AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:			CA18/2/3/9891	
Aircraft Registration	**ZS-EBC**	**Date of Accident**	30 June 2020		**Time of Accident**	1048Z	
Type of Aircraft	Piper PA-28-180 Cherokee		**Type of Operation**		Training (Part 141)		
Pilot-in-command Licence Type	Student Pilot Licence		**Age**	16	**Licence Valid**	Yes	
Pilot-in-command Flying Experience	**Total Flying Hours**		24.14		**Hours on Type**	24.14	
Last Point of Departure	Wonderboom Aerodrome (FAWB), Gauteng Province						
Next Point of Intended Landing	Wonderboom Aerodrome (FAWB), Gauteng Province						
Damage to Aircraft	Destroyed						

Location of the accident site with reference to easily defined geographical points (GPS readings if possible)

On a ploughed field behind Pretoria University Faculty of Veterinary Science Campus at GPS co-ordinates determined to be S25° 38' 55.5" E28° 10' 30.7" at an elevation of approximately 3991 feet above mean sea level (AMSL)

Meteorological Information	Wind direction: 090°; Wind speed: 08 knots; Temperature: 19°C; Dew point: -02ºC; Visibility: 9999m; QNH:1028hPa						
Number of People On-board	1 + 0	**Number of People Injured**	0	**Number of People Killed**	1	**Other (On Ground)**	0

Synopsis

On Tuesday, 30 June 2020, a student pilot on-board a Piper PA-28-180 Cherokee aircraft with registration mark ZS-EBC took off from Wonderboom Aerodrome (FAWB) Runway 11 on a solo-consolidation circuit training flight. The weather conditions at the time of the flight were in accordance with (IAW) visual flight rules (VFR) by day with clear skies. Before the accident flight, the student pilot had completed a pre-solo consolidation circuit training check flight with a Grade III flight instructor and was considered proficient to continue with the exercise after completing three circuits. Thereafter, the instructor had reviewed the weather conditions, which he found to be suitable for the student pilot to continue with the exercise before authorising the flight which was planned to include three circuit patterns. The accident occurred during the second circuit on finals for Runway 11. The aircraft was destroyed by impact and post-impact fire that erupted, and the student pilot was fatally injured. Post-accident examination of the wreckage did not reveal any signs of airframe failure, flight controls problem, loss of engine power or in-flight fire.

Probable Cause/s

The investigation revealed that the aircraft flew an extended base leg and passed the extended centreline of Runway 11. To get the aircraft to the final approach path, the student pilot executed a steeper than normal turn and the aircraft entered into a torque roll, descending left spiral. To recover the aircraft from that condition, the student pilot applied more power which resulted in a high-speed turn, increasing the left-wing bank angle from which she lost control; this was followed by an impact with the ground.

Contributing Factor

The student pilot's lack of experience.

SRP Date	19 January 2021	Publication Date	4 February 2021

ABBREVIATION	DESCRIPTION
AGL	Above Ground Level
AI	Attitude Indicator
AIID	Accident and Incident Investigations Division
AIP	Aeronautical Information Publication
ALT	Altimeter
AMO	Aircraft Maintenance Organisation
AMSL	Above Mean Sea Level
ARFF	Aircraft Rescue and Fire Fighting Team
ASI	Air Speed Indicator
ATO	Air Training Organisation
C of A	Certificate of Airworthiness
C of G	Centre of Gravity
C of R	Certificate of Registration
CAVOK	Ceiling and Visibility OK
CFI	Chief Flight Instructor
CoT	City of Tshwane
CVR	Cockpit Voice Recorder
ELT	Emergency Locator Transmitter
EMS	Emergency Medical Services
FAA	Federal Aviation Administration
FAWB	Wonderboom Aerodrome
FDR	Flight Data Recorder
FI	Flight Instructor
HI	Heading Indicator
HP	Horse Power
IAW	In Accordance With
Lbs	Pounds
LL	Low Lead
MPH	Miles per Hour
MPI	Mandatory Periodic Inspection
NM	Nautical Miles
PF	Pilot Flying
PPL	Private Pilot Licence
PTT	Press to Talk
SACAA	South African Civil Aviation Authority
SAPS	South African Police Services
SAWS	South African Weather Service
SPL	Student Pilot Licence
TCDC	Type Certificate Data Sheet
USA	United States of America
VA	Design Manoeuvring Speed
VFR	Visual Flight Rules
VHF	Very High Frequency
VSI	Vertical Speed Indicator

Reference Number	**:** CA18/2/3/9891
Name of Owner/Operator	**:** Professional Flight Centre
Manufacturer	**:** Piper Aircraft Corporation
Model	**:** Piper PA-28-180 Cherokee
Nationality	**:** South African
Registration Marks	**:** ZS-EBC
Place	**:** A farm behind Pretoria University Faculty of Veterinary Science Campus
Date	**:** 30 June 2020
Time	**:** 1048Z

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 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**.

Investigations Process:

The accident was notified to the Accident and Incident Investigations Division (AIID) on 30 June 2020 at approximately 1048Z. The investigators were dispatched to the accident site on the same day. The investigators co-ordinated with all authorities on site by initiating the accident investigation process according to CAR Part 12 and investigation procedures. The AIID of the South African Civil Aviation Authority (SACAA) is leading the investigation as the Republic of South Africa (RSA) is the State of Occurrence.

Notes:

1. Whenever the following words are mentioned in this report, they shall mean the following:

- *Accident – this investigated accident*
- *Aircraft – a Piper PA-28-180 Cherokee 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 be adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report are limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows or lines.

Disclaimer:

This report is produced without prejudice to the rights of AIID, which are reserved.

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On Tuesday, 30 June 2020, the student pilot and a Grade III flight instructor (FI) reported at the flight school situated in Wonderboom Aerodrome (FAWB) to prepare for a dual pre-solo consolidation circuit training flight. The weather at the time of the flight was in accordance with (IAW) visual flight rules (VFR) with clear skies. The wind was light at 08 knots and the temperature was 19°C. According to the instructor, they had conducted a short pre-flight briefing first, and the student pilot had acknowledged the proposed training plan and instructions before the pre-flight inspection was carried out on the aircraft, a Piper PA-28-180 Cherokee, with registration mark ZS-EBC. The aircraft was airworthy with no defects recorded. The student pilot was the pilot flying (PF) and the instructor was the pilot monitoring (PM). The student pilot had previously flown several circuits at FAWB and was familiar with the circuit patterns and procedures.

1.1.2 According to the school flight authorisation sheet entry dated 30 June 2020, 64 litres of Avgas low lead (LL) 100 fuel was uplifted to the aircraft's aluminium tanks, totalling 136 litres (216 lbs) on-board. After signing for fuel uplift, the student pilot had started the engine and requested taxi for a circuit flight with two persons on-board, which was approved. The aircraft was taxied IAW air traffic control (ATC) instruction to holding point Alpha before being cleared to line up on Runway 11. After the aircraft was cleared to line up and take-off, the student pilot selected the first notch of flaps "10 degrees", opened the throttle and accelerated at 60 miles per hour (mph). The aircraft rotated and climbed to the circuit altitude, which is 1000 feet above ground level (AGL) and at about 85 miles per hour (mph) from where two touch-and-go landings were performed. The instructor was satisfied with the student pilot's handling of the aircraft. Before a full stop landing in the third circuit, the instructor had assessed the weather conditions, which he found to be suitable for the student pilot to continue with the exercise on her own.

1.1.3 The student pilot landed safely, and the aircraft was taxied to the aerodrome terminal building where the instructor disembarked. Thereafter, the student pilot taxied the aircraft back to Runway 11, where after, she took off and completed one circuit. The accident occurred during the second circuit on a farm behind the Pretoria University Faculty of Veterinary Science Campus after turning finals for Runway 11, about 2.4 nautical miles (nm) west of FAWB. According to the controller who was on duty at the time, at 10:48:56Z, the ZS-EBC aircraft made an unreadable transmission on 118.35 megahertz (MHz) frequency. The aircraft was expected to be on base, turning final approach Runway 11. The controller kept on instructing ZS-EBC aircraft to continue approach Runway 11, but without success. Traffic on the downwind saw black smoke and notified the controller. The crash alarm was activated by ATC and the Airport Rescue and Fire-Fighting (ARFF) personnel responded to the scene and eventually extinguished the fire. The South African Police Service (SAPS) and the City of Tshwane (CoT) Emergency Medical Services (EMS) were notified of the accident. There were no casualties on ground, only damage to property as a result of the aircraft impacting the ground and the subsequent fire that erupted thereafter. The aircraft was destroyed, and the student pilot

was fatally injured.

1.1.4 The first eyewitness who was driving in a car on the Onderstepoort Road near the accident site reported that he saw a small “red and white” single engine aircraft approaching from the west. The aircraft then executed a left turn at a height of about 100 feet AGL before the left wing suddenly dropped; the aircraft descended towards the ground in a spiral (illustrated in Figure 1). The witness brought his car to a stop on the side of the road and watched the aircraft until it disappeared from his view. The next thing he heard were the high engine revolutions, followed by the high-impact sound and black smoke emerging from behind the university buildings which he had just seen the aircraft fly over before disappearing from sight.

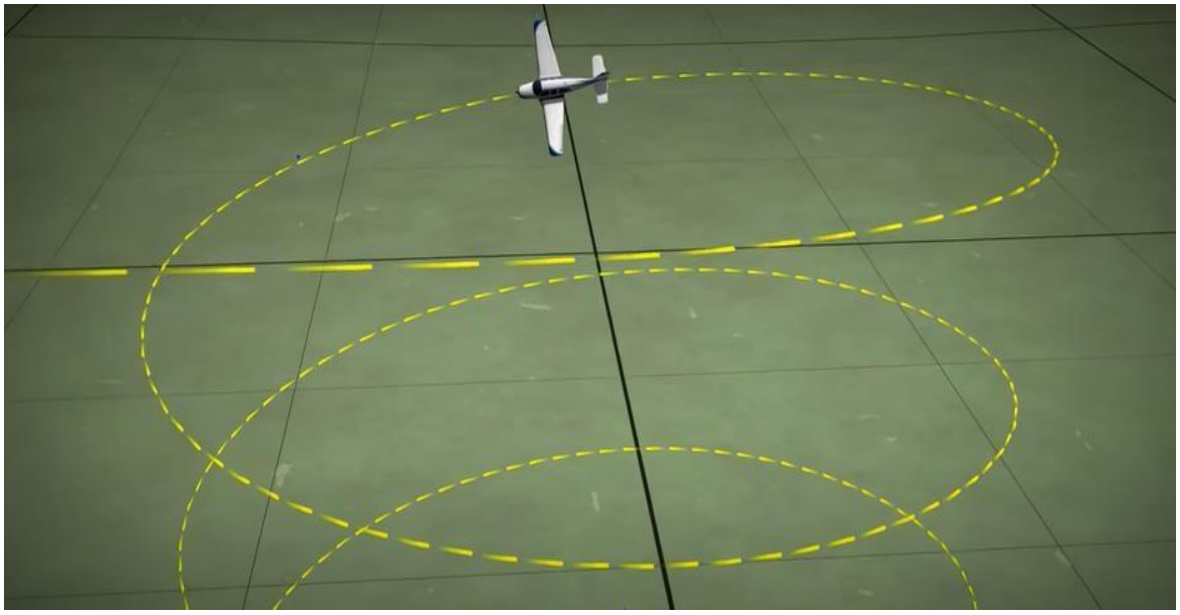


Figure 1: An illustration of a spiral. (Source: https://protectza.mimecast.com/s/LaopCAnXyBiN497vUGSx8e)

1.1.5 The second eyewitness, a business owner in the Onderstepoort area, reported that the first time he saw the aircraft was when it was flying very low before making a left turn behind the university buildings. From where he stood, the aircraft’s wings were not level; the left wing was low and the right one was high. The witness reported that the aircraft was so low he could clearly see every detail on it whilst rapidly losing height and shaking. The aircraft disappeared from his view before impacting the ground. He reported that the next thing he saw were flames and black smoke emerging from behind the university buildings.

1.1.6 The third eyewitness, a Grade III flight instructor who was also in the circuit with a student pilot on a Piper PA-28-140 Cherokee aircraft with registration mark ZS-JTO, reported that the circuit was not busy around noon and the weather conditions were ceiling and visibility OK (CAVOK). According to his observation when he first saw the accident aircraft, the wind was blowing from the north-east at about 10 knots and they were flying on the left downwind for Runway 11, east of Bon Accord Dam. The accident aircraft was ahead of them on mid-left extended base leg at about 4600 feet above mean sea level (AMSL), west of Bon Accord Dam for Runway 11. Everything appeared normal. He reported that his attention was more on

his student pilot and his checks when he heard a radio transmission which was unclear.

1.1.7 The third eyewitness then looked for the ZS-EBC aircraft ahead of them, which should have been turning final approach by that time. He spotted the ZS-EBC aircraft on his *10 o'clock* position (left side) turning 90 degrees to the left, away from the final approach path. The ZS-EBC aircraft was flying wings level for a short time towards Bon Accord Dam and was descending. Seconds later, he heard a distress call with the following statement: "I'm losing control". The aircraft then banked towards the left and spiralled towards the ground. It struck the ground in a left-bank and nose-down attitude at a high speed; fire erupted thereafter. The third witness instantly notified FAWB control tower of the accident and his student pilot aligned the aircraft on Runway 11 where after a successful full stop landing was carried out.

1.1.8 The fourth eyewitness, a student pilot who was with her instructor on a Cessna 172M aircraft with registration mark ZS-PMW at the holding point of Runway 11 at FAWB at the time of the accident reported that they had seen the accident aircraft (ZS-EBC) on base leg turning final approach for Runway 11. The student pilot on-board radioed: "I'm losing control", to which the controller responded by giving the standard instructions for landing. After the instructions from ATC, the student pilot radioed again but was inaudible. They then saw the aircraft spiralling towards the ground at an "unimaginable speed". According to the fourth eyewitness, there was a black cloud of smoke as soon as the aircraft hit the ground. Her instructor instantly notified the controller about the accident. The controller then asked for details such as the flight school she was in and if they knew to whom the aircraft belonged.

1.1.9 The fourth eyewitness and her instructor conveyed all the details needed to the controller and asked if they could assist by identifying the exact location of the accident site. At that time, the location of the accident site was unclear. The controller then contacted EMS and notified them of the accident. The fourth eyewitness' instructor then took control of the aircraft and proceeded with take-off to try and identify the precise location where the aircraft had crashed. A few minutes later, they located the accident site. There was fire and smoke at the accident scene and the aircraft had shattered into pieces. They then assisted by providing information such as which roads could be used to access the accident scene. The fourth eyewitness' instructor continued circling the accident scene to locate the ZS-EBC student pilot. As soon as the emergency vehicles arrived at the accident scene, they returned to FAWB. (Refer to Appendix C for reported traffic at FAWB around the time of the accident).

1.1.10 The aircraft was operated under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.11 The accident occurred on a ploughed field during daylight at Global Positioning System (GPS) co-ordinates determined to be S25° 38' 55.5" E28° 10' 30.7" at an elevation of approximately 3991 feet AMSL.

Figure 2: A map showing the accident site and Runway 11 at FAWB. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	1	-	-	1	
Serious	-	-	-	-	
Minor	-	-	-	-	
None	-	-	-	-	
Total	1	-	-	1	

1.3. Damage to Aircraft

1.3.1 The aircraft was destroyed during the accident sequence.

Figure 3: The wreckage at the accident site after the fire was extinguished.

1.4. Other Damage

1.4.1 The farmer estimated that 400 bales of Teff Hay were destroyed in the fire.

*NOTE: Hay is grass that has been cut and dried to be stored for use as animal food. It is usually fed to animals in winter months or during times when drought or other harsh environmental conditions make pasture unavailable.

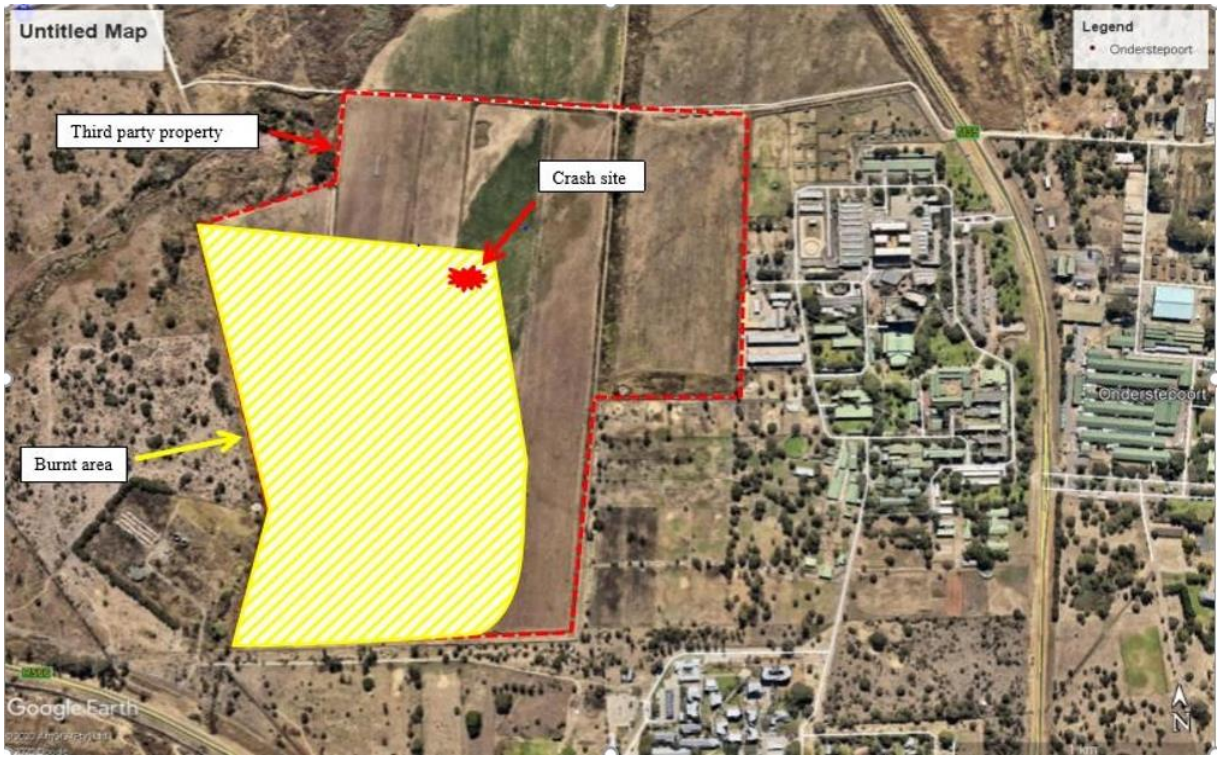


Figure 4: A map showing the accident site/burnt area and the farmer's property. (Source: Google Earth)

Figures 5/6: Bales of hay that survived the fire (left) and some that were burnt (right).

1.5. Personnel Information (Student Pilot):

Nationality	South African	Gender	Female	Age	16
Licence Number	0275501251	Licence Type	Student Pilot Licence		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Nil				
Medical Issue Date	11 September 2019				
Medical Expiry Date	30 September 2024				
Restrictions	Nil				
Previous Accidents	None				

Flying Experience:

Total Hours	24.14
Total Past 90 Days	11
Total on Type Past 90 Days	11
Total on Type	24.14

1.5.1 The hours reflected in the table (above) were obtained from the student pilot's logbook that was made available to the AIID. The last entry in the logbook was dated 29 June 2020. The student pilot had accumulated a total of 24.14 hours at the time of the accident. A total of 11 hours was flown from 2 June 2020 after South Africa COVID-19 lockdown regulations were relaxed from Alert Level 4 to Level 3 until the time of the accident flight.

1.5.2 According to available information, the student pilot had a Student Pilot Licence (SPL) issued on 23 October 2019, with an expiry date of 22 October 2020. She also had a Class 2 aviation medical certificate with no restrictions, issued by the South African Civil Aviation Authority (SACAA) on 11 September 2019, with an expiry date of 30 September 2024. Track record of the student pilot's training file showed that she had passed a technical examination of the aircraft she chose to be trained on, a Piper PA-28-180 Cherokee. Included in the file were airspace rules and procedures for the student pilot's home aerodrome, as well as flight characteristics and operational limitations of the aircraft. These included an introduction on steep turns, stalls, forced landing without engine power, navigation and spiral dive recoveries. The student pilot's performance on all the above-mentioned exercises were described in her training records as satisfactory, and neither of the instructors who conducted the most recent dual instruction identified any performance weakness that would have affected the safety of her training.

1.5.3 On Wednesday, 24 June 2020, the student pilot was recommended by the instructor (Grade III) to be tested for her initial solo flight. Her flight skills were also described to be satisfactory. In addition, the student pilot showed a satisfactory level of situational awareness, aviation safety and airmanship. During this period, she had accumulated 20.3 hours of dual flight training and she had passed all the prescribed Private Pilot Licence (PPL) examinations required for solo flights. Her initial solo flight was conducted on Friday, 26 June 2020, at 20.3 hours. The take-off, which was followed by flying a standard pattern visually to self-position for an approach and landing was successfully completed.

1.5.4 Her dual-check on the day (26 June 2020) was carried out by a Grade II chief flight instructor (CFI) IAW privileges outlined in Part 61.13.5(1) of the SACAA Regulations. Four uneventful circuits were flown. The CFI was satisfied with her flying skills on the day and had approved her initial solo. The CFI then disembarked the aircraft and the student pilot went solo and flew one circuit followed by a successful landing on Runway 11.

1.5.5 On Monday, 29 June 2020, the student pilot flew four circuits under the supervision of the instructor (Grade III). The instructor was satisfied with her performance before allowing her first solo consolidation flight. The student pilot flew five circuits alone, followed by an uneventful full stop landing on Runway 11. The following day on 30 June 2020, the student pilot again flew three circuits under the supervision of the instructor. The instructor was satisfied with her performance and allowed her to continue with the exercise after a full stop landing on Runway 11. The instructor had authorised the flight IAW his privileges as outlined in Part 61.12.5(1) of the SACAA Regulations. The accident occurred on the second circuit on short final for Runway 11.

Flight Instructor (Grade III):

Nationality	South African	Gender	Male	Age	37
Licence Number	0272552084	License Type	Commercial Pilot Licence		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instruments Rating: Grade III Flight Instructor				
Medical Issue Date	11 June 2020				
Medical Expiry Date	30 June 2021				
Restrictions	Nil				
Previous Accidents	None				

Flying Experience:

Total Hours	498.93
Total Past 90 Days	10.3
Total on Type Past 90 Days	5.8
Total on Type	67.22

1.5.6 The hours reflected in the table (above) were obtained from the instructor during the investigation. The instructor had a Commercial Pilot Licence (PPL), as well as a Class 1 aviation medical certificate which was issued on 11 June 2020 with an expiry date of 30 June 2021. His medical certificate had no restrictions. The instructor had a valid Flight Instructor's (FI) rating, which authorised him to provide flying training on small single-engine aircraft including a Piper PA-28-180 Cherokee type. His last competency test was carried out on 19 June 2020. He had accumulated about 22 hours of dual flight with the student pilot. He had the following aircraft endorsed on his licence: Cessna 172 Skyhawk, Cessna 177RG Cardinal and Piper Series aircraft, which are single and twin-engine light aircraft.

Air Traffic Controller:

Nationality	South African	Gender	Male	Age	39
Licence Number	0856	Licence Type	Air Traffic Services Licence		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Aerodrome Controller				
Medical Expiry Date	31 October 2021				
Restrictions	Nil				
Previous Accidents	Nil				

1.5.7 The ATC on duty had signed on for his shift at 0745Z. He was in possession of a valid Class 3 aviation medical certificate that was issued on 23 April 2018 with an expiry date of 31 October 2021. His last proficiency check was carried out on 8 June 2019 with an expiry date of 19 July 2020. He had a valid Air Traffic Services (ATS) licence and was certified to provide aerodrome control duties at FAWB. His main responsibility was to control the use of the runways. Other responsibilities included regulating the number of aircraft operating concurrently, issuing clearances for non-standard operations and providing, where practicable and necessary, collision risk alerting service to aircraft in the circuit pattern.

1.6. Aircraft Information

1.6.1 The Piper PA-28-180 Cherokee is a four-seat, single-engine, low-wing aircraft fitted with a fixed tricycle landing gear manufactured by Piper Aircraft Corporation in the United States of America (USA). The aircraft was designed for flight training and for personal use. The aircraft type is powered by a four-cylinder Lycoming O-360-A30 engine rated at 180 horsepower (HP) at 2700 revolutions per minute (RPM) driving a two-bladed Sensenich 76EM855-0-60 fixed pitch propeller made from a one-piece alloy forging. The throttle on the aircraft is of a push-pull type and is located on the lower centre of the instrument panel. A knurled friction lock provided prevents it from creeping from any desired position. 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 (rudder, elevators and ailerons).

Figure 7: The ZS-EBC aircraft. (Source: https://www.jetphotos.com)

1.6.2 The instrument panel on the aircraft is designed to accommodate the customary advanced flight instruments and the normally required power plant instruments. The artificial horizon and directional gyro are vacuum-operated through use of a vacuum pump installed on the engine, while the turn and bank instrument is electrically operated. The aircraft has two 25 US gallons (300 lbs – 298 lbs useable) fuel tanks which equate to 189 litres of fuel secured to the leading-edge structure of each wing by screws and nut plates.

Type	PA-28-180 Cherokee	
Serial Number	28-1520	
Manufacturer	Piper Aircraft Corporation	
Year of Manufacture	1963	
Total Airframe Hours (At time of Accident)	5840.9	
Last MPI (Hours & Date)	5804.7	26 November 2019
Hours Since Last MPI	36.2	
C of A (Issue Date)	17 November 2017	
C of A (Expiry Date)	30 November 2020	
C of R (Issue Date) (Present owner)	16 October 2017	
Operating Categories	Part 141	
Recommended Fuel Used	Avgas LL 100	

1.6.3 Previous accidents/incidents:

According to available records, on 16 March 1999, the ZS-EBC aircraft's nose landing gear collapsed during the landing phase at 5421.59 recorded total airframe hours. The propeller blades and the fire wall were damaged during the incident. The fire-wall was repaired, and the engine was subjected to a shock-load inspection and overhaul. A new propeller was fitted to the engine crankshaft flange. The task was carried out by a SACAA-approved maintenance organisation (AMO) 85; the aircraft was returned to service on 4 August 2008.

Engine:

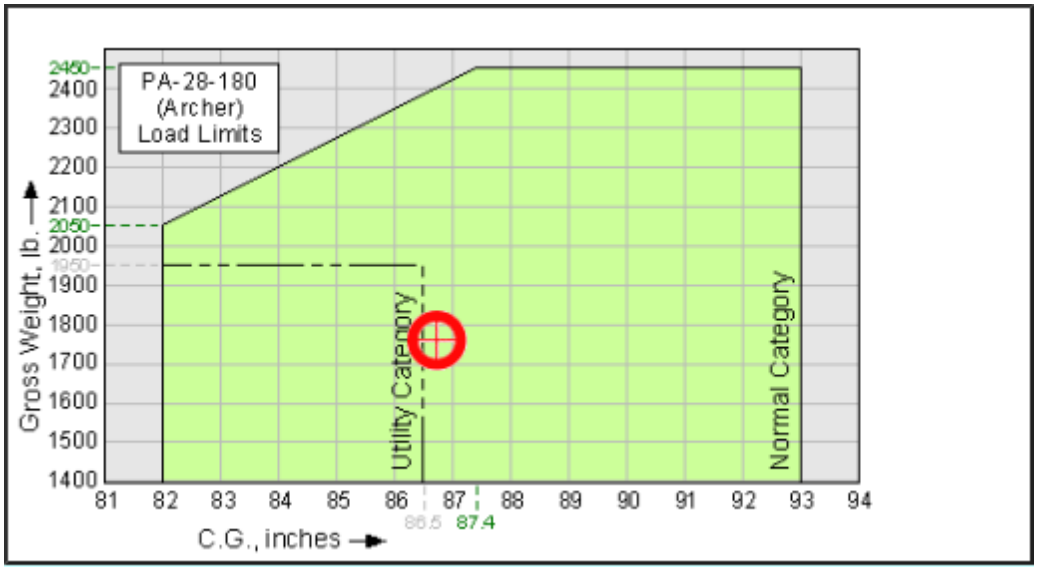
Type	Lycoming O-360-A30
Serial Number	L-6678-36
Hours Since New	5804.7
Hours Since Overhaul	1287.7

Propeller:

Type	Sensenich 76EM855-O-60
Serial Number	39 160K
Hours Since New	383.11
Hours Since Overhaul	Not Reached

1.6.4 Weight and Balance Calculation:

Piper PA-28-180	Weight (lbs)	Arm (inches)	Moment (lbs-inches)
Aircraft Empty Weight	1438.1	86.7	124683
7 Quarts of Oil	12	27.5	337
Pilot (Front Seat)	145	80.5	11673
Fuel (50 US Gallons Max)	162	95	15390
Rear Seat L & R	0	118.1	0
Baggage (200 lbs Max)	5	142.8	714
Operating Empty Weight	**1762**	**86.7**	**152797**



1.6.5 The maximum take-off weight of this aircraft, according to the Pilot Operating Handbook (POH), is 2 400 pounds (lbs). According to the last weight and balance calculation carried out on 23 August 2017, the aircraft's empty weight was 1438.1 lbs. The total fuel capacity for this aircraft type is 50 US gallons (300 lbs/189 litres). The aircraft burns or consumes 10 US gallons of fuel per hour. Due to the severity of the accident impact, both fuel tanks were destroyed, and it was not possible to retrieve any fuel post-accident. However, during the one-on-one interview with the student pilot's flight instructor at the flight school, he indicated that the aircraft burned 54 lbs (9 US gallons) of Avgas LL 100 fuel during the earlier check-flight (assuming normal fuel burn from taxi to take-off and subsequent three circuits that were flown) and 162 lbs (24.2 US gallons/92 litres) remained in the tanks prior to the student pilot's undertaking of a solo consolidation flight. According to post-accident weight and balance calculations, the aircraft was within the allowable weight category and centre of gravity (C of G) for the intended flight.

1.7. Meteorological Information

1.7.1 An official weather report was obtained from the South African Weather Service (SAWS) for the day and time of the accident. The satellite image taken on the day indicated no low-level turbulence around Onderstepoort area with clear skies, including Wonderboom Aerodrome.

1.7.2 Surface data:

The Meteorological Aeronautical Report (Metar) recorded at FAWB for the day and time of the accident is included (see Figure 8) and contains the following weather variables:

Wind direction	090º	Wind speed	08kts	Visibility
Temperature	19ºC	Cloud cover	Nil	Cloud base
Dew point	-02ºC	QNH	1028hPa	

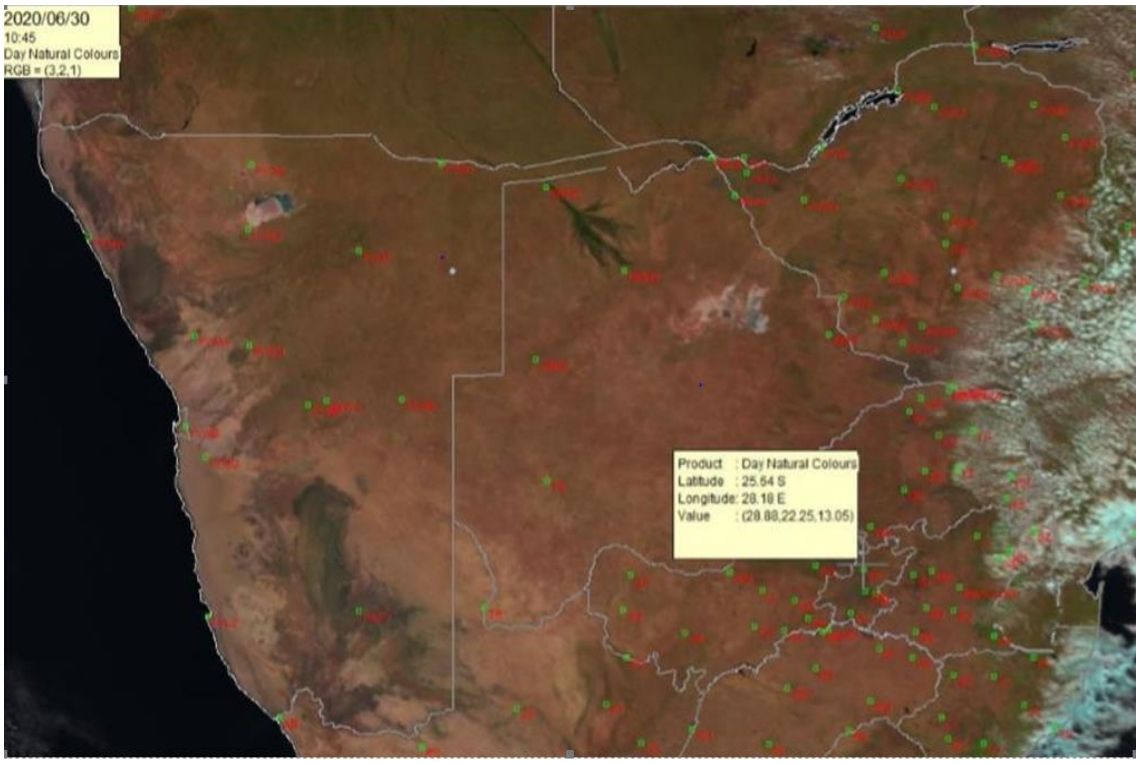


Figure 8: Satellite image indicated clear skies.

1.8. Aids to Navigation

1.8.1 The aircraft was equipped with standard navigation equipment as approved by the Regulator (SACAA) for the aircraft type. There were no recorded defects with the navigation equipment prior to the flight.

1.9. Communication

1.9.1 The aircraft was equipped with standard communication equipment as approved by the Regulator for the aircraft type. There were no recorded defects with the communication equipment prior to the accident flight. The student pilot had broadcast a distress call prior to the aircraft impacting the ground.

1.9.2 Some witnesses from aircraft that were in the circuit or in proximity to the circuit stated that they had heard the ZS-EBC student pilot stating: “I’m losing control”; but from the recorded transmission, that transmission was not audible and the reason for that is because Very High Frequency (VHF) works with line of sight. If the aircraft that was making the transmission was not visible or in line of sight to the recipient (FAWB ATC), that transmission will not be audible; however, it would be audible to any receiver (any aircraft) within line of sight. The other reason for the transmission not being audible would be if the person pushing the Push-to-Talk (PTT) button does not push/depress the button deep enough; the transmission may be intermittent or broken and would not be clearly received. A transcript of all communications between the student pilot and FAWB control tower on VHF 118.35 MHz is attached as Appendix A.

1.10. Aerodrome Information

1.10.1 The accident occurred approximately 2nm west of FAWB at GPS co-ordinates determined to be S25° 38’ 55.5” E28° 10’ 30.7” 3991 feet AMSL. Below is the aerodrome information and the standard training circuit pattern.

Aerodrome Location	Wonderboom (FAWB)	
Aerodrome Co-ordinates	S25º 39’ 19.11” E28º 13’ 16.81”	
Aerodrome Elevation	4 095 feet AMSL	
Runway Dimensions	5997 x 98 feet and 4200 x 72 feet	
Runway Designations	11/29	06/24
Runway Used	11	
Runway Surface	Asphalt	
Aerodrome Status	Licensed	
Approach Facilities	Runway lighting, VOR, DME and PAPI’s	

Figure 9: A map showing the standard training circuit pattern (blue colour) at FAWB, Runway 11. The red line shows the approximate flight path of ZS-EBC aircraft. (Source: Google Earth)

1.10.2 The above circuit pattern was set-up and designed IAW the International Civil Aviation Organisation (ICAO) standard procedure for the circuit pattern. The procedures are as follows:

I. Take-off and climb out on the runway to 500ft AGL or altitude required for the aerodrome.

II. Crosswind left-hand turn is initiated at 500ft AGL and is flown perpendicular route from the runway axis whilst climbing to 1000ft above the aerodrome elevation.

III. Downwind turn is initiated when the aircraft is positioned at 45° to the upwind threshold. Downwind leg is flown parallel to the runway in use, not converging or diverging towards or away from the runway, also not following a line feature or some obscure reference point.

IV. Base leg turn is initiated when the aircraft is positioned at 45° to the downwind or landing threshold, descending to about 500ft AGL. Traffic to base is flown perpendicular to the runway in use, again, not following a line feature or reference point. First stage of flaps is lowered to reduce airspeed for the required rate of descent.

V. In the final approach leg, you start a continuous descent above the extended centreline until touchdown.

1.11. Flight Recorders

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

1.12 Wreckage and Impact Information

1.12.1 The accident occurred on a privately-owned farm situated behind the Pretoria University campus in the Onderstepoort area at 230° magnetic heading. The main wreckage came to rest approximately 98.8 metres from the first point of impact. The furthest item of the wreckage was the nose landing gear wheel assembly, which had travelled about 128m from the initial impact point. The main wreckage indicated no signs of in-flight break-up. The wreckage was contained in one area and exhibited severe structural damage consistent with high-speed impact. The single cabin entry door, located on the right-side of the aircraft, suffered impact damage and fire. However, it was noticed that part of the door frame which contained double latches engagement slot was damaged in a manner that suggested that the door had burst open during the accident sequence. Examination of the accident site showed that the aircraft was in a left-wing low nose-down attitude when it hit the ground. The aircraft skidded for approximately 4 metres (m) after impact, leaving a shallow impression made by the forward edge of the bottom cockpit area and the propeller.

1.12.2 The aircraft cart-wheeled and, during the process, the left-wing outboard section had broken off before the aircraft came to rest approximately 65m from the main wreckage. The left fuel tank had raptured, and the fuel ignited, setting alight the main wreckage and a portion of the ploughed field. The cockpit Plexi-glass windshield had shattered during the accident sequence, and the engine top cowling had separated and came to rest next to the outboard left-wing section. The engine had detached from the cradle and was found next to the wreckage. Three propeller blades slash marks were noticed on the soft ground at the first point of impact.

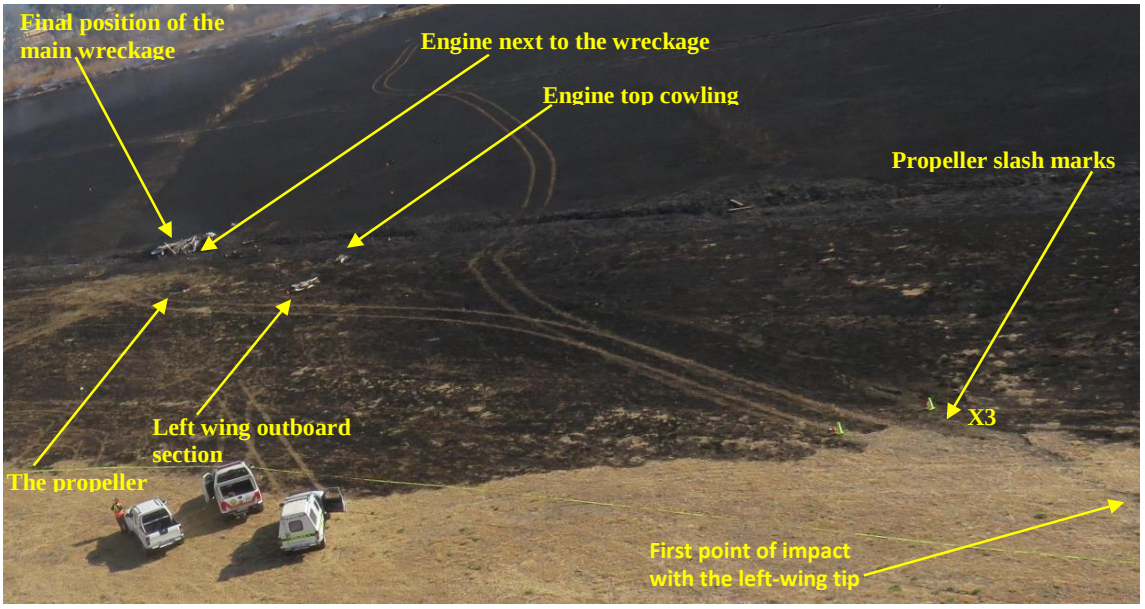


Figure 10: An aerial view of the accident site.

1.12.3 Next to the blades slash (grooves) marks were the aircraft seat rails from the left pilot seat floor. The propeller had separated from the engine crankshaft (drive shaft) flange and was found next to the main wreckage, about 12m to the left. One blade was bent aft from the shank to the tip, and the other was twisted.

1.12.4 Examination of the propeller/blades, the broken drive shaft and impact marks on the soft ground indicated that the engine was producing a large amount of power at the time of impact – the amount of power sheared off the drive shaft.

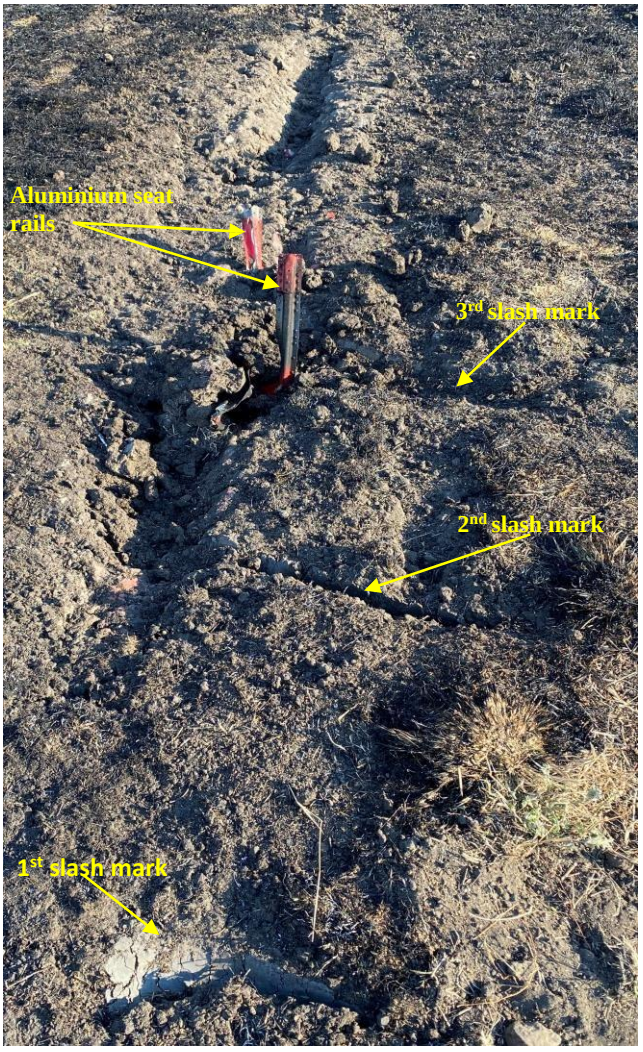


Figure 11: Blades slash marks and the seat rails.

Figures 12/13: The propeller (left) and the crankshaft flange (right).

1.12.5 The fire had destroyed the cockpit/cabin interior furnishings including seat cushions, seatbelts, wall coverings and floor carpets. All six main flight instruments, the engine instruments and the radio had burnt and got detached from their respective mounting points. The flight instrument panel surface was examined for witness marks of any needle positions at the time of impact; no reliable marks were found. The position of the power lever and the mixture control lever could not be determined due to the extent of damage. The position of the fuel selector could not be confirmed due to the fire damage. The circuit breaker panel had burnt with a majority of breakers fractured. The aircraft's avionics had burnt and got detached from their mounting brackets.

Figure 14: Burnt cockpit/cabin.

1.12.6 The flying controls surface sustained varying degrees of damage during the accident sequence. Both ailerons were still attached to the wings pivot points, however, the left aileron had separated from its control inputs rods. The right-wing aileron control rod and bellcrank were intact and moved freely through their full range when examined. The rudder control cables had dislodged from their fuselage support pulleys but were continuous and correctly attached to the damaged rudder pedal mechanisms. The left and right rudder pedal assemblies were severely disrupted during the accident, and the pedal "reach set" by the pilot could not be determined. The rudder was correctly attached and moved freely through its full range when examined. The elevators were still attached and moved freely through their respective range when examined. Despite the fuselage fracture, the elevator push rods and linkages were intact, had full continuity and operated in their full range when examined. The horizontal stabiliser was in a position corresponding to neutral trim. The flaps were found in a retracted (UP) position as supposed to a partial landing configuration (second notch "25 degrees) to decrease speed and height in a controlled manner.

Figures 15/16: The left-wing outboard section (left) and the right-wing flap still in retracted position (right).

1.13 Medical and Pathological Information

1.13.1 A preliminary post-mortem examination of the student pilot was carried out by the pathologists. They found no sign of pre-existing medical condition which might have contributed to the accident. The student pilot was reported to have been in good health and a pathological report revealed that she succumbed to her injuries from multiple blunt forces during the accident.

1.14 Fire

1.14.1 There was no report or evidence of an in-flight aircraft fire. A severe post-impact fire torched the aircraft wreckage. The fire had consumed the entire fuselage and the cockpit/cabin area. There was sufficient fuel remaining on-board the aircraft for more than two-and-half hours when the solo consolidation flight commenced. The ignition source could not be established although there was enough impact-related disruption to the electrical system to have caused arcing at some point during the impact sequence. The fuel could also have ignited from contact with a heat source in the engine.

1.15 Survival Aspects

1.15.1 The accident was considered not survivable due to the high kinetic energy associated with the impact that was well above that of human tolerance.

1.16 Tests and Research

1.16.1 After the aircraft was recovered from the accident site, the engine, a Lycoming O-360-A30 Serial No. L-6678-36 was transported to the engine overhaul facility at FAWB where it was subjected to a teardown examination in the presence of the investigator-in-charge (IIC). The engine showed no evidence of any pre-impact airflow restrictions. The engine ignition systems, which consisted of two magnetos, ignition wiring harnesses and spark plugs, were visually examined and bench-tested for continuity, and the electrodes on them were normal. The carburettor and the engine starter had detached from the engine after impact. The engine was disassembled, and no physical damage was found inside. The carburettor and the alternator could not be tested due to impact damage. The engine-driven fuel pump was removed and inspected, and the pump was found to be in good condition.

1.16.2 The accessory housing was removed and the internal bolt on oil pump assembly was examined. Oil was evident throughout the pump body. The oil cooler, bypass valve and oil pump together with its drive gears were serviceable, and all filter screens and oil galleries throughout the crankcase and crankshaft were found free from obstruction. The oil pressure relief valve was also examined and found to be correctly installed and serviceable. The engine oil filter was cut open and the filter mat inspected; no evidence of metal particles was observed. Piston rings were free and rotating in all piston ring channels and some cylinders still showed the machined barrel surface cross hatch marks from the original cylinder machining with minimum barrel wear. The pistons exhibited no signs of detonation and had normal combustion signatures on the piston heads. The intake and exhaust valve heads were good. Dimensions of the engine crankshaft, counterweights, counterweight bushings, and counterweight pins and plates were measured and checked and found to be within the engine manufacturer's new parts limits. This indicated a very high degree of engine balancing that was performed on the engine.

1.16.3 Hydraulic lifters, engine gears, camshaft and all internal engine bearings were in good condition. No pitting or corrosion was found on the engine camshaft or hydraulic lifter assemblies. No corrosion or pitting was observed on the engine gears. The valve rocker arms were in good condition with no wear indications and smooth rocker tip machined surfaces were found to be in good condition. Dimension of all internal engine parts were measured and found to be within the original manufacturer's new parts limits listed under the engine overhaul manual. Connecting rods were all in good condition with no signs of wear, fretting or misalignment. Examination and testing of the engine components and accessories did not identify any evidence of mechanical malfunction or significant defects that would have prevented normal engine operation.

1.16.4 The fractured engine crankshaft/driveshaft that was noted at the accident site was an indication that the engine was developing a large amount of power at impact and that the internal

components were in good condition. The exact amount of engine power was undetermined due to the absence of a flight data recorder (FDR). According to the type certificate data sheet (TCDC), the maximum permissible take-off engine revolutions per minute (RPM) is 2 475 and for all other operations the maximum permissible RPM is 2 700. Experts opinion indicated that the engine was operating at approximately 2 400 RPM at the time of impact.

1.16.5 No fuel was available for testing at the accident site, however, the fuel test report from the service provider dated 30 June 2020 indicated the following: fuel density — 0.713; temperature — 22°C; density correction — -0.0017 and 0.7147; batch density — 0.7146 and difference (1) — (2) ± good. The test results revealed that the fuel uplifted to the aircraft prior to the flight was the correct grade and was free from contamination.

1.16.6 According to the latest Lycoming service instruction No.1009BE dated 24 April 2020, time between overhaul (TBO) periods for Lycoming O-360-A30 engine model is 2000 hours or 12 years, whichever comes first. The engine was operated within the manufacturer's recommended TBO schedule.

Figure 17: The aircraft engine.

1.17 Organisational and Management Information

1.17.1 This was a training flight (Part 141).

1.17.2 The training school had a valid aviation training organisation (ATO) certificate issued by the Regulator on 1 January 2018 with an expiry date of 31 December 2022.

1.17.3 The training school had complied with South Africa's COVID-19 lockdown regulations and had commenced with flying activities when the regulations were relaxed from Alert Level 4 to Level 3 on 1 June 2020.

1.17.4 The student pilot was trained and assessed by two instructors at various stages of her training. Both instructors had valid licences and the required instructor ratings to carry out training.

1.17.5 The last 100-hour Mandatory Periodic Inspection (MPI) on the aircraft was completed on 26 November 2019 at 5804.7 tachometer hours. The aircraft was maintained by the AMO No 0278. The AMO certificate was issued by the Regulator on 28 August 2019 with an expiry of 31 August 2020.

1.17.6 Examination of a 100-hour maintenance work pack, job card No PA 00763, indicated that all applicable recurring Service Bulletins (SBs) and Airworthiness Directives (ADs) were complied with as recommended by the aircraft manufacturer.

1.17.7 The Certificate of Release to Service was issued on 27 November 2019 and lapses at 5904.70 tachometer hours when the next inspection is due or on 27 November 2020, whichever occurs first, unless the aircraft is involved in an accident or becomes unserviceable, in which case the certificate is invalid for the duration of the period.

1.17.8 The FAWB ARFF team had dispatched to the accident site timeously and they were able to extinguish the fire.

1.18 Additional Information

1.18.1 *Requirements for a Student Pilot Licence (SPL) – (Source: SACAA Regulations 2011)*

61.02.1 An applicant for a SPL shall –

(a) be 15 years or older, except where provided otherwise in Part 62; (b) hold a valid Class 1 or 2 medical certificate issued in terms of Part 67; (c) be registered with an approved aviation training organisation for training towards a PPL.

Application for a SPL

61.02.2 The application for a SPL must be made to the Director on the appropriate prescribed form, and must be accompanied by – (a) an original or certified proof of the identity of the applicant; (b) proof of the age of the applicant; (c) a valid Class 1 or Class 2 medical certificate issued in terms of Part 67;

(d) the appropriate aircraft by name on which training will be conducted, provided that in the case of helicopters, that the student pilot will be restricted to two types of aircraft; (e) two recent passport-size photographs of the applicant; and (f) the appropriate fee as prescribed in Part 187.

Issuing of a SPL

61.02.3 (1) The Director shall issue a SPL in the appropriate prescribed form, as by the Director, if the applicant complies with the requirements referred to in regulation 61.02.2.

(2) Upon receipt of the SPL, the holder must immediately affix his or her signature thereon in ink in the space provided for such purpose.

Validity of a SPL
61.02.4 (1) A SPL is valid for a period of 2 years from the date of issue, provided the annual currency fees are paid.

(2) The holder of a valid SPL may not exercise the privileges of that license unless he or she – (a) is in the possession of a valid Class 1 or Class 2 medical certificate, issued to him or her in terms of Part 67; and (b) has submitted a copy of the medical certificate to the licensing authority, as required in regulation 61.01.6(6), in the event that the aviation medical examiner

is unable to submit electronic data to the Director.

Privileges and limitations of SPL

61.02.5 *(1) The holder of a valid SPL may only fly solo as prescribed in Document SA-CATS 61 for the purpose of training for the applicable pilot license –*

(a) *in the type of aircraft in which he or she is undergoing training as endorsed in his or her logbook;*

(b) *after a prior written authorisation thereto for a flight, or a sequence of flights, as prescribed in the relevant curriculum and all such flights are under the supervision of the holder of an appropriate and valid flight instructor rating, or a person appointed by the Chief Flying Instructor, provided that such person is the holder of at least a PPL.*

(c) *without carrying any passengers; (d) on a flight other than an international flight; and (e) in VMC by day.*

1.18.2 Privileges and limitations of a valid Grade II Aeroplane Flight Instructor Rating

61.13.5 (1) The holder of a valid Grade II Aeroplane Flight Instructor Rating may, with due regard to the provisions of sub-regulation (2), exercise all the privileges of a Grade III Aeroplane Flight Instructor, and may in addition in respect of aeroplanes of which he or she is the holder of the appropriate class or type ratings as flight instructor –

(a) authorise the holder of a SPL for his or her initial solo flight;

(b) conduct the training for all aeroplane class and type ratings;

(c) conduct training in a turbine-engine aeroplane, provided he or she is the holder of the turbine instructor rating endorsement;

(d) conduct the training for a CPL (Aeroplane);

(e) conduct the training for an ATPL (Aeroplane), provided that he or she is the holder of an ATPL (Aeroplane);

(f) conduct the training for an instrument rating, provided he or she is the holder of an instrument flight training endorsement

1.18.3 *Privileges and Limitations of the holder of valid Grade III Flight Instructor Rating (Aeroplane)*

61.12.5 (1) A Grade III Flight Instructor (Aeroplane) may give ground or flight instruction only under the supervision of the holder of a valid Grade I or Grade II Flight Instructor Rating (Aeroplane).

(2) A Grade III Flight Instructor (Aeroplane) may, subject to sub-regulations (1) and (3), give instruction as limited by the endorsements in his or her logbook or license, towards – (a) the issue of a SPL;

(b) the issue or revalidation of a PPL;

(c) familiarization and differences training;

(d) the issue of a night rating;

(e) the issue of an instrument rating;

(f) the issue of a multi-engine piston class rating

1.18.4 In the South African CARs 2011, solo and dual instruction flight time are defined as:

- ***Solo flight** means flight time during which the pilot is the sole occupant of the aircraft and in which there is no other person present in the aircraft, be it an instructor, a safety pilot, another pilot or any other passenger.*
- ***Dual instruction time**, in terms of flight training, means flight time during which a person is receiving flight instruction from a properly authorised pilot on-board the aircraft.*

1.18.5 Definition of a spiral. Source: The Federal Aviation Administration Airplane Flying Handbook (Chapters 4– 23):

A spiral is a descending turn during which airspeed and G-load can increase rapidly and often results from a botched turn. In a spiral dive, the airplane is flying very tight circles, in a nearly vertical attitude, and will be accelerating because it is no longer stalled. Below are instrument indications of the aircraft in a spiral.

- *Increasing airspeed*
- *Attitude indicator showing nose below the horizon*
- *Loss of altitude*
- *Turn co-ordinator showing a full deflection in the direction of the dive*
- *Heading indicator changing*
- *Vertical speed indicator showing a rapid descent*

Figure 18: An example of the instrument panel of an aircraft in a spiral.
Source: (http://www.studyflight.com/spiral)

1.18.6 *Spiral recovery:*

In order to exit the spiral, engine power needs to be reduced. The next step requires the wings to be rolled level and a gentle climb should be commenced to exit the dive. Once the aircraft is in a climbing attitude and the airspeed is in the safe band, power can be reapplied. Caution must be taken during the recovery process not to abruptly correct the dive. An abrupt correction may overstress the aircraft or cause a high-speed stall.

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 particular organisation or individual.

2.2 Analysis

2.2.1 The official weather report obtained from the SAWS for the day and time of the accident indicated no low-level turbulence with clear skies around Onderstepoort area, including FAWB. FAWB is a licensed manned aerodrome and Runway 11, which is a left-hand circuit, was in use at the time. The controller on duty at the time was in possession of a valid Class 3 aviation medical certificate that was issued on 23 April 2018 with an expiry date of 31 October 2021. There were no recorded defects with the communication equipment prior to the flight. The student pilot had broadcast a distress call prior to the aircraft impacting the ground.

2.2.2 The last 100-hour MPI on the aircraft was completed on 26 November 2019 at 5804.7 hours. The AMO that maintained the aircraft held a valid AMO certificate No 0278. Examination of the aircraft's last maintenance work pack indicated that the AMO had complied with all the applicable aircraft/engine ADs and SBs as recommended by the manufacturer. The aircraft Certificate of Release to Service was issued on 27 November 2019. The aircraft Certificate of Airworthiness (C of A) and Certificate of Registration (C of R) were both valid. There was sufficient fuel remaining on-board the aircraft for more than two-and-half hours when the solo consolidation flight commenced. The student pilot had completed three circuits with a Grade III flight instructor prior to the accident flight. According to the flight instructor, the student pilot had demonstrated a satisfactory standard of ability in the operation of the aircraft, sufficient to be allowed to continue with the exercise on her own.

2.2.3 Examination of the flight instructor's (Grade III) records indicated that he had a valid Class 1 aviation medical certificate, which was issued on 11 June 2020 with an expiry date of 30 June 2021. The instructor also had a valid flying instructor's rating, which intitled him to conduct flying training on small single-engine aircraft, including the type of aircraft operated on the day of the

accident. His last competency test was carried out on 19 June 2020. He had accumulated about 22 hours of dual flight with the student pilot. Examination of the student pilot's records indicated that she had a valid SPL issued on 23 October 2019 with an expiry date of 22 October 2020. She also had a Class 2 aviation medical certificate with no restrictions, issued by the SACAA on 11 September 2019 with an expiry date of 30 September 2024. The student pilot's training file showed that she had passed a technical examination of the aircraft she chose to be trained on, a Piper PA-28-180 Cherokee. Included in the file were airspace rules and procedures for her home aerodrome, as well as flight characteristics and operational limitations of the aircraft before she was granted a solo flight. These included an introduction on steep turns, stalls, forced landing without power, navigation and spiral dive recoveries. The student pilot's performance on all the above-mentioned exercises was described in her training records as satisfactory.

2.2.4 Her initial solo flight was conducted on Friday, 26 June 2020 at 20.3 hours. Take-off which was then followed by flying a standard pattern visually to self-position for an approach and landing were successfully completed. Her dual-check on the day was carried out by the CFI - Grade II IAW privileges outlined in Part 61.13.5(1). Four uneventful circuits were flown. The CFI was satisfied with her flying skills on the day and approved her initial solo flight. The CFI disembarked the aircraft and the student pilot went solo and flew one circuit followed by a successful landing on Runway 11. On Monday, 29 June 2020, the student pilot flew four circuits under the supervision of the instructor (Grade III). The instructor was satisfied with her performance before allowing her the first solo consolidation flight. The student flew five circuits, followed by an uneventful full stop landing on Runway 11. The following day on 30 June 2020, the student pilot again flew three circuits under the supervision of the instructor. The instructor was satisfied with her performance and allowed her to continue with the exercise after a full stop landing on Runway 11. The accident occurred on the second circuit on short finals for Runway 11.

2.2.5 A review of all available medical records and reports revealed no indication of any pre-existing medical issue that would have adversely affected the student pilot's ability to control the aircraft. Post-mortem report indicated no sign of pre-existing medical condition which might have contributed to the accident. The aircraft flying controls surface sustained varying degrees of damage during the accident sequence. The empennage separated from the fuselage and the rudder and the elevators were still attached and moved freely through their full range. The right-wing aileron had continuity and operated freely. The engine teardown inspection did not reveal any pre-impact mechanical failure or conditions that would have prevented its normal operation. The crankshaft damage indicated that the engine was producing power on impact. The exact amount of engine power was undetermined due to the absence of the FDR. Experts opinion indicated that the engine was operating at approximately 2 400 RPM at the time of impact.

2.2.6 The investigation revealed that the aircraft flew an extended base leg and passed the extended centreline of Runway 11. To get the aircraft to the final approach path, the student pilot executed a steeper than normal turn and the aircraft entered into a torque roll, descending left spiral. To recover the aircraft from that condition, the student pilot had applied more power

which resulted in a high-speed turn, increasing the left-wing bank angle from which she lost control; this was followed by an impact with the ground.

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 particular 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 or incident occurring, or mitigated the severity of the consequences of the accident or incident. 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 student pilot was issued a SPL on 23 October 2019 with an expiry date of 22 October 2020. The student pilot's Class 2 aviation medical certificate was issued on 11 September 2019 with an expiry date of 30 September 2024 with no restrictions. The aircraft type was endorsed on the student pilot's licence. The student pilot's initial solo flight was conducted on 26 June 2020 at 20.3 hours total flight time.

3.2.2 The student pilot was authorised by her supervising flight instructor to conduct the solo consolidation flight following the three-circuit training conducted under the supervision of the flight instructor. The flight was conducted under the provisions of Part 141 of the CAR 2011 as amended. The student pilot's licence was issued IAW the provisions of Part 61 and Subpart 61.02.1 (a, b and c) 61.02.2 (b) and 61.02.5 (1) of the CAR 2011 as amended. The student pilot had accumulated 24.14 total flight hours using the same aircraft type at the time of accident. The student pilot flew a total of 11 hours in the last 90 days prior to the accident.

3.2.3 According to the school flight authorisation sheet entry dated 30 June 2020, 64 litres of Avgas LL 100 fuel was uplifted to the aircraft aluminium tanks to make a total of 216 lbs (136 litres). Following the accident, it was determined that the aircraft had enough fuel, correct grade and was free of contamination; and it was estimated to last two-and-half hours. The flight instructor

reported that the aircraft was airworthy with no defects recorded in the flight folio.

3.2.4 The weather at the time of the accident was as follows: Wind: 090° at 08kts, Visibility: 9999m, QNH: 1028hPa, Temperature: 19°C and Dew Point: -02°C. The weather conditions were fine and clear and there was no reported low-level turbulence.

3.2.5 The training school was issued an ATO certificate on 1 January 2018 with an expiry date of 31 December 2022.

3.2.6 The aircraft's Certificate of Airworthiness was issued on 17 November 2017 with an expiry date of 30 November 2020.

3.2.7 The aircraft was issued a Certificate of Registration on 16 October 2017.

3.2.8 The last 100-hour MPI on the aircraft was completed on 26 November 2019 at 5804.7 tachometer hours. The aircraft was maintained by the AMO No 0278. The AMO certificate was issued by the Regulator on 28 August 2019 with an expiry date of 31 August 2020.

3.2.9 Examination of a 100-hour maintenance work pack, job card No PA 00763, indicated that all applicable recurring SBs and ADs were complied with as recommended by the aircraft manufacturer.

3.2.10 The certificate of Release to Service was issued on 27 November 2019 with an expiry date of 27 November 2020 or at 5904.70 tachometer hours, whichever occurs first.

3.2.11 There were no reported failures recorded in the flight folio and no reported failures or emergency calls broadcasted by the student pilot prior to the accident. On-site investigation revealed no evidence of pre-existing failures with the aircraft and its systems, and all damages were attributed to the accident.

3.2.12 According to the post-accident weight and balance calculations, the accident aircraft was within the allowable weight category and centre of gravity (CG) limitations for the intended flight.

3.2.13 The aircraft flew an extended base leg and passed the extended centreline of Runway 11. To get the aircraft to the final approach path, the student pilot executed a steeper than normal turn and the aircraft entered into a torque roll, descending left spiral. To recover the aircraft from that condition, the student pilot had applied more power which resulted in a high-speed turn, increasing the left-wing bank angle from which she lost control; this was followed by an impact with the ground.

3.2.14 The farmer estimated that 400 bales of Teff Hay were destroyed in the fire.

3.3 Probable Cause/s

3.3.1 The aircraft flew an extended base leg and passed the extended centreline of Runway 11. To get the aircraft to the final approach path, the student pilot executed a steeper than normal turn and the aircraft entered into a torque roll, descending left spiral. To recover the aircraft from that condition, the student pilot had applied more power which resulted in a high-speed turn,

increasing the left-wing bank angle from which she lost control; this was followed by an impact with the ground.

3.4 Contributory Factors

3.4.1 Student pilot's lack of experience.

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 It is recommended to the Director of Civil Aviation, in consultation with flying training schools, to review and determine if the minimum hours/experience required for student pilots to be released for solo flying are still acceptable or if adjustment and more stringent measures are required. This follows two fatal accidents in which two students from two independent flying schools crashed within the first five (5) solo flights. In both occurrences, flying experience was a contributor to the cause of the fatal accident.

5. APPENDICES

5.1 Appendix A - Air traffic control transcript.

5.2 Appendix B – FAWB layout as per the Aeronautical Information Publication (AIP).

5.3 Appendix C - Graph showing traffic at FAWB airspace around the time of the accident.

5.4 Appendix D - Engine teardown inspection.

This report is issued by:

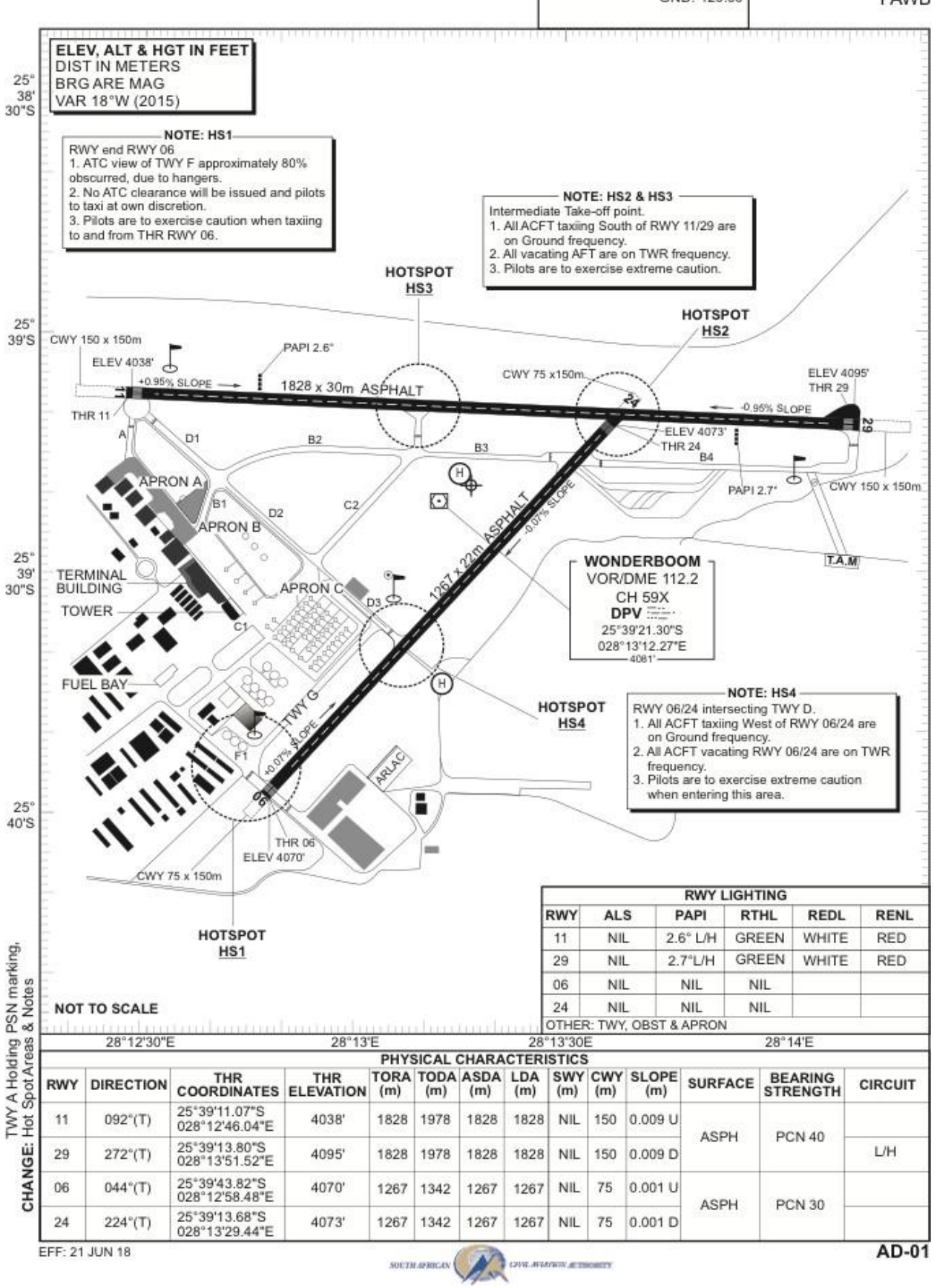
Accident and Incident Investigations
Division South African Civil Aviation
Authority Republic of South Africa

Appendix A - Air traffic control transcript

Time	From	To	Message
12:37:36	ZS-EBC	ATC	Echo Bravo Charlie left-hand downwind runway 11…
12:37:48	ATC	ZS-EBC	Echo Bravo Charlie report final approach runway 11 Echo Bravo Charlie…
12:37:56	ZS-EBC	ATC	Final approach runway 11 number one Echo Bravo Charlie
12:38:11	ATC	ZS-KUT	Kilo Uniform Tango and company wind 060 degrees 9 knots runway 11 cleared for take-off climb to 5500 feet report outbound…
12:38:19	ZS-KUT	ATC	Cleared for take-off runway 11, we will report 5500 feet Kilo Uniform Tango…
12:38:28	ZS-SHV	ATC	Sierra Hotel Victor outbound 124.4 speak to you returning…
12:38:30	ATC	ZS-SHV	Sierra Hotel Victor...
12:38:37	ZS-SPL	ATC	Sierra Papa Lima recovered, and we are on left downwind now for full stop…
12:38:41	ATC	ZS-SPL	Sierra Papa Lima copy the full stop, report final approach runway 11. You are number two, number one Cherokee over Benekot Quarry…
12:38:49	ZS-SPL	ATC	Copy the traffic and we'll report final approach runway 11 number two Sierra Papa Lima
12:39:05	ZS-JTO	ATC	Juliet Tango Oscar recovered…
12:39:08	ATC	ZS-JTO	Juliet Tango Oscar report final approach number three behind Cherokee on early downwind
12:39:11	ZS-JTO	ATC	Copy final approach runway 11 number three behind the traffic Juliet Tango Oscar…
12:39:14	ZS-RJJ	ATC	Romeo Juliet Juliet ready to cross one one…
12:39:17	ATC	ZS-RJJ	Romeo Juliet Juliet, standby…
12:39:24	ZS-OHW	ATC	Oscar Hotel Whiskey we are ready if you can accommodate…
12:39:27	ATC	ZS-OHW	Oscar Hotel Whiskey line-up and wait runway 11, helicopter to cross ahead…
12:39:32	ZS-OHW	ATC	Helicopter ahead, line-up and wait Oscar Hotel Whiskey…
12:39:36	ATC	ZS-RJJ	Romeo Juliet Juliet there's traffic crossing your nose now, do you have that traffic in sight?
12:39:40	ZS-RJJ	ATC	Affirm I have the traffic left of sight Romeo Juliet Juliet…
12:39:42	ATC	ZS-RJJ	Behind the traffic expedite the cross, cross runway 06 land on own discretion. The wind is 030 degrees 5 knots
12:39:52	ZS-RJJ	ATC	Expedite the cross, crossing behind the taxiing aircraft…. Romeo Juliet Juliet
12:39:57	ZS-NWG	ATC	Wonderboom tower November Whiskey Golf…
12:39:59	ATC	ZS-NWG	November Whiskey Golf good day to you go ahead…
12:40:01	ZS-NGW	ATC	November Whiskey Golf two miles from the power station 5600 feet request instruction for joining and landing please November Whiskey Golf…
12:40:07	ATC	ZS-NWG	QNH 1027 Cleared inbound 5600 feet join and report on the left downwind runway 11

12:40:09			Double transmission. Unreadable
12:40:19	ZS-NWG	ATC	Join on the left downwind runway 11 November Whiskey Golf
12:40:24	ATC	ZS-OHW	Last call was a double transmission…Oscar Hotel Whiskey wind is 090 degrees 6 knots runway 11. Cleared take-off climb to 6000 feet report outbound…
12:40:30	ZS-OHW	ATC	cleared take-off 11 climb to 6000 feet outbound next November Whiskey Golf…
12:40:40	ATC	ZS-EBC	Echo Bravo Charlie confirm it's a full stop landing?
12:40:44	ZS-EBC	ATC	Echo Bravo Charlie continue the approach, can we please make it a touch and go…
12:40:51	ATC	ZS-EBC	Echo Bravo Charlie copy for the touch and go wind is 090 degrees 9 knots runway 11 cleared touch and go…
12:40:57	ZS-EBC	ATC	Cleared touch and go, left downwind next Echo Bravo Charlie…
12:41:07	ZS-PMW	ATC	Wonderboom tower Zulu Sierra Papa Mike Whiskey…
12:41:13	ATC	ZS-PMW	Zulu Sierra Papa Mike Whiskey go ahead…
12:41:16	ZS-PMW	ATC	Papa Mike Whiskey Charlie (C) 172 two on board we are three hours on fuel requesting circuits please Papa Mike Whiskey
12:41:28	ATC	ZS-PMW	Papa Mike Whiskey QNH 1027 taxi Foxtrot, Golf, Delta holding point runway 11 report ready…
12:41:36	ZS-PMW	ATC	QNH 1027, Foxtrot, Golf, Delta holding point 11 ready next and we will taxi in about one-minute Papa Mike Whiskey…
12:45:39	ZS-EBC	ATC	Echo Bravo Charlie left hand downwind runway 11…
12:45:46	ATC	ZS-EBC	Echo Bravo Charlie report final approach runway 11 you are number two Mam, number one is a Cessna 172 Benekot Dam…
12:45:55	ZS-EBC	ATC	Report final approach, number two Echo Bravo Charlie…
12:45:59	ZS-OHW	ATC	Oscar Hotel Whiskey is outbound 6500 feet switching 124,4…
12:46:05	ATC	ZS-OHW	Oscar Hotel Whiskey cheers…
12:48:56	ZS-EBC	ATC	Echo Bravo Charlie (*the transmission is unreadable although it is supposed to indicate that the aircraft is on final approach as instructed earlier*)
12:49:04	ATC	ZS-EBC	Echo Bravo Charlie continue the approach…
12:49:06	ZS-EBC	ATC	(unreadable transmission from Echo Bravo Charlie)
12:49:10	ZS-LAJ	ATC	Wonderboom tower good morning Lima Alpha Juliet…
12:49:16	ATC	ZS-LAJ	Lima Alpha Juliet, Wonderboom, good morning to you go ahead…
12:49:18	ZS-LAJ	ATC	Calinan 6000 feet requesting joining and landing instruction Patenavia one on board 2 hours endurance, Lima Alpha Juliet…
12:49:24	ATC	ZS-LAJ	Lima Alpha Juliet you are cleared inbound 6000 feet left downwind runway 11 report abeam the Petroport QNH 1026…
12:49:31	ZS-LAJ	ATC	QNH 1026 6000 feet we will report abeam the Petroport, Lima Alpha Juliet…

12:49:40	Unknown	ATC	Wonderboom tower I think there's crash on short final Echo Bravo Charlie I believe…
12:49:51	Unknown	ATC	There's black smoke Sir, the aircraft went from base…
12:50:00	ATC	ZS-JTO	Juliet Tango Oscar Wonderboom…
12:50:02	ZS-JTO	ATC	Juliet Tango Oscar go ahead…
12:50:04	ATC	ZS-JTO	Juliet Tango Oscar if you could just circle overhead there for us please…
12:50:08			We will circle overhead, Juliet Tango Oscar…
12:50:24	ATC	FT1	Foxtrot Tango 1 and company Wonderboom
12:50:27	FT1	ATC	Hi Sir…
12:50:24	ATC	FT1	The crash is outside of the airfield outside of the airfield…
Juliet Tango Oscar advised that the crash was 2 miles west of the station and that they should use highway N4 to get to the crash site. The End			

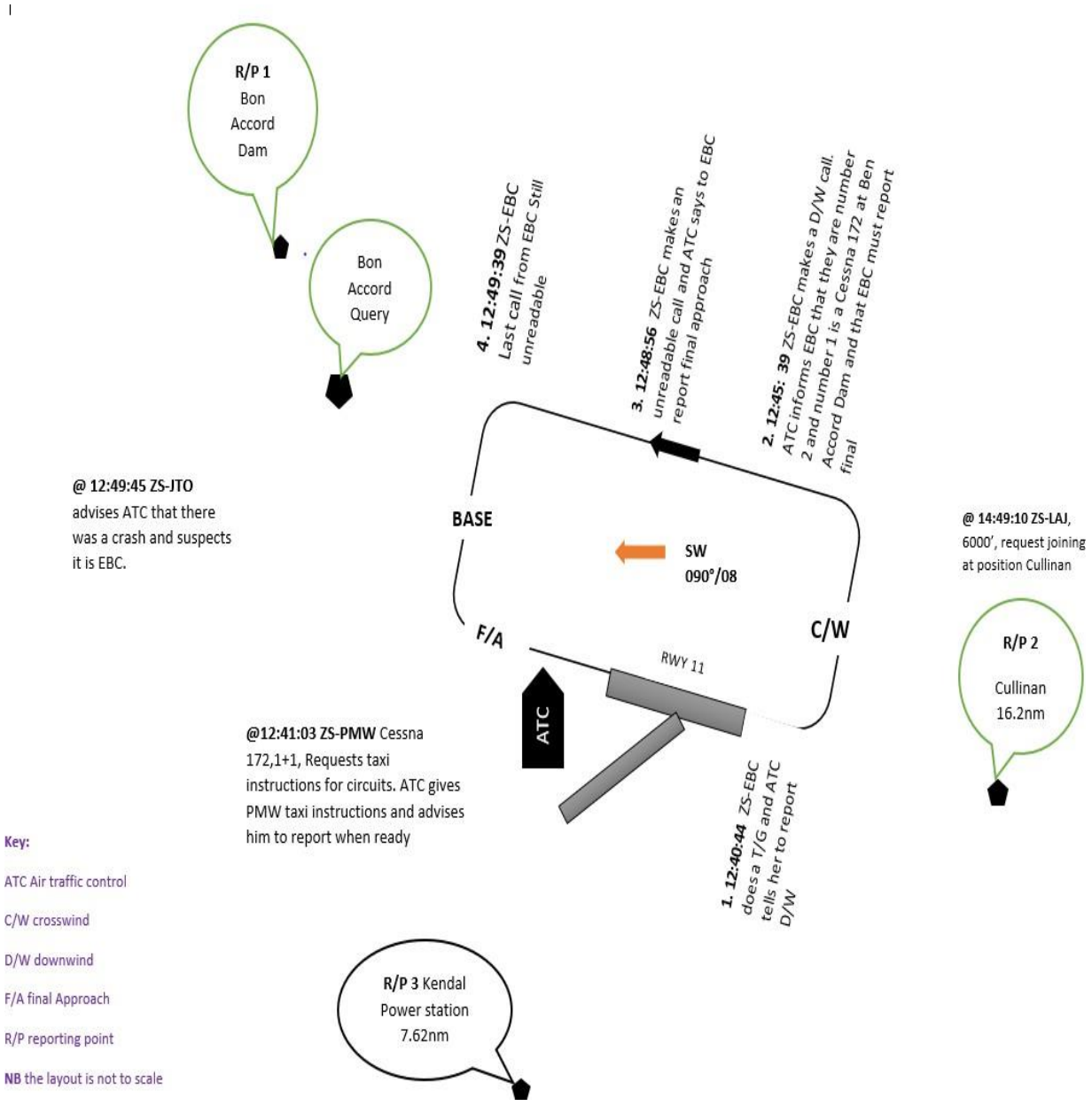


RWY LIGHTING					
RWY	ALS	PAPI	RTHL	REDL	RENL
11	NIL	2.6° L/H	GREEN	WHITE	RED
29	NIL	2.7°L/H	GREEN	WHITE	RED
06	NIL	NIL	NIL		
24	NIL	NIL	NIL		
OTHER: TWY, OBST & APRON					

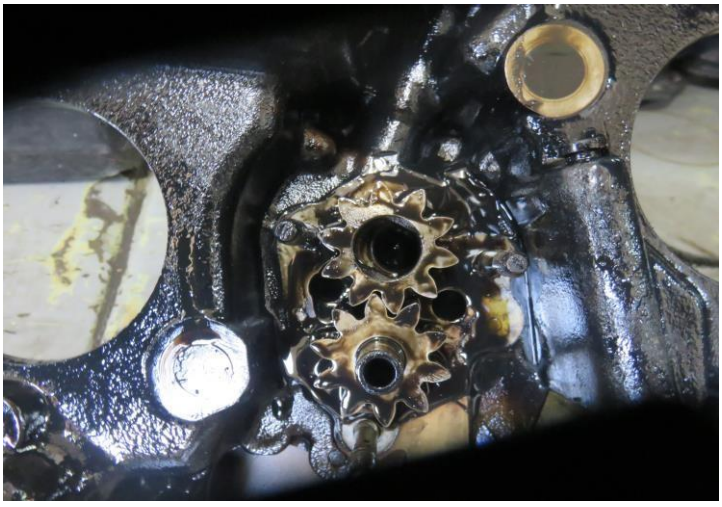
PHYSICAL CHARACTERISTICS													
RWY	DIRECTION	THR COORDINATES	THR ELEVATION	TORA (m)	TODA (m)	ASDA (m)	LDA (m)	SWY (m)	CWY (m)	SLOPE (m)	SURFACE	BEARING STRENGTH	CIRCUIT
11	092°(T)	25°39'11.07"S 028°12'46.04"E	4038'	1828	1978	1828	1828	NIL	150	0.009 U	ASPH	PCN 40	
29	272°(T)	25°39'13.80"S 028°13'51.52"E	4095'	1828	1978	1828	1828	NIL	150	0.009 D			L/H
06	044°(T)	25°39'43.82"S 028°12'58.48"E	4070'	1267	1342	1267	1267	NIL	75	0.001 U	ASPH	PCN 30	
24	224°(T)	25°39'13.68"S 028°13'29.44"E	4073'	1267	1342	1267	1267	NIL	75	0.001 D			

Appendix B – FAWB layout as per the Aeronautical Information Publication (AIP)

Appendix C - Traffic at FAWB airspace around the time of the accident



	The engine, a Lycoming O-360-A30 engine, Serial No. L-6678-36.

	Impact damaged carburettor.
	Magnetos were tested and were correctly set.
	Engine-driven oil pump (gears), correctly assembled and normal.

	Cylinders showing normal wear with all inlet and exhaust valves in a normal operation condition.
	Four undamaged spark plugs were tested for continuity and the electrodes on them were normal.
	Left crankcase half showing hydraulic tappets/lifters in a good condition.

	Right crankcase half showing hydraulic tappets/lifters in a good condition.
	Engine crankshaft normal with oil galleries/passageways unobstructed.

	Bearings were undamaged and showed normal lubrication.
	The camshaft was normal with no evidence of wear on the camshaft lobes.

	Connecting rods correctly assembled and normal.