South GFA.

2.2.7 The accident may have been avoided if a thorough flight planning and pre-flight had been conducted as it would have shown that the fuel on-board was insufficient for the flight planned and/or the elected flight. The flight was undertaken with insufficient fuel on-board for the planned flight which resulted in in-flight stoppage of both engines and the subsequent loss of control and a crash.

3. CONCLUSION

3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this accident. These shall not be read as apportioning blame or liability to any organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusion heading:

- **Findings —** are statements of all significant conditions, events, or circumstances in this accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this accident.
- **Contributing factors —** are actions, omissions, events, conditions or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident occurring, or would have mitigated the severity of the consequences of the accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

3.2. Findings

3.2.1. The Grade II instructor was initially issued a Commercial Pilot Licence (CPL) on 20 August 2020. His last validation was conducted on 10 July 2022, on which the licence was issued with an expiry date of 31 July 2023. The Piper PA-30 aircraft was endorsed on his licence. The instructor was issued a Class I aviation medical certificate on 25 July 2022 with an expiry date of 31 July 2023.

3.2.2. The pilot was initially issued a Private Pilot Licence (PPL) on 1 May 2022 with an expiry date of 31 May 2023. The Piper PA-30 aircraft was not endorsed on his licence. His Class II aviation medical certificate was issued on 1 May 2022 with an expiry date of 31 May 2023.

3.2.3. The flight was conducted in daylight under visual flight rules (VFR) and under visual meteorological conditions (VMC) in accordance with the provisions of Part 141 of the CAR 2011 as amended. Fine weather conditions prevailed at the time of the flight.

3.2.4. The ATO had an approved ATO Certificate that was issued on 1 November 2021 with an expiry date of 31 October 2026.

3.2.5. The aircraft was maintained by an approved AMO with a valid certificate that was issued by the Regulator on 12 July 2022 with an expiry date of 31 July 2023.

3.2.6. The aircraft engines teardown report did not reveal any anomalies with the engines prior to the accident flight; all damage to the engines was as a result of the accident.

3.2.7. The flight was undertaken with insufficient fuel on-board for the planned flight which resulted in in-flight stoppage of both engines and the subsequent loss of control and a crash.

3.2.8. The failure to conform to Regulation Part 91.07.12.

3.2.9. It is probable that the flight instructor, with the knowledge that the aircraft was not refuelled following the flight he authorised as stated in paragraph 2.2.5, deviated from the submitted flight plan and elected to conduct touch-and-go landings at FAGC before routing to Johannesburg South GFA.

3.3. Probable Cause/s

3.3.1. The aircraft was operated with insufficient fuel on-board which led to an in-flight engine stoppage of both engines due to fuel exhaustion, resulting in the loss of control and a crash.

3.4. Contributory Factor/s

3.4.1. Inadequate flight planning and pre-flight check.

3.4.2. Lack of verification by the instructor.

4. SAFETY RECOMMENDATIONS

4.1. General

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report. The AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisations.

4.2. Safety Recommendation/s

4.2.1. In the interest of safety and to prevent injury and damage to property, ATO's and Instructors must ensure that the information entered into the flight authorisation sheet, flight plan and information communicated to ATC is correct for the flight intended.

5. APPENDICES

5.1. Appendix 1: Flight authorisation sheet.

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

Flight authorisation sheet

Flight Training Services

The next generation of pilot and flight crew training

Tel +27 (0)11 805 9015 Fax +27 (0)11 805 9018
Email info@fts.co.za
Web http://www.fts.co.za

I036034
Booking #131866

FLIGHT AUTHORISATION

ATO Number CAA/0284

DATE 13-01-2023

Pilot	Subash Pandey () Weeping Willow
Signature	_____

In signing this do[illegible] edges that the flight recorded herein is undertaken strictly [illegible] to Flight Training Services constitution and rules and th[illegible]rned by the indemnity and disclaimer accepted by the pilot in his application for membership / renewal thereof.

12280

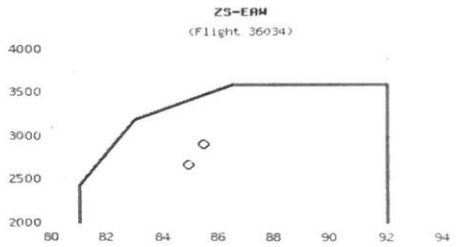
Aircraft	ZS-EAW
Start Time	0254Z
Aircraft Hours	H: 136.9, T: 10388.11
Destination	FAGC-FALA-FAPN-FAGC
Exercise	EX-19,23

Membership	Training (expires on 2023-02-01)
Licence	0275509860 (PPL) expires on 2023-03-04

Instructor	Arian Assad 0272577537
Instruction Type	Dual
Payment Method	School
Flight Type	Other (e.g.Hire and fly)
Signature:	

Station	Mass (lb)	Arm (in)	Moment (lb.in)
Basic Empty Mass	2387	84.66	202135
Student	132	84.80	11194
Instructor	154	84.80	13059
Fuel	229	91.78	21023
Baggage Rear Baggage	11	142.00	1562
Ramp Weight	**2913**	**85.45**	**248974**

FAGC METARNo data
FAGC TAFNo data



Only persons authorised in terms of the rules of the Flight Training Services may hire aircraft. All aircraft operations shall be conducted in accordance with these rules and Civil Aviation Regulations.

NO PASSENGERS

Hobbs Start: 136.9
Hobbs End : 139.2
Flight Time : 2.3
Tacho Time: 2350.09

Pilot signature after flight: