

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9104	
Aircraft Registration	ZS-SPI	Date of Accident	09 November 2012		Time of Accident	18:59Z
Type of Aircraft	Cessna172R		Type of Operation		Private	
Pilot-in-command Licence Type	Private		Age	24	Licence Valid	Yes
Pilot-in-command Flying Experience	Total Flying Hours		194		Hours on Type	158.3
Last point of departure		Wonderboom aerodrome (FAWB): Gauteng Province.				
Next point of intended landing		Wonderboom aerodrome (FAWB): Gauteng Province.				
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)						
On the mountain at GPS coordinates determined to be (S 24° 07 6.76 E 029° 13 7 .58) at an elevation of approximately 5 940 feet above mean sea level (AMSL).						
Meteorological Information		Low clouds were observed in the vicinity of Polokwane area.				
Number of people on board	1 + 1	No. of people injured	0	No. of people killed	2	
Synopsis						
<p>On Friday evening 09 November 2012 at 1758Z, the pilot accompanied by a passenger departed Wonderboom (FAWB) aerodrome on a private flight under Visual Flight Rules (VFR) with the intention to build Night hours. According to a FAWB air traffic controller (ATC) take off and climb out from FAWB appeared to be normal. There was no further communication with the pilot and FAWB ATC. The pilot did not reach his destination. The following day the aircraft was reported missing and the search and rescue mission commenced. During search operation the aircraft was found to have collided with a mountain approximately 21 nautical miles (nm) South of Polokwane (FAPP) International. The aircraft was destroyed on impact and all occupants were pronounced dead on the scene. The aircraft was operated under Part 141 of the Civil Aviation Regulations.</p>						
Probable Cause						
Controlled flight into terrain (CFIT).						
Contributing factor/s:						
<p>(i) The pilot encountered inclement weather conditions in flight and in an attempt to maintain or regain visual contact with the ground in the area, he descended unknowingly and the aircraft collided with the mountain.</p> <p>(ii) Spatial disorientation.</p>						
IARC Date				Release Date		
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AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator :Guzto Property Company
Manufacturer :Cessna Aircraft Company
Model :Cessna 172R
Nationality :South African
Registration Marks :ZS-SPI
Place :(S24°07 6.76 E 029°13 7 .58) en-route to Polokwane
Date :09 November 2012
Time :18:59Z

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 (1997) 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 establish legal liability**.*

Disclaimer:

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

1. FACTUAL INFORMATION:

1.1 History of Flight:

- 1.1.1 On Friday 09 November 2012 at approximately 1758Z, a Cessna 172R aircraft, S/n number 172-80598 departed Wonderboom (FAWB) aerodrome on a private flight under Visual Flight Rules (VFR) with the pilot and one passenger on-board. The estimated flight time was three hours, ten minutes {(0310) (at flight level 075 feet above mean sea level) (AMSL)}. The pilot had planned a night navigation to fly overhead Warmbaths (FAWA) aerodrome direct to Nylstroom (FANY) aerodrome thereafter direct to Polokwane International Airport (FAPP) where he would perform a touch and go and return to FAWB.
- 1.1.2 The day before the accident flight the aircraft was refuelled to full capacity with aviation gasoline Avgas LL 100. On the day of the accident the FAWB air traffic controller (ATC) who was on duty at the time stated, ZS-SPI departed at 1758Z and climbed to 7500 feet AMSL. The flight appeared to be normal and no further communication between FAWB ATC and the aircraft took place. At approximately 21 nautical miles South West of FAPP aerodrome the aircraft collided with a mountain.

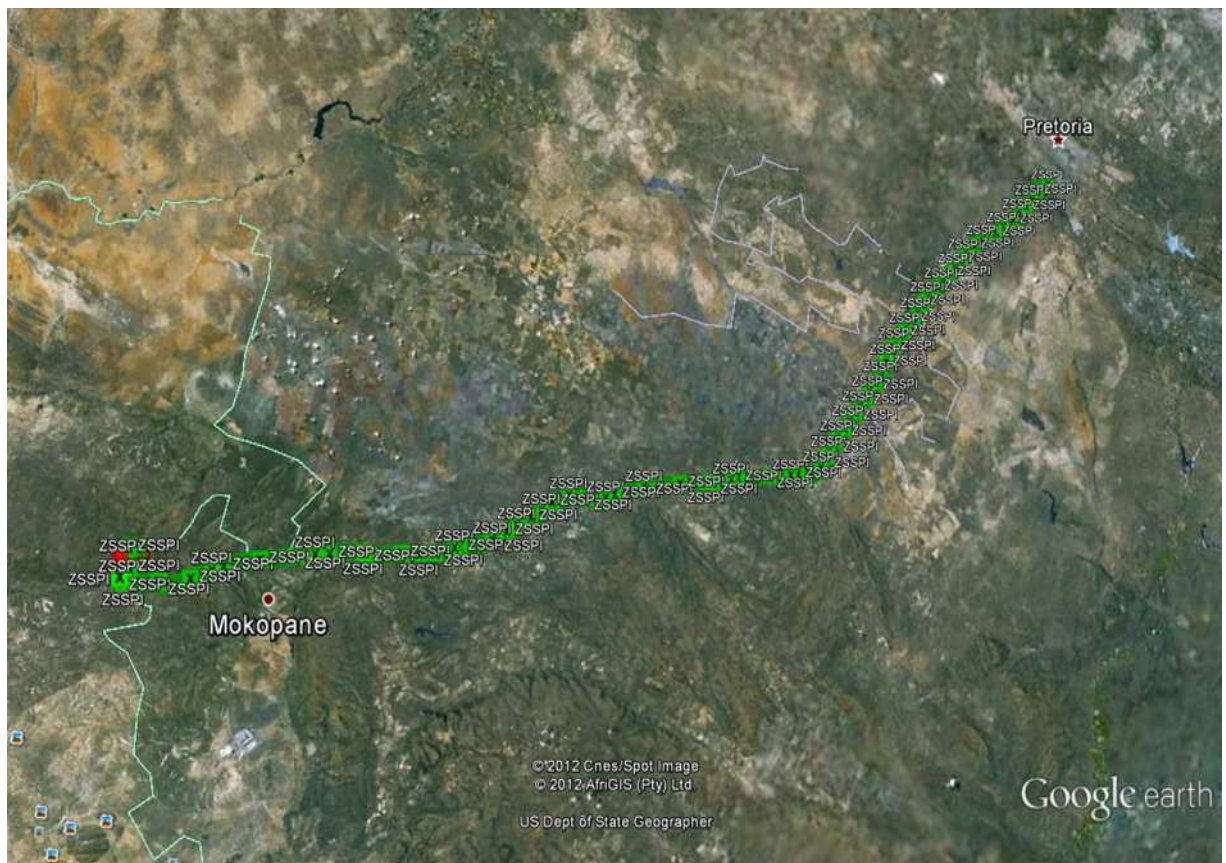


Figure 1: A radar plot of the aircraft's flight path from FAWB to accident site.

- 1.1.3 The accident occurred at approximately 1859Z according to the radar data made available by ATNS. The South African Search and Rescue (SASAR) coordinating centre was immediately informed when the pilot of ZS-SPI failed to cancel his SAR. The SASAR coordinating centre immediately notified the South African Police Services (SAPS) and the Emergency Medical Services (EMS). The following morning at approximately 0815Z the search mission was commenced by a SAPS helicopter. During the search process the helicopter pilot experienced inclement weather conditions and the search mission was called off.
- 1.1.4 At approximately 0925Z, the search mission recommenced and the aircraft was located from the air on the mountain. The aircraft parts were scattered all over the accident site and the helicopter pilot flew closer to the site with the objective to see if there was any movement (sign of survivors), but to no avail. The SAPS helicopter pilot immediately flew back to the airport and landed uneventfully. The SAPS, SASAR and the Emergency Medical Services (EMS) team were immediately flown by the helicopter to the accident site. The helicopter landed safely on the mountain top and arriving at the accident site the aircraft was found to have been destroyed and both occupants were pronounced dead at the scene.

- 1.1.5 During on-site investigation a farm worker in the area informed the investigators that he observed a small single engine aircraft with flashing navigation lights routing in a South Westerly direction where after a loud explosion was heard. Post interview with a FAPP air traffic controller revealed that the pilot called telephonically at approximately 1.5 hours before departure enquiring if the runway lights would be ON at night. The controller stated the lights are ON permanently and also advised the pilot that the weather was not good at FAPP. He recommended that the pilot reconsider his flight into FAPP. The pilot made another telephone call closer to the end of the FAPP ATC shift which ended at 1800Z, he asked for an update of the weather at FAPP, which was still Visual Meteorological Conditions (VMC) but overcast at 2000 feet with visibility of 8000 metres (Visual flight rules minima according to regulation state within a control zone visibility required is 5000m and vertical distance from cloud 500 feet). FAPP tower closed for the day and the next morning when the tower reopened, they received a call from FAWB tower asking if ZS-SPI was parked at FAPP and the answer was negative.
- 1.1.6 The accident happened at night in 21nm South West of FAPP aerodrome at GPS coordinates determined to be S24°07' 6.76" E029°13 ' 7.58" at an elevation of approximately 5 940 feet above mean sea level (AMSL).
- 1.1.7 Referencing the radar image provided by ATNS, the flight path shows deviations from the intended flight plan. The pilot opted to route directly to FAPP from FAWA which was different from his flight plan which stated routing from FAWA direct to FANY then direct to FAPP for a touch and go. The initial heading selection of the aircraft from FAWA placed the aircraft approximately 4nm off track to FAPP. It is unknown if the diversion was planned prior to departure from FAWB. The correct true track to steer would have been 045° True from FAWA direct to FAPP.
- 1.1.8 A series of incorrect heading changes by the pilot continued prior to the accident. It is possible that due to inadequate flight planning and poor estimation of a suitable track to fly the pilot positioned the aircraft directly into terrain.

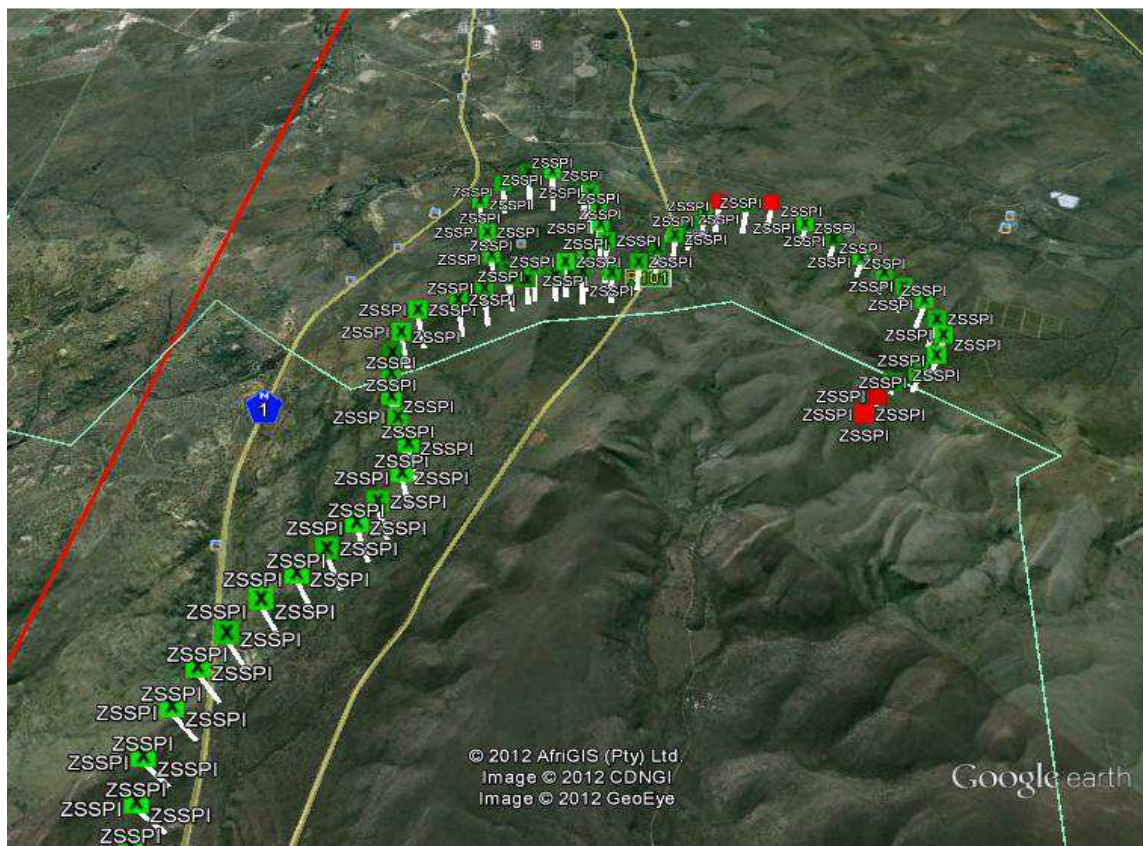


Figure 2: Radar plot detailing the aircraft's flight path prior to impact.

1.1.9 The aircraft completed one left hand orbit prior to the accident. The aircraft's speed was fairly constant however a shallow rate of descent was noted on the radar plot. After completing the orbit the pilot continued to route to the right off track placing the aircraft directly into terrain. It was noted that the aircraft's speed varied between 120-150kts during this period and continued to descend. Prior to impact the aircraft regained 500ft altitude and was maintaining a cruise speed of 120kts.

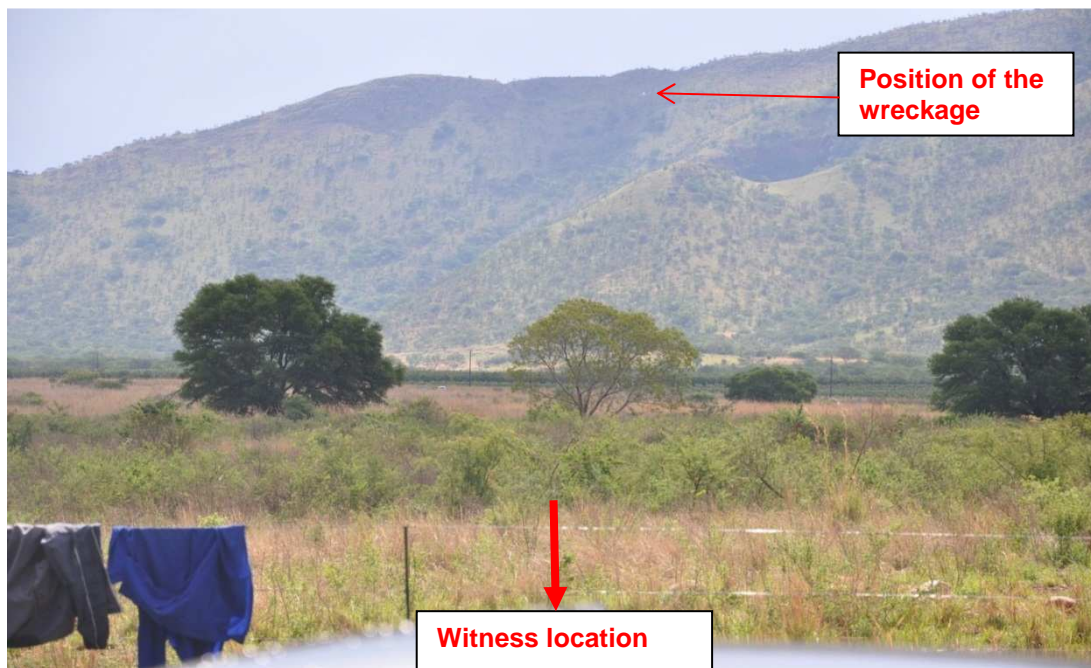


Figure3: View of the terrain, the accident site and the location of the witness.



Figure 4: Aerial view of the wreckage.

1.2 Injuries to Persons:

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

1.3 Damage to Aircraft:

1.3.1 The aircraft was destroyed by impact during the accident sequence.



Figure 5: View of the wreckage as found at the accident site.



Figure 6: Side view of distribution of wreckage.

1.4 Other Damage:

1.4.1 Damage was limited to the trees.

1.5 Personnel Information:

Pilot:

Nationality	Nigerian	Gender	Male	Age	24
Licence Number	0272358128	Licence Type	Private		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night Rating				
Medical Expiry Date	31 May 2013				
Restrictions	None				
Previous Accidents	Nil				

Flying Experience:

Total Hours	194
Total Past 90 Days	14.8
Total on Type Past 90 Days	6.9
Total on Type	158.3

- 1.5.1 The pilot held a South African Civil Aviation Authority issued Private Pilot License(PPL), issued 13February 2008 with a Night Rating issued on 13 December 2010.
- 1.5.2 The pilot's logbook was made available during the investigation. The pilot had 194 hours totalaeronautical experience, with 158.3 hours on Cessna 172R aircraft.
- 1.5.3 The last recorded flight was on the 06 November 2012. The logbook indicated that the pilot had 33.6 hours total night flying experience on a Cessna 172R aircraft.
- 1.5.4 In the last 6 months prior to the accident, the pilot had completed approximately 15night flying hours, all on a Cessna 172R aircraft.
- 1.5.5 The pilot had commenced his commercial pilot license examinations and had successfully obtained one examination credit.
- 1.5.6 The pilot was a Nigerian national and was eager to complete his training and return home. His training file showed evidence of this behavior.

1.6 Aircraft Information:

- 1.6.1 The C172R is a high-wing semi-cantilever aircraft with a single engine and fixed undercarriage. The fuselage is a semi-monocoque design of metal construction, with metal skin attached with rivets. The aircraft has Fowler flaps, with the earlier versions extending to 40 degrees and the later versions only to 30 degrees. The rudder and nose wheel are operated via the rudder pedals, however the nosewheel can only be steered to 10 degrees left and right. The nosewheel can castor up to 30 degrees if differential braking is utilized. The disc brakes are hydraulically operated.



Figure 7: ZS-SPI aircraft parked on the apron (photo found on internet).

Airframe:

Type	Cessna172R	
Serial Number	172-80598	
Manufacturer	Cessna Aircraft Company	
Date of Manufacture	1998	
Total Airframe Hours (At time of Accident)	± 8126	
Last MPI (Hours & Date)	8033.3	14 September 2012
C of A (Issue Date)	11 December2009	
C of A (Expiry Date)	10 December 2012	
C of R (Issue Date) (Present owner)	07 October 2009	
Recommended fuel used	Avgas LL 100	
Operating Categories	Standard Part 141	

*NOTE: The Aircraft Maintenance Organisation (AMO) that performed the last maintenance on the aircraft prior to the accident flight was in possession of a valid AMO Approval certificate No 1194.

Engine:

Type	Lycoming IO-360-LZA
Serial Number	L-29224-51A
Hours since New	Unknown
Hours since Overhaul	1 984

Propeller:

Type	Mc-Cauley
Serial Number	SG 073
Hours since New	Unknown
Hours since Overhaul	1 984

1.7 Meteorological Information:

1.7.1 Weather information as obtained from the SA Weather Services:

SATELLITE IMAGE, RADAR IMAGE AND SIGNIFICANT WEATHER CHART:

The satellite image provided in figure8, indicated Overcast low-level cloud in and around the area marked on the image and 21:00Z SIGWX chart provided indicated a forecast of scattered *low-level cloud* with base 1000ft minimum ceiling, poor visibility and *moderate low-level turbulence* in the area of the accident.

OBSERVED WEATHER CONDITIONS IN THE VICINITY OF THE AIRCRAFT ACCIDENT:

Polokwane International Airport (FAPP) 18:00Z METAR provided, indicates overcast low-level cloud at 2000ft, good visibility and light North Easterly winds. 1900Z & 2000Z AUTO METARs indicated that the dew-point depression decreased by a degree from 18:00Z to 2°C i.e. possible indication of 500ft to 1000ft cloud base drop close to the time of the accident.

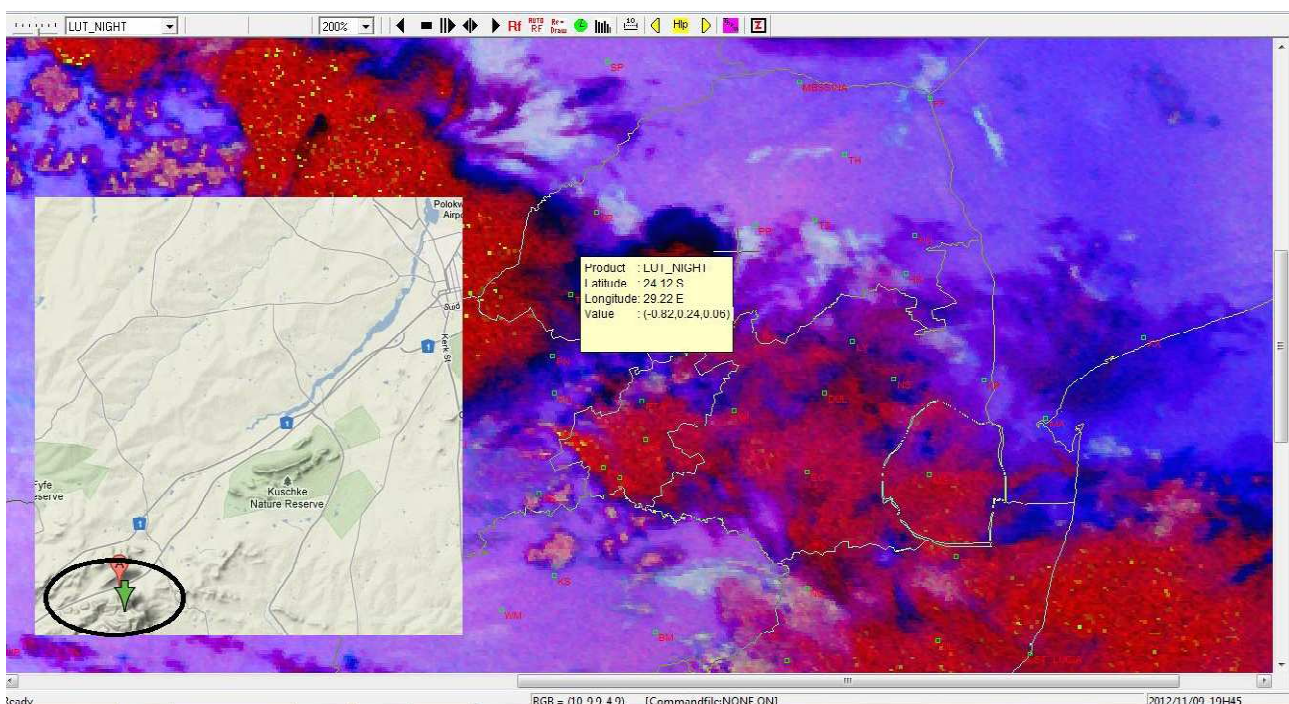


Figure 8: View of the satellite image.

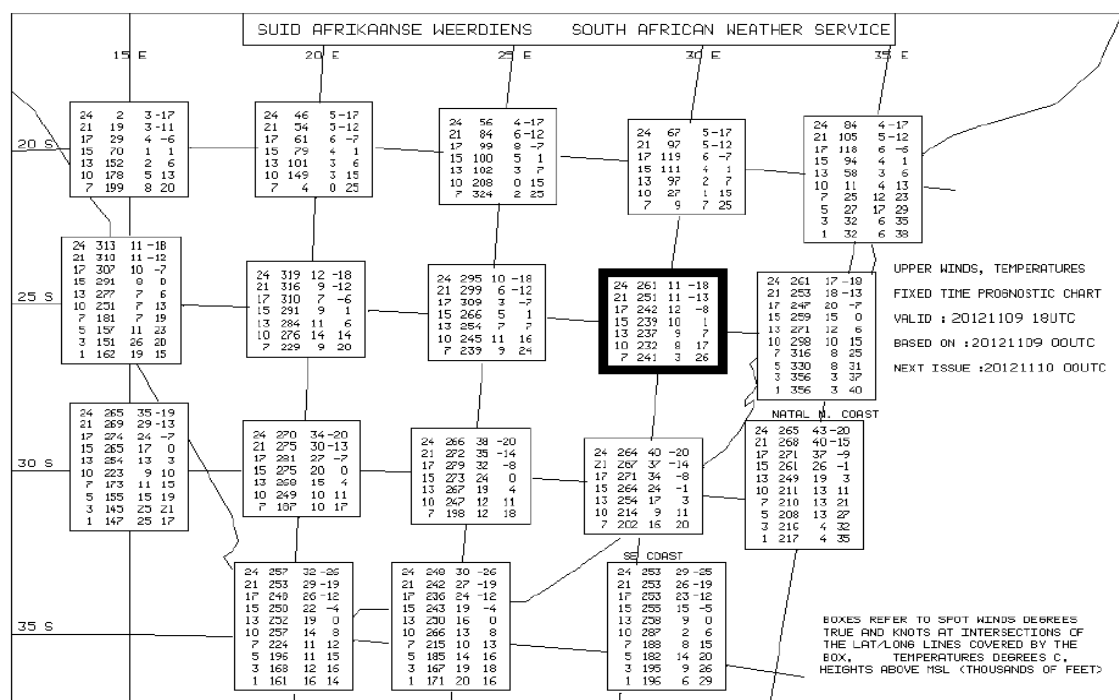


Figure 9: Highlighted block indicates wind chart observation in the Polokwane area.

1.8 Aids to Navigation:

1.8.1 The aircraft was fitted with the following navigational equipment.

- (i) Magnetic compass.
- (ii) Panel-mounted Bendix King GPS.
- (iii) Transponder.
- (iv) ADF (Automatic Direction Finder).
- (v) DME (Distance Measuring Equipment).

1.9 Communications:

1.9.1 The aircraft was fitted with standard communication equipment as approved by the regulator for this aircraft type. There was no recorded radio communication between JohannesburgNorth Flight Information Services on frequency 127.4 Megahertz (Mhz). It is believed that the pilot transmitted on the unmanned frequency 124.8Mhz. The radio equipment was destroyed on impact. It could not be concluded if the radio was operative at the time of the accident. The aircraft was not equipped with a Ground Proximity Warning System (GPWS).

1.10 Aerodrome Information:

1.10.1 Polokwane International Airport was the intended arrival aerodrome for a touch and go, thereafter routing to FAWB for a full stop landing.

Aerodrome Location	Polokwane International Airport	
Aerodrome Co-ordinates	(23°50'58.73"S 027°55'32.07"E)	
Aerodrome Elevation	4 076ft	
Runway Designations	01/19	05/23
Runway Dimensions	2320m x 45 m	
Runway Used	05	
Runway Surface	Asphalt	
Approach Facilities	VOR/DME, Runway lighting	

1.10.2 The accident happened during night conditions in a mountainous area at GPS coordinates determined to be S24°07' 6.76" E 029°13' 7.58" at an elevation of approximately 5 940 feet above mean sea level (AMSL).



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1.11 Flight Recorders:

1.11.1 The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR) nor was it required by regulation to be fitted to this aircraft type.

1.12 Wreckage and Impact Information:

1.12.1 The wreckage was contained within 60 metres from the first point of impact. The compactness of the cockpit/cabin area and the high degree of damage indicated that the aircraft had impacted the mountain at a high speed. The wings, T-tail section, fuselage, including the cockpit/cabin were destroyed by impact and no fire was reported. The aircraft wind screen (perspects glass) was shattered. The aircraft wings were substantially damaged and both fuel tanks ruptured on impact. During on site investigation, the investigating team could still smell fuel, although there was rain in the area after the accident. It was also not possible to determine the position of the fuel tank selector.

1.12.2 The entire engine and flight instruments such as the vertical speed indicator, turn and bank co-ordinator, the magnetic compass and the attitude gyro were destroyed and that limited detailed examination of the cockpit area. All the seats were still secured to their anchors inside the wreckage and both occupants seat belts snapped. Although no pre-existing defects were detected, it could not be conclusively determined whether any airframe failure or system malfunction contributed to the accident.

1.12.3 The engine detached from the fuselage and the propeller also detached from the engine. The engine components such as the electric starter, the magnetos, and the alternator detached from the engine. The position of the flaps and the ailerons could not conclusively be confirmed. Both control surfaces and rudder pedals broke after impact. Mechanical damage to all cabin door latches were consistent with both doors being in the closed position at impact. The nose gear detached from its mounting point and the main undercarriage are damaged but still attached to its mounting points.

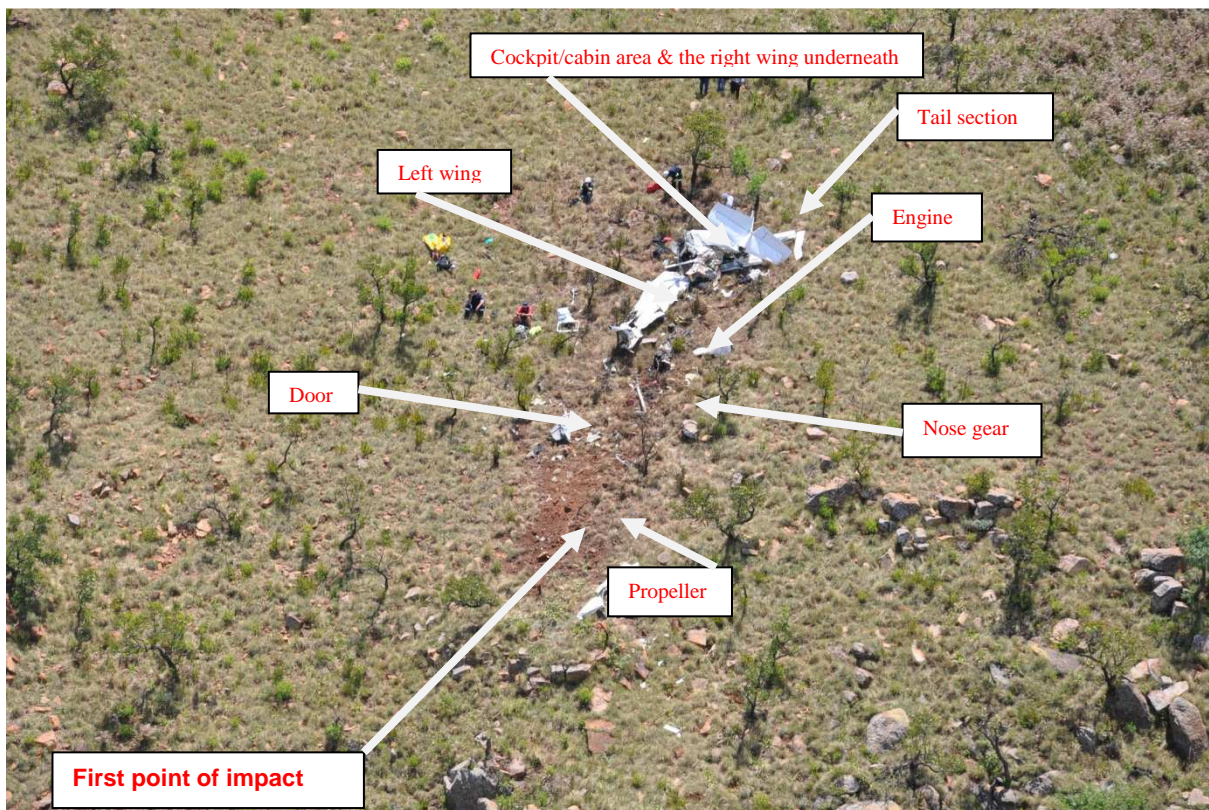


Figure 11: First point of impact and evidence of fuel spill at the accident site.

1.13 Medical and Pathological Information:

1.13.1 The pilot held a valid SACAA medical certificate at the time of the accident. The post-mortem and blood toxicology reports were still outstanding at the time of compiling this report. Should any of the results have a bearing on the circumstances leading to this accident; it will be treated as new evidence that will necessitate the reopening of this investigation.

1.14 Fire:

1.14.1 No evidence of pre or post impact fire

1.15 Survival Aspects:

1.15.1 The accident was considered to be non-survivable due to the magnitude of the deceleration forces and the collapse of the cockpit/cabin area. The aircraft was equipped with a Pointer Emergency Locator Transmitter (ELT), model 3000-11, serial number 326560. The ELT onboard the aircraft had dislodged from its fixed mounting bracket. The Auto/On switch was however selected to the Auto position and the operation indicator light had no illumination to show that the internal inertia switch had turned the transmitter ON.

1.15.2 Functional tests by the investigators indicated that the ELT was not radiating any signal and the investigator in charge (IIC) was not advised by the South African Search and Rescue Coordination Centre of any ELT signals being received at the time of the accident. Below is the picture of the ELT after it was disconnected from the wreckage. Research will be conducted by the investigation team to conclude why the ELT was not serviceable.



Figure 12: View of the ELT after it was disconnected from the wreckage to allow a clear picture of the position of the switch as found at the accident site.

1.15.2 Both occupants were found to be fatally injured and were extracted from the wreckage by the SAPS, Search and Rescue and EMS team. The accident site was not accessible by foot or by road and all the people who participated in the rescue mission had to be hoisted from the police Squirrel helicopter to the accident site. The South African Police Services (SAPS) air wing must be complimented for their assistance during this investigation.

1.16 Tests and Research:

1.16.1 The aircraft was completely destroyed by impact and no fuel was available for analysis. The investigation revealed that the aircraft had enough fuel for the planned flight. According to available aircraft documentation no reported defects were recorded since the last maintenance inspection was certified. Investigation revealed that no communication to FAPP tower or distress call was made by the pilot prior to the accident. The on-site examination of the wreckage revealed that the aircraft had broken apart on impact. The diagram below illustrates a similar track flown by the accident aircraft into the mountain.

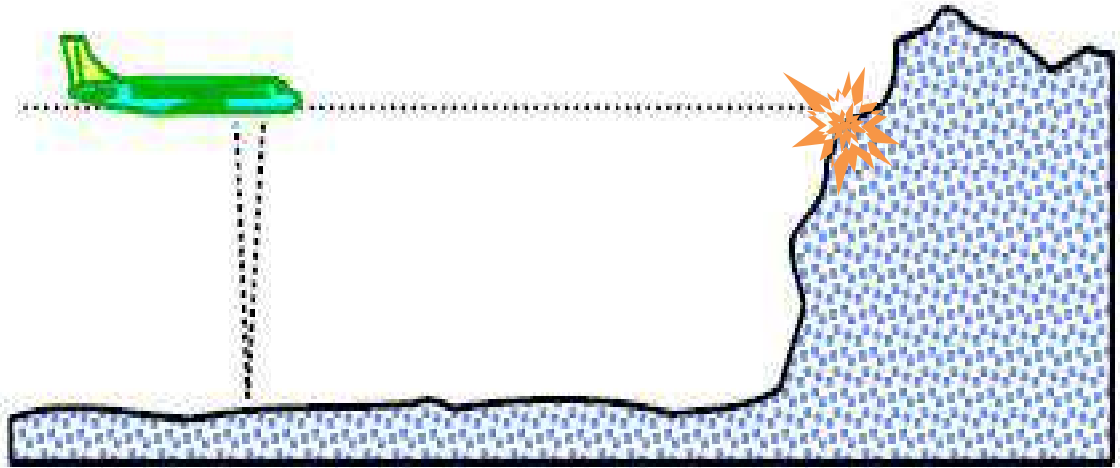


Figure 13: Illustration of CFIT.

1.16.2 During the investigation, the engine was set up together with the propeller to determine the position of the propeller to the engine at the moment of impact when the propeller detached from the engine. The propeller attachment point was fractured and the blade tip was severed/ cut off after impact and that suggests that the propeller was still turning on impact however the amount of power it was producing couldn't be determined by visual inspection. See the pictures below.



Figure 14: View of the propeller as found at the accident site.



Figure 15: Closer view of the fractured propeller hub.

1.17 Organizational and Management Information:

- 1.17.1 This was a private flight (hire and fly with the intention to build night hours) that was authorised by an Approved Training Organisation (ATO).
- 1.17.2 The flight school indicated that a designated flight instructor had checked the pilot's flight planning prior to departure and found the planning satisfactory.
- 1.17.3 The aircraft's departure time was on a late Friday evening when the school was hosting a year end function.
- 1.17.4 The Aircraft Maintenance Organisation (AMO) that performed the last maintenance on the aircraft prior to the accident flight was in possession of a valid AMO Approval certificate No 1194.

1.18 Additional Information:

1.18.1 Controlled Flight into Terrain (CFIT):

CFIT occurs when an airworthy aircraft, under the control of a pilot, is flown into terrain (water or obstacles) with inadequate awareness on the part of the pilot of the impending disaster (FAA, 2000). A number of general aviation (GA) weather accidents have been associated with external or social pressures, such as the pilot's reluctance to appear "cowardly" or to disappoint passengers eager to make

or continue a trip. There is almost always pressure to launch, and pressure to continue. Even the small investment in making the trip to the airport can create pressure to avoid “wasted” time.

One of the most effective safety tools at a pilot’s disposal is waiting out bad weather. Bad weather (especially involving weather fronts) normally does not last long, and waiting just a day can often make the difference between a flight with high weather risk and a flight that you can make safely.

Many times, weather is not forecast to be severe enough to cancel the trip, so pilots often choose to take off and evaluate the weather as they go. While it is not necessarily a bad idea to take off and take a look, staying safe requires staying alert to weather changes. GA pilots and their aircraft operate in (rather than above) most weather. At typical GA aircraft speeds, making a 200-mile trip can leave a two to three-hour weather information gap between the pre-flight briefing and the actual flight.

In-flight updates are vital! Because a single-piloted, small GA aircraft is vulnerable to the same CFIT risks as a crewed aircraft but with only one pilot to perform all of the flight and decision-making duties, that pilot must be better prepared to avoid a CFIT type accident. In some cases, a GA pilot may be more at risk to certain CFIT type accidents because the pilot does not have the company management or government oversight that a corporate or commercial operator may be exposed to.

Without such oversight, such as detailed standard operating procedures and higher mandatory safety requirements, it is the responsibility of the single pilot to ensure he or she is well trained, qualified for the intended flight, meets all regulatory requirements for the flight, and has the self-discipline to follow industry recommended safety procedures that can minimize CFIT type accidents.

The Instrument Procedure Handbook (FAA-H-8261-1A), Chapter 4, states:

The basic causes of CFIT accidents involve poor flight crew situational awareness. One definition of situational awareness is an accurate perception by pilots of the factors and conditions currently affecting the safe operation of the aircraft and the crew. The causes of CFIT are the flight crews’ lack of vertical position awareness or their lack of horizontal position awareness in relation to the ground, water, or an obstacle. More than two-thirds of all CFIT accidents are the result of an altitude error or lack of vertical situational awareness. CFIT accidents most often occur during reduced visibility associated with instrument meteorological conditions (IMC), darkness, or a combination of both.”

1.18.2 VFR – Low Ceilings:

“If you are not instrument rated, do not attempt “VFR on Top” or “Special VFR” flight clearances. Being caught above a solid cloud layer when an emergency descent is required (or at destination) is an extremely hazardous position for the VFR pilot. Accepting a clearance out of airport control zones with no minimum ceiling and one-mile visibility as permitted with “Special VFR” is a foolish practice for the VFR/non instrument rated pilot.

Avoid areas of low ceilings and restricted visibility unless you are instrument rated and proficient and have an IFR equipped airplane. Then proceed with caution and plan for alternates”.

Reference: (POH, Section 10, Safety Information, Pg. 10-33)

1.18.3 Vertigo – Disorientation:

Disorientation can occur in a variety of ways. During flight, inner ear balancing mechanisms are subjected to varied forces not normally experienced on the ground. This combined with loss of outside visual reference can cause vertigo. False interpretations (illusions) result, and may confuse the pilot’s conception of the attitude and position of his airplane.

Under VFR conditions, the visual sense, using the horizon as a reference, can override the illusions. Under low visibility conditions (night, fog, clouds, haze, etc) the illusions predominate. Only through awareness of these illusions, and proficiency in instrument flight procedures, can an airplane be operated safely in a low visibility environment. Flying in fog, dense haze or dust, cloud banks, or very low visibility, with strobe lights or rotating beacons turned on can contribute to vertigo. They should be turned off in these conditions, particularly at night.

All pilots should check the weather and use good judgement in planning flights. The VFR/non instrument rated pilot should use extra caution in avoiding low visibility conditions.

Motion sickness often precedes or accompanies disorientation and may further jeopardise the flight. Disorientation in low visibility conditions is not limited to VFR pilots. Although IFR pilots are trained to look at their instruments to gain an artificial visual reference as a replacement for the loss of visual horizon, they do not always do so. This can happen when the pilot’s physical condition will not permit him to concentrate on his instruments; when the pilot is not proficient in flying instrument conditions in the airplane he is flying; or, when the pilot’s work load of flying by reference to his instruments is augmented by such factors as turbulence.

Even an instrument rated pilot encountering instrument conditions, intentional or unintentional, should ask himself whether or not he is sufficiently alert and proficient in the airplane he is flying, to fly under low visibility conditions and in the turbulence anticipated or encountered. If any doubt exists, the flight should not be made or it should be discontinued as soon as possible. The result of vertigo is loss of control of the airplane. If the loss of control is sustained, it will result in an excessive speed accident.

Excessive speed accidents occur in one of two manners, either as an in-flight airframe separation or as a high speed ground impact; and they are fatal accidents in either case. All airplanes are subject to this form of accident.

1.18.4 Weather and Minimum Altitude Regulations:

- ❖ The flight from FAWB to FAPP was conducted under Visual Flight Rules (VFR) which requires to be conducted under the following conditions:
 - (i) Every VFR flight **shall** be so conducted that the aircraft is flown with visual reference to the ground by day and to identifiable objects by night and at no time above more than three eighths of cloud within a radius of five nautical miles of such aircraft.
 - (ii) In controlled airspace the flight visibility should be 5km and the distance from cloud of 2000 feet horizontally and 500 feet vertically. (Civil Aviation Regulations, Part 91, paragraph 91.06.21 and 91.06.21(a) of the Rules of the Air).

1.18.5 Altitude is the vertical distance measurement above a reference datum. Altitude information is useful for separation from terrain and from other aircraft, so when flying low reasonably low, QNH (sea level pressure) is set on the altimeter subscale as the reference datum. When flying level above the terrain, where separation between traffic is a primary consideration, the standard pressure setting of 1013hpa is used as the reference datum.

Reference: (Air pilot's manual, Section 1, Altimeter settings, Pg. 59)

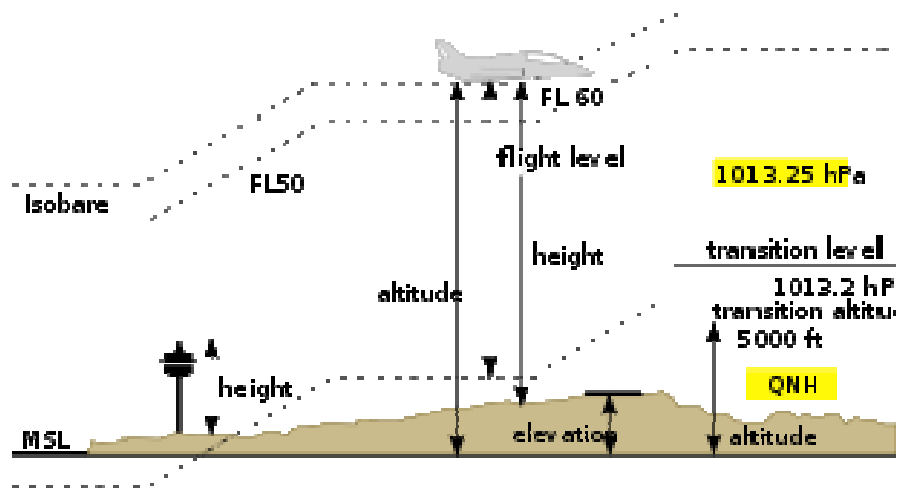


Figure 16: Transition from altitude to flight levels.

1.18.6 The altimeter recovered at the wreckage site indicated a subscale setting of 1013hpa.



Figure 17: Altimeter recovered from wreckage.

1.18.7 The local QNH at FAPP was 1018hpa. QNH was higher than standard pressure 1013.2.

1.18.8 The difference between standard pressure and QNH altitude ($1018 - 1013.2 = 144\text{ft}$).

1.18.9 QNH altitude ((last radar altitude) $6075 + 144 = 6219\text{ft}$).

1.18.10 Clearance over high ground ($6219 - 5940 = 279\text{ft}$).

1.19 Useful or Effective Investigation Techniques:

1.19.1 Not applicable.

2 ANALYSIS:

2.1 Man:

2.1.1 The pilot held a valid Private Pilot's License and was authorised to fly at night. The pilot was in possession of a valid aviation medical certificate and there was no indication that medical factors might have affected his performance at the time of the accident. The pilot had flown similar night navigation routes before.

2.1.2 On 9 November 2012, the day of the accident eyewitnesses stated that the pilot had checked the weather information available on the South African Aviation Weather website. The reports at the time indicated low cloud in the Polokwane area. He had also enquired with FAPPATC about the weather conditions prior to departure. The ATC at FAPP informed the pilot that although the weather conditions at the intended time of departure was VMC it would be better to reconsider his flight as the weather was deteriorating. ATC at FAPP reported that before closure they received a flight plan stating the pilot intended continuing with his flight despite their recommendation. At the time of the accident the pilot was completing hour building towards his Commercial Pilot's License.

2.1.3 The pilot was a commercial student at an ATO and was completing training towards his Instrument rating for his Commercial Pilot's License. He had completed seventeen hours of dual instrument simulator training prior to the accident. The pilot's progress reports stated that he was inconsistent with his progress. During the pilot's instrument training his instructor stated that he was eager to complete his training and return to his home country, however he was not utilising his time to prepare sufficiently for his simulator lessons. The reports were all signed by the pilot. The pilot's last training simulator flight was 23 October 2012.

2.1.4 Referencing the radar image provided by ATNS, the flight path shows deviations from the intended flight plan. The pilot opted to route directly to FAPP from FAWA which was different from his flight plan which stated routing from FAWA direct to FANY then direct to FAPP for a touch and go. The initial heading selection of the aircraft from FAWA placed the aircraft approximately 4nm off track to FAPP. It is unknown if the diversion was planned prior to departure from FAWB. The correct true track to steer would have been 045° True from FAWA direct to FAPP.

- 2.1.5 The flight level planned for the flight was 075. The aircraft would have had minimum clearance over terrain. The minimum safe altitude for the flight was 9000ft. For the aircraft to complete the flight according to VFR as per the regulations a selected flight level of 095 would have been required however cloud in the area was forecast at 2000ft overcast at the time of the accident. Selection of flight level 095 would have placed the aircraft in cloud, so the pilot opted to fly at a lower flight level 075. The weather deteriorated on route and the pilot encountered low cloud.
- 2.1.6 The radar image shows the aircraft continued to descend in the vicinity of the terrain. The pilot was inexperienced and not qualified to carry out flight in Instrument Meteorological Conditions (IMC) and due to a poor instrument scanning technique became fixated on routing out of cloud that he did not maintain his altitude correctly. His disorientation subsequently led to him routing directly into terrain.
- 2.1.7 The pilot's navigation log and map were recovered at the accident site. The navigation log was basic and did not contain any on route checkpoints. This prevented the pilot from referencing ground features easily when he had encountered bad weather. Also when the pilot had opted to divert he did not have sufficient ground check points to aid him in determining his exact position.
- 2.1.8 The pilot's map was a 1: 1000 000. The map does not contain a lot of details compared to a 1: 500 000 map. This would have limited his reference to ground features at night. The map did not contain any markings that indicated the pilot's flight routing.
- 2.2 Machine:
- 2.2.1 Examination of the aircraft documentation revealed that the aircraft was airworthy to under-take the flight on 09 November 2012. The aircraft did not have any documented mechanical snags prior to the accident. On-site investigation and examination of the wreckage indicated that the aircraft collided with the mountain whilst routing in a South Westerly direction and was destroyed on impact. Due to the high impact forces, the engine components were not intact to conduct further investigation. Due to the positioning of the wreckage and the damage to the propeller, it is conclusive that the propeller was rotating at the time of impact however determination of the power setting was not possible. An eye witness stated that he saw the aircraft's navigation lights followed by a loud explosion. This indicates that the aircraft's electrical equipment was serviceable. A torch was found at the wreckage site which indicates that lighting in the cockpit was sufficient.

2.3 Mission:

2.3.1 The pilot was eager to return to his homeland and was determined to complete his training in South Africa. The pilot was desperate to complete his hour building and departed knowing that the weather was substandard. Even though the pilot was not qualified to conduct instrument flight, it is believed that due to the few hours of dual instrument simulator instruction he received he felt more confident to venture into substandard weather conditions.

2.4 Environment:

2.4.1 The weather at the time of departure was sufficient for VFR flight however another pilot's statement and ATC reports indicate that the weather was deteriorating on route to FAPP. The pilot's planned route would have resulted in him routing to the left of the N1 highway. According to the radar plot the aircraft routed to the right of the N1 highway. The highway has approximately four toll gates on route to FAPP that are well lit at night. Had the pilot marked the diversion on his map he would have been able to use the road as a reference point to navigate at night.

2.4.2 It is possible that when the aircraft encountered bad weather the pilot had planned to route away from the weather. Due to the pilot not being aware of the terrain in the aircraft's vicinity he collided with the mountain at a cruise speed of approximately 120kts according to the radar image. The pilot had selected a subscale setting of 1013 on his altimeter. The local QNH at FAPP was 1018hpa. With this subscale setting the aircraft would have had a 279ft clearance over terrain. However the altimeter does have a calibration error of +/-100ft.

3. CONCLUSION:

3.1 Findings:

3.1.1 The pilot was a holder of a valid private pilot's licence and had the aircraft type endorsed on his pilot profile.

3.1.2 The pilot's aviation medical certificate was valid.

3.1.3 The weather had deteriorated on route to FAPP and the pilot inadvertently entered cloud.

3.1.4 The pilot did not comply with the Civil Aviation Regulations of 1997, Part 91,

paragraph 91.06.21 and 91.06.21(a) of the Rules of the Air, while flying under VFR flight rules: “Every VFR flight shall be so conducted that the aircraft is flown with visual reference to the surface by day and to identifiable objects by night and at no time above more than three eighths of cloud within a radius of five nautical miles of such aircraft.”

3.1.5 The altimeter at the crash site had a reading of 1013hp set on the subscale.

3.1.6 The aircraft collided with the mountain in a South Westerly direction.

3.1.7 The aircraft was in possession of a valid Certificate of Airworthiness and Registration.

3.1.8 Examination of the aircraft documentation revealed no evidence of anomalies or deficiencies.

3.1.9 The bad weather conditions that prevailed in the Polokwane area were considered to have had a bearing on the accident.

3.1.10 The accident was considered not survivable.

3.2 Probable Cause/s:

3.2.1 Controlled flight into terrain (CFIT).

3.3 Contributing factor/s:

3.3.1 The pilot had planned the incorrect Flight level for routing to FAPP following his diversion. His selection of F075 did not give him minimum clearance over terrain in that area. The minimum safe altitude for the route is 9000ft. A Flight level selection of 095 would have provided sufficient terrain clearance.

3.3.2 The pilot deviated from his flight plan without notifying anyone. His navigation log did not reflect the diversion and there was no evidence on his map or navigation log that planning was done prior to the diversion. The pilot selected the incorrect track to FAPP due to insufficient planning.

3.3.3 The incorrect track selection placed the aircraft on a path into terrain.

3.3.4 Poor weather conditions resulted in the pilot encountering inclement weather conditions in flight and in an attempt to maintain or regain visual contact with the ground in an area, he descended and the aircraft collided with the mountain.

- 3.3.5 The aircraft had a standard pressure setting of 1013 on the altimeter subscale. Although the aircraft would have had a 279ft clearance over terrain due to the error on the altimeter and the disorientation of the pilot sufficient clearance would not have been possible.
- 3.3.6 Spatial disorientation.
- 3.3.7 Decision making error.

4. SAFETY RECOMMENDATIONS:

- 4.1 The pilot was a commercial student pilot undergoing training at an Approved Training Organization (ATO). He did not have sufficient flight experience to allow him to make decisions in substandard weather conditions.

It is highly recommended that the Director of the Civil Aviation (DCA) authority through relevant department instruct ATO's to implement a commercial student pilot monitoring program in their training procedures manual. This program would allow commercial student pilots hour building training to be completed in a controlled environment with the option to fly in substandard weather conditions remaining the decision of the ATO or instructor in charge and not the student commercial pilot. This would prevent commercial student pilots without the relevant aeronautical experience making decisions hastily due to their personal circumstances.

5. APPENDICES:

- (i) Pilot flight plan.
- (ii) Hire and fly.
- (iii) Pilot Navigation log.

FAPPZTZX

From: FAJSZPZX [C="XX";A="ICAO";P="FA";O="AFTN";OU1="FAJSZPZX"]
 Sent: Friday, November 09, 2012 16:15
 To: FALAZTZX; FAWBZTZX; FAPPZTZX

□PRI: FF
 FT: 091615
 □(FPL-ZSSPI-VG
 -C172/L-SD/C
 -FAWB1700
 -N0100F075 DCT FAWA DCT FANY DCT PPV/N0100F085 DCT FANY DCT FAWA DCT WB -FAWB0310 FALA
 FAPP -OPR/LOUTZAVIA 0125676775 0849601047 RMK/SARFAJSETA1HR 1TGLFAPP REFID091101302
 DOF/121109)

HIRE AND FLY AUTHORISATION SHEET



Departure Date	Returning Date	Aircraft	Pilot in Command Name & Licence Number	Client Code	Pilot in Command Licence Expire Date	Passengers	Routes	Departure Time	Pilot in Command Sign Before	Returning Time	Pilot in Command Sign After	Total Flight Time
8/11/12	8/11/12	ZS	A. F. G. 027240250	POT	07/10/12	2	FAWB-FALA	08:00	[Signature]	09:10	[Signature]	0.9
8/11/12	8/11/12	ZS	B. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
8/11/12	8/11/12	ZS	C. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
9/11/12	9/11/12	ZS	D. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
9/11/12	9/11/12	ZS	E. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	F. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	G. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	H. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	I. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	J. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	K. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	L. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	M. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	N. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	O. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	P. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	Q. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	R. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	S. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	T. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	U. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	V. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	W. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	X. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	Y. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2
10/11/12	10/11/12	ZS	Z. M. 027240250	VEN	11/10/2021		FAWB-FALA	10:30	[Signature]	12:55	[Signature]	2.2

Please Note that the Pilot's signatures in Columns 9 to 12, signify that:

He/she has ascertained that his/her pilot's licence is valid during the period that the aircraft is to be flown. He/she has ascertained that the flight has been authorized in accordance with the requirements of the Air Navigation Regulations of 1976 and the new SACAR's as applicable and amended.
 He/she is fully familiar with the sequence of instruction authorized, or the nature of the flight authorized and understands that the flight is not to include any exercises that are not authorized.
 He/she understands the privileges and limitations of a student, private or commercial pilot as applicable.
 He/she assures that the aircraft is properly equipped with a serviceable fire extinguisher, first aid kit and signal and strips for the proposed flight in terms of the Aviation Regulations.
 He/she ascertained that there is sufficient fuel and oil in the aircraft for the duration of the proposed flight plus a minimum of one hour of reserve oil and fuel. He/she is to carry out a comprehensive pre-flight inspection of the aircraft about to be flown in accordance with the approved aircraft operating handbook and that he/she is satisfied that the aircraft is in every way fit for flight and that the aircraft is loaded according to the weight and balance restrictions applicable to the aircraft.
 He/she has read and understood the local rules of Loutzavia cc as displayed in the office, and will abide by them.
 No passengers will be allowed on training flights except with the written permission of the Chief Flying Instructor.
 The pilot in command and/or student indemnifies the flight school Loutzavia cc and its members and its employees against any claim that may arise due to an accident or incident and that he/she has discussed the matter with his next of kin and that they also indemnify Loutzavia cc against any such claim.
 He/she accepts responsibility for any claims that may arise from any party due to an accident / accident resulting due to breach of Air Navigation regulations and or the CAT's and CAR's currently in force.
 He/she accepts that the flying school does not run accounts and that he/she will pay 10% interest on accounts outstanding.

HF-2008566

NAVIGATION LOG																				
A/c registration: ZS-SPI																	Destination Runway Layout:			
Notes:																				
NAVIGATION LOG FOR PLANNED FLIGHT FAWB-FAWA-FANY-FAPP-FAWB ACCORDING TO FILED FLIGHT PLAN																				
TOTAL DISTANCE: 264NM																				
TOTAL TIME: 2HR40MIN																				
Check Points (fixes)	VOR	True Track	Altitude	Wind		CAS	TH	MH	CH	Mag Track	Dist	GS	Time Off		GPH	Airport & ATIS Advisories				
	Ident			Dir	Vel.						Leg				Departure		Destination			
	Freq.	Route		Temp.	TAS	-E+W Var	+/- Dev	Rem.			Est.	ETE	ETA	Fuel		ATIS Code				
FAWB			FO75	311	6	100	002	019			45	96	29.0				Ceiling/Vis			
		5		26	17W		0								Wind					
															Altimeter					
															Approach					
FAWA			FO75	311	6	100	026	043			15	99	10.0				Runway			
		029		26	17W		0								Time Check					
															Airport Frequencies					
															Departure	Destination				
FANY			FO75	311	6	100	045	061			76	100	45.0				ATIS	ATIS		
		048		26	16W		0								Grnd	Apch				
															Tower	Tower				
															Dep.	Grnd				
FAPP/FAWB			F085	311	6	100	215	232			128	101	1HR15				Elev	Elev		
		212		26	17W		0													
			Totals ---->													Block In		Log Time		
			Total Usable Fuel on Board ---->													Block Out				

Date: