AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:		CA18/2/3/9964		
Aircraft Registration	**ZS-CUU**	**Date of Accident**	4 March 2021		**Time of Accident**	0754Z	
Type of Aircraft	Cessna 182E Skylane		**Type of Operation**		Private (Part 91)		
Pilot-in-command Licence Type	Commercial Pilot Licence		**Age**	63	**Licence Valid**	Yes	
Pilot-in-command Flying Experience	**Total Flying Hours**		1565.2		**Hours on Type**	850	

Last Point of Departure	Tzaneen Aerodrome (FATZ), Limpopo Province
Next Point of Intended Landing	Nelspruit Aerodrome (FANS), Mpumalanga Province
Damage to Aircraft	Destroyed

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

On the peak of Mariepskop Mountain at GPS co-ordinates determined to be S24°51'45" E30°17'62" at an elevation of 2821 feet

Meteorological Information	Wind direction: 140,5°; Wind speed: 5 knots; Temperature: 23,4°C; Dew point: 15,3ºC; Visibility: 10km; QNH:1009hPa						
Number of People On-board	1 + 0	**Number of People Injured**	0	**Number of People Killed**	1	**Other (On Ground)**	0

Synopsis

On Thursday morning, 4 March 2021, a pilot arrived at Tzaneen Aerodrome (FATZ) in Limpopo Province where he was assisted by his fellow aviators to tow an aircraft, a Cessna 182E Skylane with registration ZS-CUU, out of the hangar. Approximately 10 minutes later, the pilot carried out a pre-flight inspection of the aircraft in preparation for a private flight to Nelspruit Aerodrome (FANS). Visual Meteorological Conditions (VMC) prevailed at the time. Later, the aircraft took off from Runway 06 around 0621Z. At 0721Z, the pilot, for the first time after departing FATZ, made a radio transmission to the Lowveld controller on 119.0 very high frequency (VHF), routing to FANS at flight level (FL) 075. At 0745Z, the pilot reported to Lowveld controller that he was not feeling well and requested to land at the closest aerodrome. His position at the time was 8 nautical miles (nm) north-east (NE) of Ohrigstad. The Lowveld controller advised him to turn left for Hoedspruit Civil Aerodrome (FAHT) and to contact Air Force Base (AFB) Hoedspruit (FAHS) approach on 126.4 VHF. At 0751Z, the pilot called FAHS approach controller informing him that his medical condition was getting worse and that he was not sure if he would make it to FAHT. At 0753Z, the pilot broadcasted a MAYDAY call (three times) and was given directions to fly to FAHT, and to follow 100º heading. The pilot reported that he was unable to see the aircraft's instruments. At 0754Z, the aircraft impacted Mariepskop Mountain peak, and the pilot was fatally injured during the accident. At the accident site, all the aircraft control surfaces were accounted for, and the propeller displayed signatures consistent with the engine being under power at the time of impact.

Probable Cause

Uncontrolled flight into terrain due to the pilot's loss of consciousness.

Contributing Factor/s:

According to the toxicology report, the specialists were unable to state with certainty if the physiological changes due to hypertension and diabetes contributed to the pilot's ill health in-flight.

SRP Date	9 November 2021	Publication Date	12 November 2021

ABBREVIATION	DESCRIPTION
AMO	Aircraft Maintenance Organisation
AIID	Accident and Incident Investigations Division
AMSL	Above Mean Sea Level
ARCC	Aeronautical Rescue Co-ordination Centre
AFB	Air Force Base
Ads	Airworthiness Directives
CAR	Civil Aviation Regulations
CVR	Cockpit Voice Recorder
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
DETRESFA	Distress Phase
ELT	Emergency Locator Transmitter
EMS	Emergency Medical Services
FDR	Flight Data Recorder
FAOR	O.R. Tambo International Airport
FAPO	Pilgrim's Rest
FPS	Forensic Pathology Services
FHS	Hoedspruit Air Force Base
FAHT	Hoedspruit Civil Aerodrome
FANS	Nelspruit Aerodrome
FATZ	Tzaneen Aerodrome
hPa	Hectopascal
INCERFA	Alert Phase
FL	Flight Level
KIAS	Knots Indicated Airspeed
LFPA	Letaba Fire Protection Association
Kts	Knots
NE	North-east
NM	Nautical Miles
MPI	Mandatory Periodic Inspection
MHz	Megahertz
OC	Officer Commanding
RPM	Revolutions per Minute
USA	United States of America
SAWS	South African Weather Service
SAPS	South African Police Service
SACAA	South African Civil Aviation Authority
SB	Service Bulletin
SA	South Africa
VMC	Visual Meteorological Conditions
VHF	Very High Frequency
Z	Zulu (Universal Coordinated Time – Zero Hours Greenwich)

Reference Number	**:** CA18/2/3/9964
Name of Owner/Operator	**:** Fountain Square Trading 235 CC
Manufacturer	**:** Cessna Aircraft Corporation
Model	**:** C182E Skylane
Nationality	**:** South African
Registration Marks	**:** ZS-CUU
Place	**:** On the peak of Mariepskop Mountain, Limpopo Province
Date	**:** 4 March 2021
Time	**:** 0754Z

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 4 March 2021 at approximately 0830Z. 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 Cessna 182E Skylane 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:

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On Thursday morning, 4 March 2021, a pilot arrived at Tzaneen Aerodrome (FATZ) in Limpopo Province where his fellow aviators assisted him to tow the aircraft, a Cessna 182E Skylane with registration ZS-CUU, out of the hangar. Approximately 10 minutes later, the pilot carried out a pre-flight inspection of the aircraft in preparation for a private flight to Nelspruit Aerodrome (FANS) where he was going to attend a meeting at Kishugu, Working on Fire head office in Nelspruit. Other pilots reported that the weather conditions at FATZ were good at the time. Visual Meteorological Conditions (VMC) prevailed, and no flight plan was filed. No fuel was uplifted on the day. The aircraft flight folio last entry on page serial number 0158 dated 5 January 2021, indicated that the aircraft had 190 litres (50.1 gallons) of Avgas LL100 fuel remaining in the tanks. The engine was started and taxied to Runway 06 for departure. The pilot was heard conducting pre-departure checks. At about 0621Z, the aircraft was observed departing Runway 06.

1.1.2 According to available information, at 0721Z, the ZS-CUU pilot, for the first time after departing FATZ, made a radio transmission to the Lowveld controller on 119.0 very high frequency (VHF), routing from FATZ to FANS at flight level (FL) 075 at 120 knots (kt) indicated air speed (KIAS). The aircraft was identified on radar approximately 12 nautical miles (nm) east of the South African (SA) Air Force Base (AFB) Hoedspruit (FAHS) and was requested to squawk 7414. The pilot reported that he had one-hour endurance. At 0745Z, the pilot reported to the Lowveld controller that he was not feeling well; he was experiencing chest pains and requested to land at the closest aerodrome. The pilot also called Kishugu on his mobile phone informing them that he was not feeling well. He was advised to land at the closest aerodrome and to advise when he was safely on ground. His position at the time was 8nm, north-east (NE) of Ohrigstad. The Lowveld controller informed him that Ohrigstad Aerodrome was on his twelve o' clock position as well as Pilgrim's Rest (FAPO), but the pilot requested to be diverted to Hoedspruit Civil Aerodrome (FAHT), which he needed 15 to 17 minutes to reach.

1.1.3 The Lowveld controller advised the pilot to turn left for FAHT and to contact FAHS approach on 126.4 VHF frequency. Lowveld controller then briefed FAHS approach controller about the situation of ZS-CUU pilot. At 0751Z, the pilot called FAHS approach controller informing him that his medical condition was getting worse and that he was not sure if he would make it to FAHT. At 0753Z, the pilot declared a MAYDAY call (three times) on 126.4 VHF. The pilot reported that he was unable to see the aircraft's instruments. The FAHS approach controller (during an interview after the accident) informed the investigators that during this time, the radar showed that the aircraft was losing height; last recorded at 3200 feet on 060º heading over the Mariepskop Mountain range. The aircraft's transponder continued to transmit. The pilot was instructed to climb or maintain height to follow a

heading of 100º and to report when he was ready to descend. At 0754Z, the aircraft radar contact was lost at Global Positioning System (GPS) co-ordinates determined to be S24º 31'.48" E030º48'.05".

1.1.4 The FAHS approach controller attempted to establish contact with the pilot, however, no further transmissions from the aircraft were received. The office at O.R. Tambo International Airport (FAOR) responsible for dispatching aeronautical messages to air traffic control (ATC) units (COMSERN) was called by FAHS approach controller to upgrade from an alert phase (INCERFA) to a distress phase (DETRESFA). The FAHS approach controller found this unhelpful and, thus, notified the Aeronautical Rescue Co-ordination Centre (ARCC) in Johannesburg. The FAHS approach controller reported that at 0810Z, a person from Swadini called FAHS control tower and reported that a small white aircraft had impacted the peak of Mariepskop Mountain (3000 feet above mean sea level), near Swadini Forever Resort. At 0812Z, a Savannah light sport aircraft with registration ZU-IRN from Hippo Pools Resort en route to FAHT was requested by the FAHS approach controller if he would be willing to assist in looking out for the ZS-CUU aircraft which was missing. The ZU-IRN pilot's response was that he would assist. Then the FAHS approach controller gave the ZU-IRN pilot directions to the last recorded position of the missing aircraft. At 0825Z, the ZU-IRN pilot reported that he had seen debris of the aircraft on the mountain peak on the northern side, adjacent to the camping area (Swadini Forever Resort).

1.1.5 The FAHS approach controller thanked the ZU-IRN pilot who instantly routed to FAHT. All other aircraft requesting to route through the Blyde Canyon were instructed to remain clear of the accident area due to the rescue operation that was about to be rolled out. The Officer Commanding (OC) of FAHS was notified of the accident. The South African Air Force (SAAF) command-post in Pretoria approved and tasked an Oryx helicopter to assist with the rescue operation. At 0902Z, the Oryx helicopter with a call sign R909 lifted off from Drankensig Helipad at FAHS to the accident site. After locating the accident site on the mountain peak, the Emergency Medical Services (EMS) personnel and the South African Police Service (SAPS) members were hoisted down from the helicopter to the accident scene. The aircraft was found destroyed by impact forces and fire that erupted; the pilot was declared fatally injured. The pilot's body was placed on a stretcher and hoisted into the helicopter where after it was handed over to the care of the Forensic Pathology Services (FPS) in Hoedspruit. At 1115Z, the Oryx helicopter reported airborne from the accident site routing back to Drakensig Helipad where it landed safely.

1.1.6 The eyewitness, a farm worker from Mahlatsi Citrus farm in Hoedspruit, about 1.5 kilometres south of the accident site reported seeing the ZS-CUU aircraft heading in a southerly direction between the mountains. The eyewitness was facing north and, according to his estimation, the aircraft was at a height of about 500 feet above ground level (AGL). Seconds later, he observed the aircraft making a slight right turn in the direction of the mountain; that was followed by a loud bang and post-impact fire.

1.1.7 The accident occurred on the peak of Mariepskop Mountain at GPS co-ordinates determined to be S24°51'45" E30°17'62" at an elevation of 2821 feet.

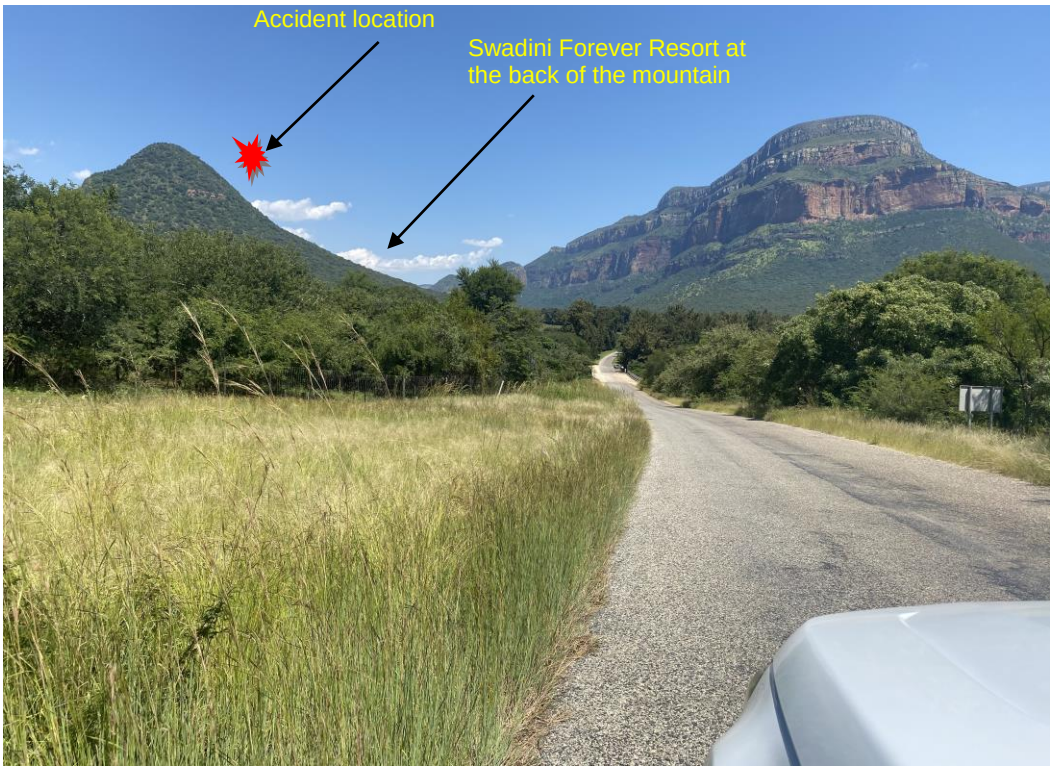

Figure 1: The accident location and Swadini Forever Resort.

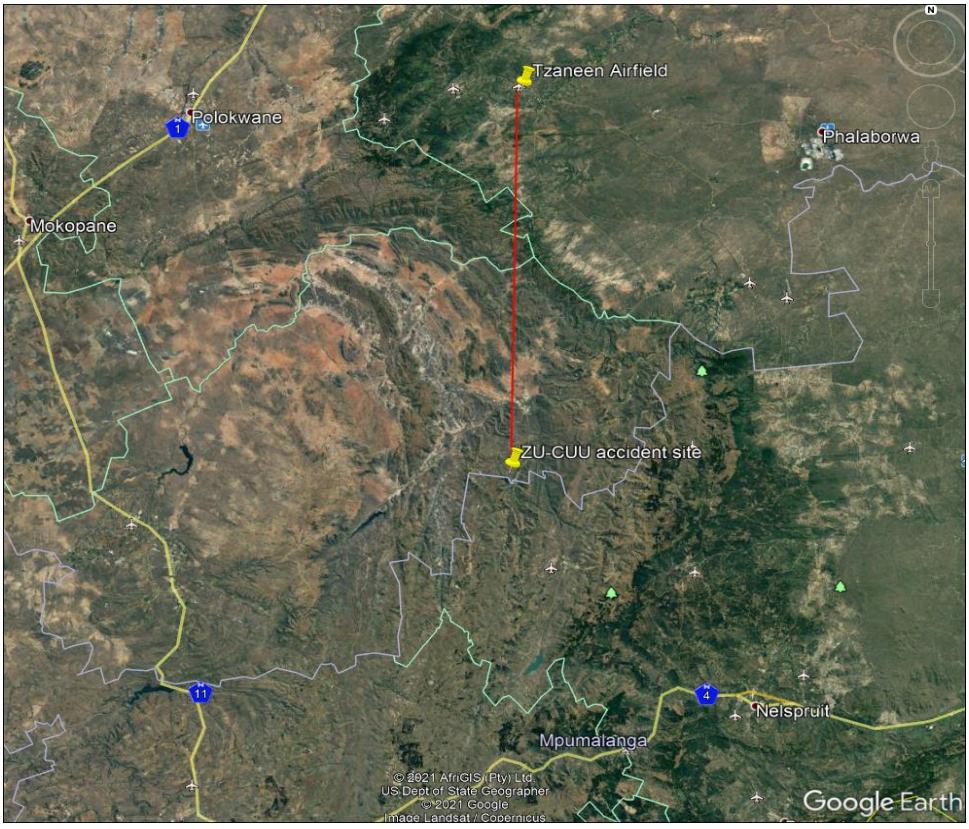

Figure 2: The approximate flight path and accident location. (Source: Google Earth).

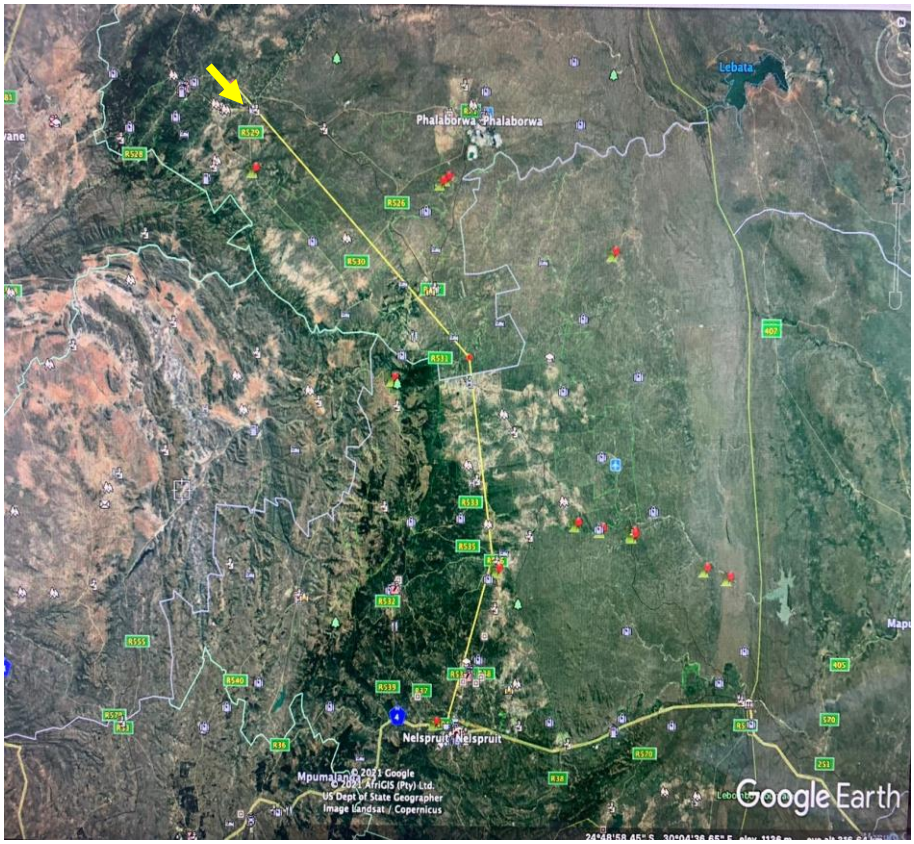

Figure 3: Normal routing from FATZ to FANS via Klaserie and Hazyview at 4000 feet (117nm). (Source: Google Earth)

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 4: The wreckage at the accident site.

1.4. Other Damage

1.4.1 None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	63
Licence Number	0270501000	Licence Type	Commercial (A)		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night and Safety Pilot				
Medical Expiry Date	31 May 2021				
Restrictions	1. Suitable corrective lenses 2. Hypertension protocol				
Previous Accidents	Yes				

*NOTE: On Saturday, 19 December 2020 at about 1554Z, a Cessna 182 aircraft with registration ZS-IIN, serial number 182-60505, under command of the accident pilot overran Runway 17 at Porterville Aerodrome during an attempted take-off for a fire spotting operation, east of Citrusdal in the Western Cape Province. The pilot and the passenger

sustained no injuries. The pilot was well-known as the spotter pilot affiliated to the Letaba Fire Protection Association (LFPA).

Flying Experience:

Total Hours	1565.2
Total Past 24 Hours	0
Total Past 7 Days	0
Total Past 90 Days	8.4
Total on Type Past 90 Days	8.4
Total on Type	850

1.6. Aircraft Information

1.6.1 The Cessna 182E Skylane is an all-metal, four-seat, high wing, single-engine aircraft equipped with fixed tricycle landing gear. The aircraft is powered by a horizontally opposed, six-cylinder fuel injected engine with a wet sump lubrication system. The engine is a Continental Model 0-470-R and is rated at 2600 revolutions per minute (rpm), 230 horsepower. The aircraft fuel system consists of two 46-gallon vented integral fuel tanks, two wing manifolds, a dual stack, four position selector valve, and an electrically driven auxiliary fuel pump. Fuel flows by gravity from the two wing tanks, through the fuel manifold, and into a four-position selector valve. The aircraft's flight control system consists of conventional aileron, rudder and elevator control surfaces. Engine operation is monitored by the following instruments: oil pressure gauge, oil temperature gauge, cylinder head temperature gauge, tachometer and manifold pressure gauge.

Figure 5: The file picture of the ZS-CUU aircraft. (Source: http://defenceweb.co.za)

Airframe:

Type	Cessna 182E Skylane	
Serial Number	182-54072	
Manufacturer	Cessna Aircraft Corporation	
Top Ceiling	18 900 feet	
Year of Manufacture	1964	
Total Airframe Hours at the Time of Accident	4815.3	
Last Mandatory Periodic Inspection Before the Accident Flight (Hours & Date)	4808.16	5 May 2020
Hours Since Last Inspection	7.14	
C of A (Issue Date)	23 May 1969	
C of A (Expiry Date)	31 May 2021	
C of R (Issue Date) (Present owner)	15 December 2003	
Maximum Take-off Weight	2800 kg	
Airworthiness Directive Status	Complied With	
Recommended Fuel Used	Avgas LL100	
Operating Categories	Standard Part 91	

*NOTE: The airframe hours of the aircraft at the time of the accident could not be determined with accuracy due to the destruction of the cockpit area during the impact sequence. The hours entered as “total hours at the time of the accident” in the table above were obtained from the aircraft’s flight

folio after it was recovered from the accident scene during the on-site investigation. The last entry in the flight folio on page serial number 0158 of the document dated 5 January 2021, the airframe hours were recorded as 4815.3. This entry was made 58 days prior to the day of the accident flight. The aircraft was manufactured in 1964 and imported to South Africa from the United States of America (USA) in 2003 (see the Certificate of Registration "C of R" date in the table above). The pilot was the sole owner of the aircraft. All applicable Airworthiness Directives (ADs) and mandatory Service Bulletins (SBs) on the aircraft were complied with as on the date of accident. Scrutiny of the aircraft flight folio revealed that there was no snag pending on the aircraft prior to the accidented flight.

Engine:

Manufacturer/Model	Continental Model 0-470-R
Serial Number	83524-2R
Hours Since New	Unknown
Hours Since Overhaul	270.96

Propeller:

Manufacturer/Model	Hartzell PHC-C3VF-1RF
Serial Number	NT391B
Hours Since New	Unknown
Hours Since Overhaul	83.46

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 turbulence around Hoedspruit; Mariepskop Mountain range area had clear skies, including Hoedspruit Civil Aerodrome (FAHT).

Surface data:

The Meteorological Aerodrome Report (METAR) recorded at Hoedspruit for the day and time of the accident (see Figure 6) contained the following weather variables:

Wind direction	140º.5	Wind speed	05kts	Visibility	10KM
Temperature	23.4°C	Cloud cover	N/A	Cloud base	N/A
Dew point	15.3°C	QNH	1009 hPa		

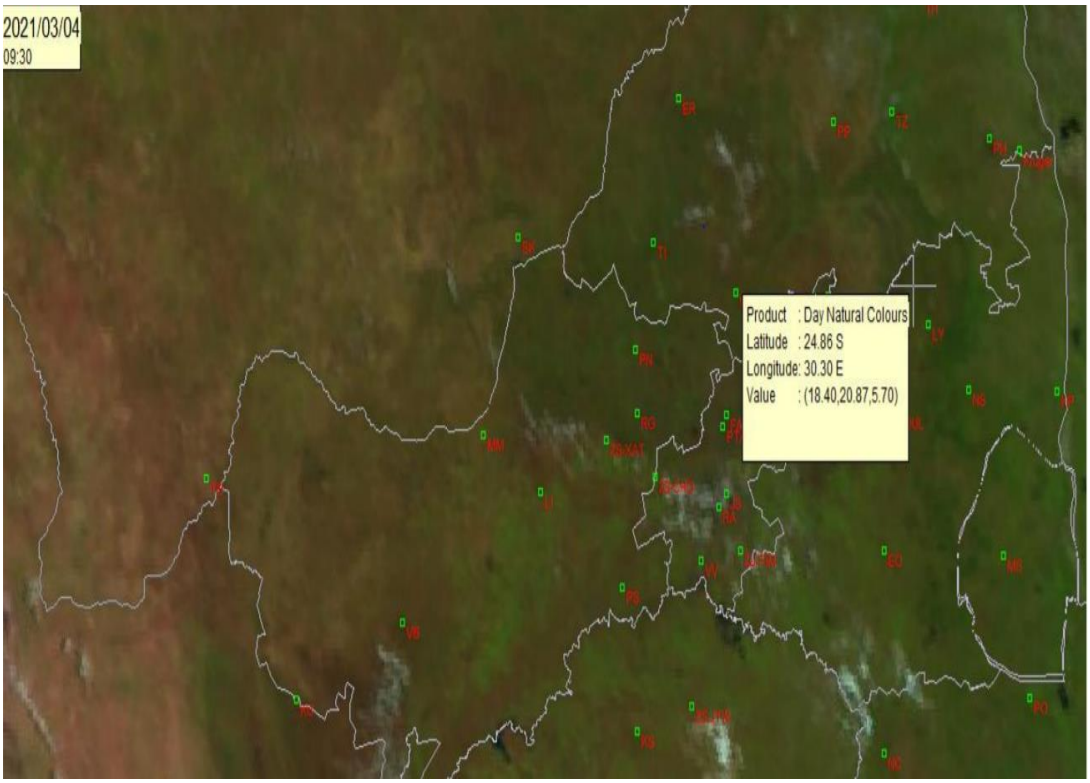

Figure 6: The satellite image at the accident site on 4 March 2021.

1.8. Aids to Navigation

1.8.1 The aircraft was equipped with basic navigational aids, which consisted of a magnetic compass. According to available information, the pilot had a portable GPS on-board the aircraft; however, the GPS was not found at the accident scene. The South African Civil Aviation Authority (SACAA) aircraft file indicated that the aircraft was equipped with a Garmin GTX-327 transponder.

1.9. Communication

1.9.1 The aircraft was equipped with a Garmin GTR 225 radio. The pilot, for the first time after departing FATZ, made a radio transmission to the Lowveld controller on 119.0 VHF, routing from FATZ to FANS at FL075 at 120 KIAS. The aircraft was identified on radar approximately 12nm east of FAHS and the pilot was requested to squawk 7414.

1.9.2 The pilot reported one-hour endurance. At 0745Z, the pilot reported to the controller at Lowveld that he was not feeling well; he was experiencing chest pains and requested to land at the closest aerodrome.

1.10. Aerodrome Information

1.10.1 The accident occurred at a peak of Mariepskop Mountain, approximately 12nm (22.2 km) east of FAHT at GPS co-ordinates determined to be S24°51’45” E30°17’62” at an elevation of 2821 feet.

1.11. Flight Recorders

1.11.1 The aircraft was not 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 Examination of the accident scene showed that the aircraft impacted the mountain peak at 093º degrees Magnetic heading and in a slight nose-up attitude. The elevation of the mountain is about 3000 feet. The aircraft wreckage was distributed in a linear pattern of about 50 metres (m) in the direction of impact. The aircraft was intact on impact and no evidence of any pre-impact failures was observed. The propeller and the left main gear hit first, and the propeller separated from the engine crankshaft flange. The aircraft then spun 360º, whereupon the engine separated from the fuselage. The engine rolled downhill approximately 15m in line with the main fuselage where it came to rest in an inverted position. The cabin and the tail-section folded onto each other and were found towards the end of the wreckage trail. The pilot was ejected from the aircraft during the accident sequence and was found about 20 feet downhill from the main wreckage. The right-side seat (passenger) was found secured to the main wreckage.

1.12.2 The pilot’s seat was found three metres in front and to the right of the main wreckage. The engine controls (throttle, propeller and mixture) were found fully forward.

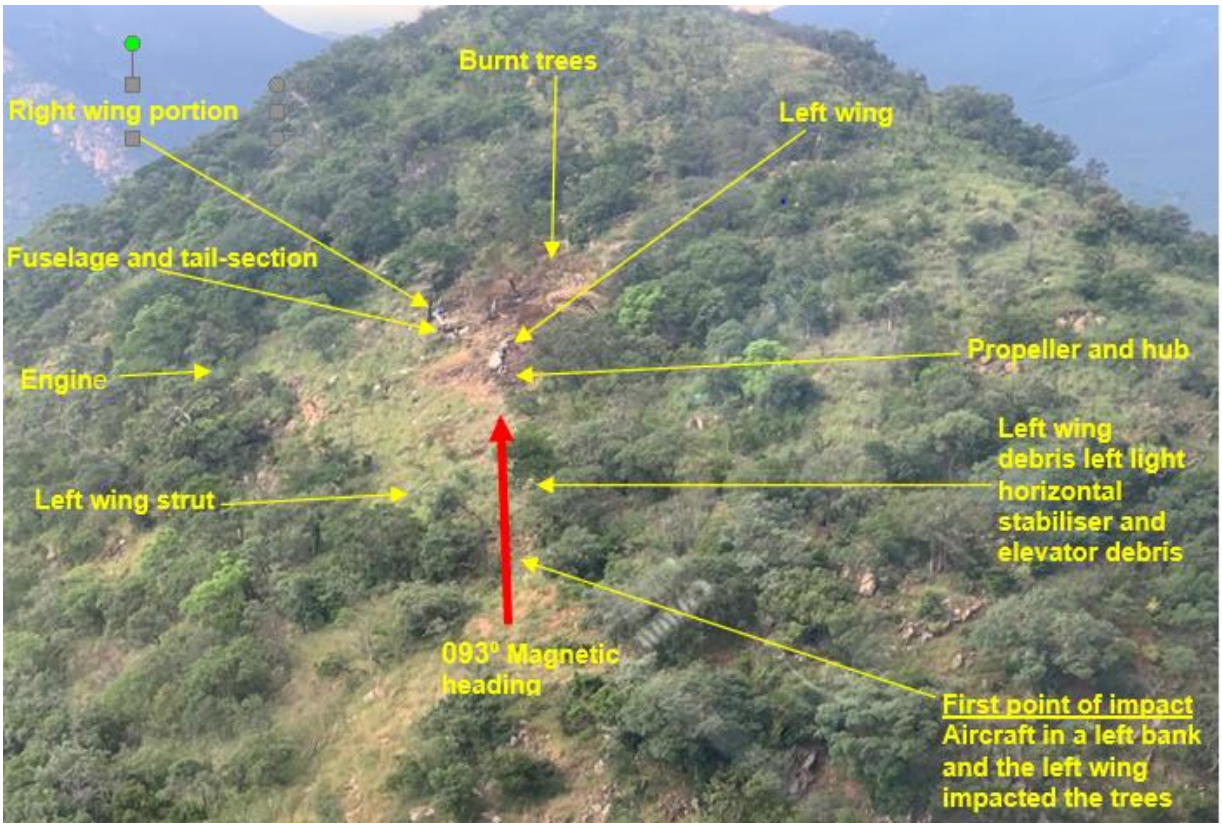

Figure 7: Aerial view of the accident scene and wreckage distribution.

1.12.3 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 fuel selector was found selected to the right tank. Tree impact marks and the impact crater showed that the aircraft impacted the trees at high speed. The debris trail started with the engine cowlings, exhaust pipe, the oil cooler, air hoses and the magnetos. Both wings failed during the accident sequence and fuel tanks raptured. Fuel ignited, setting alight the wings and nearby trees. Some of the trees broke off at the trunk, other tree branches were cut off. Some trees around the wreckage burnt almost to the top and were blackened by smoke and soot. Examination of the fractures on the wing spars were an indication that the wings failed due to impact forces. As the aircraft passed through the tree-tops during the accident sequence, the wings and fuselage had progressively disintegrated. The flaps were in a retracted position on impact; all failures on the flaps system were because of the accident. The elevators and the rudder were found attached to their respective positions. The propeller blades and the broken drive shaft were an indication that the engine was producing a large amount of power at the time of impact. The pilot's spectacles were found at the accident site, suggesting that he had them on at the time of the flight as mandated on his medical.

Figure 8: The fuel selector set to the right tank.

Figure 9: Fractured driveshaft and the propeller showing curled blades.

Figure 10: Close-up picture of the fuselage and tail section.

Figure 11: Close-up picture of the right wing.

Figure 12: Close-up picture of the left wing.

1.13 Medical and Pathological Information

1.13.1 Post-mortem examination determined that the pilot succumbed from blunt force injuries consistent with high energy impact.

1.13.2 The pilot's medical records indicated that he was diagnosed with hypertension and diabetes that could cause unfavourable changes in one's organs, thus, compromising one's health.

1.13.3 The pilot's SACAA-approved medical general practitioner (GP) was aware that the pilot was prescribed with medication to treat hypertension and diabetes, and both were listed as "current and long-term medication". The GP also signed the pilot's current medical declaration and certificate as being fit to fly.

1.13.4 According to the toxicology report, the specialists were unable to state with certainty if the physiological changes due to hypertension and diabetes contributed to the pilot's ill health in-flight.

1.14 Fire

1.14.1 There was a post-impact fire that burnt a portion of the aircraft and the surrounding trees. 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. Fuel could have also ignited from contact with the hot 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. The pilot made use of the factory-fitted four-point safety harness which was fitted to the left front seat. The Oryx military helicopter was dispatched to the scene of the accident. The pilot had succumbed to his injuries. The pilot's body was handed over to the care of the Forensic Pathology Services. The police have opened an inquest docket.

1.15.2 The aircraft was equipped with a Kannad 406-megahertz (MHz) emergency locator transmitter (ELT) part number S1840501-02, serial number KA0003438005 installed near the tail of the aircraft and was connected to an outside antenna. The ELT was installed so that the device's longitudinal axis was aligned with the aircraft's longitudinal axis. The ELT was last inspected by the aircraft maintenance organisation (AMO) during the mandatory periodic inspection (MPI) that was completed on 5 May 2020. When the on-site investigation was conducted, the ELT was found secured to its mounting position and undamaged. The ELT transmits signals on both the international civilian distress frequency 121.5 MHz as well as the military distress frequency 243.0 MHz to enable rescue teams to locate a crashed aircraft within a short period. The ARCC office in Johannesburg was consulted and it was reported that the ELT did not activate during the accident sequence.

1.15.3 The ELT was equipped with a three-position control switch labelled ON, OFF and ARM; the switch was found in the ARM position. In this position, automatic activation is supposed to occur when impact forces are sufficient. Manual activation occurs by selecting the control switch to the ON position. In this occurrence, the impact forces were severe, and the aircraft was destroyed. An impact of this nature will generally cause the shock sensor to activate the ELT automatically in the event of a crash. If the impact forces are adequate for activation but are insufficient along the ELT location (in this aircraft, the longitudinal axis), activation may not occur. The ELT was removed from the wreckage and tested, and it was determined that it was capable of functioning as designed.

Figures 13/14: The Kannad 406 ELT and the position of the switches.

1.16 Tests and Research

1.16.1 On-site investigation did not reveal any failure or malfunction of the engine and airframe prior to impact that might have reduced the aircraft's performance. The investigator-in-charge (IIC) did not find it necessary to conduct any tests or research on any part or component of the aircraft during the investigation. According to available aircraft documentation, no reported defects were recorded since the last maintenance inspection was certified. Examination of the propeller flange and the blades (Figure 9) indicated that the engine was producing a substantial amount of power at the time of impact.

1.17 Organisational and Management Information

1.17.1 This was a private flight which was conducted under the provisions of Part 91 of the South African Civil Aviation Regulations 2011 as amended.

1.17.2 The AMO certificate was issued by the Regulator on 20 January 2021 with an expiry of 31 January 2022.

1.18 Additional Information

1.18.1 Federal Aviation Administration (FAA) diseases protocols hypertension:

Hypertension (or high blood pressure) is a common condition where the pressure of the blood flowing through the arteries of the body is higher than it should be. Pilots and controllers are often affected whether or not they have the classic "type A" personality. Much like the pressure of the air in a tyre, if the pressure of the blood is too high it can damage the arteries and organs of the body. Just like the tyre, if the pressure suddenly becomes very high, catastrophic events can happen. Similarly, if the pressure remains somewhat elevated for a long enough period of time, premature wear and failure can occur.

Hypertension has its worst effects on the heart, kidneys, eyes and brain. High blood pressure is a risk factor for heart attack, stroke, kidney failure, haemorrhages of the retina of the eye, and generalised atherosclerosis (hardening of the arteries all over the body).

It is easy to understand, then, why are we concerned about pilots who have high blood pressure. We don't like to see aviators flying when they are at an increased risk for these conditions. Fortunately, hypertension is easy to treat. For many people, simply achieving an appropriate weight, exercising regularly, and watching dietary salt will control their mild hypertension. Other individuals may be required to take medications to reduce their blood pressure. Either way, hypertension and its treatment should have little effect on one's ability to be medically certified to fly.

Measuring Blood Pressure:

Blood pressure can be measured with the individual lying down, sitting, or standing. Regardless of the position, the blood pressure recording will always consist of two numbers written like a fraction with the top number called the systolic pressure and the bottom number called the diastolic pressure. In the example 120/80, the systolic pressure is 120 and the diastolic pressure is 80. These numbers are in units of "millimetres of mercury". (That means that a pressure of 120 is enough to support a column of mercury 120 millimetres high.) One can think about the systolic pressure as representing the peak pressure during the heart's contraction and the diastolic pressure as representing the resting or baseline pressure within the blood stream between contractions.

Most doctors today believe that people who consistently run blood pressures higher than 140/90 are at increased risk for the complications noted above and should be considered for treatment. Remember, however, that blood pressure is variable and occasional readings above this level are to be expected. It is a preponderance of readings above 140/90 that defines hypertension.

Aerospace Medical Disposition:

If an individual with no known history of hypertension is found during the FAA exam to have blood pressure readings consistently higher than 155/95 then further investigation is required. Initially, this should consist of recording the blood pressure twice a day (morning and evening) for three consecutive days. If at least 4 of these 6 readings are 155/95 or less and the applicant is otherwise qualified, then no further action is required, and the certificate can be issued.

If the three-day blood pressure checks confirm the presence of hypertension, then treatment of some kind will generally be required for certification. Once a person is on a stable treatment plan and their blood pressure is adequately controlled without significant adverse effects, certification can be considered. When the FAA is notified for the first time about an aviator who has initiated treatment for high blood pressure, the following items will need to be reviewed and cleared by an Aviation Medical Examiner (AME):

1. *Complete review of pertinent history including personal, social and family history related to hypertension and risk factor analysis for complications.*
2. *Statement from treating physician describing the effects of treatment and any risk factor modification program.*
3. *Representative blood pressure readings.*
4. *Laboratory testing to include electrolyte, lipid profile and glucose.*
5. *Resting ECG.*

If the above is acceptable, the AME may issue the medical certificate, good for its normal duration. An individual who has already reported the hypertension and received an initial clearance will require hypertension follow-ups annually for first- and second-class medical certificate applicants and at the time of renewal for third-class certificate applicants. The information required at each hypertension follow-up is as follows:

1. *A statement (current status report) from the treating physician describing at a minimum the medication(s) used and the dosage(s); the adequacy of blood pressure control; the presence or absence of medication side effects; and the presence or absence of any "end organ" hypertension complications (that is, in the heart, blood vessels, brain, eyes and kidneys). A one-sentence, "no problems" report will not suffice and will delay certification.*
2. *The results of any appropriate tests or studies deemed necessary by the treating physician.*
3. *A serum potassium level if the airman is taking a diuretic.*

The above evaluation may also be performed by the AME if the AME can attest to the accuracy of the above information. For an individual who has already reported the hypertension and received

an initial clearance, the follow-up requirements at the next and subsequent FAA medical exams are very simple. All that is required is a statement from the treating physician that the individual is in good health and having no blood pressure-related problems and including some sample blood pressure readings.

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 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 turbulence around Hoedspruit; Mariepskop Mountain range area had clear skies, including Hoedspruit Civil Aerodrome (FAHT).

2.2.2 Examination of the aircraft documentation revealed that the aircraft was airworthy to undertake the flight on 4 March 2021. Scrutiny into the aircraft documentation showed that the aircraft was properly maintained with the last MPI conducted on 5 May 2020 at 4808.16 airframe hours. Scrutiny into the last maintenance work pack indicated that all applicable Airworthiness Directives (ADs), mandatory Service Bulletins (SBs) on the aircraft and its engine have been complied with as on the date of accident. Scrutiny of the aircraft flight folio revealed that there were no snags pending on the aircraft prior to the accident flight.

2.2.3 Examination of the pilot's file held at the SACAA indicated that the pilot was properly licensed with an aircraft type endorsed on his licence. The pilot had a Class 1 aviation medical certificate issued on 4 November 2020 with an expiry date of 31 May 2021. A medical examination for his aviation medical issued on 4 November 2020 specified that the pilot had normal distance vision corrected with glasses in both eyes. A restriction on his medical certificate required him to wear suitable corrective lenses when flying and to follow diabetes and hypertension protocol. A review of his medical record by the SACAA aviation medical division could not find anything from his visual history and examination that suggested his vision, and in particular, his history of eye disease was a cause or contributory factor to the accident. The pilot, in general, was reported to be in good health.

2.2.4 According to available information, at 0721Z, ZS-CUU pilot for the first time after departing FATZ made a radio transmission to the Lowveld controller on 119.0 very high frequency (VHF), routing from FATZ to FANS at flight level (FL) 075 at 120 knots (kt) indicated air speed (KIAS). The aircraft was identified on radar approximately 12nm east of the South African (SA) Air Force Base (AFB) Hoedspruit (FAHS) and was requested to squawk 7414. The pilot reported one-hour endurance. At 0745Z, the pilot reported to the controller at Lowveld that he was not feeling well; he was experiencing chest pains and requested to land at the closest aerodrome. The pilot also called Kishugu on his mobile phone informing them that he was not feeling well. He was encouraged to land at the closest aerodrome and to advise when he was safe on the ground. His position at the time was 8nm north-east (NE) of Ohrigstad. The Lowveld controller informed him that Ohrigstad Aerodrome was on his twelve o' clock position as well as Pilgrim's Rest (FAPO), but the pilot requested to be diverted to Hoedspruit Civil Aerodrome (FAHT).

2.2.5 The pilot did not make it to FAHT as advised and the aircraft impacted the mountain peak at 093º degrees Magnetic; the pilot succumbed to his injuries at the accident site. On-site investigation and examination of the wreckage indicated that the aircraft collided with the mountain whilst routing in a southerly direction and was destroyed on impact. The fractured engine crankshaft/driveshaft and the propeller that were noted at the accident site were an indication that the engine was developing a substantial amount of power at the time of impact. The exact amount of engine power was undetermined due to the absence of a flight data recorder (FDR).

2.2.6 The investigation determined the accident to be an uncontrolled flight into terrain due to incapacitation and impairment as reported by the pilot, however, the toxicology report was unable to state with certainty if the physiological changes due to hypertension and diabetes contributed to the pilot's ill health in-flight.

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 pilot had a Commercial Pilot Licence issued on 12 June 2020 with an expiry date of 30 June 2021.

3.2.2 The pilot had a Class 1 aviation medical certificate issued on 4 November 2020 with an expiry date of 31 May 2021. On his medical, the pilot had restrictions to wear suitable corrective lenses as well as hypertension and diabetics protocol.

3.2.3 The aircraft was issued the Certificate of Airworthiness on 23 May 1969 with the latest reissued certificate bearing an expiry date of 31 May 2021.

3.2.4 The aircraft was issued the Certificate of Registration on 15 December 2003.

3.2.5 The last 100-hour MPI on the aircraft was completed on 5 May 2020 at 4808.16 airframe hours. The aircraft was maintained by a Regulator-approved AMO. The AMO certificate was issued by the Regulator on 20 January 2021 with an expiry date of 31 January 2022.

3.2.6 The Certificate of Release to Service was issued on 5 May 2020 which would have lapsed at 4908.16 flight hours when the next inspection was due or on 4 May 2021, whichever occurs first; unless the aircraft is involved in an accident or becomes unserviceable, in which case the certificate becomes invalid for the unexpired period.

3.2.7 Examination of a 100-hour maintenance work pack, work order No 54514, indicated that all applicable recurring SBs and ADs were complied with as recommended by the aircraft manufacturer.

3.2.8 The aircraft was equipped with a Kannad 406MHz ELT part number S1840501-02, serial number KA0003438005 installed near the tail of the aircraft and was connected to an outside antenna. The ELT did not activate at the time of impact.

3.2.9 The accident was considered not survivable due to the high kinetic energy associated with the impact that was well above that of human tolerance. The pilot made use of the factory-fitted four-point safety harness which was fitted to the left front seat.

3.2.10 The Oryx military helicopter was dispatched to the scene of the accident. The pilot was found to have succumbed to his injuries. The pilot's body was handed over to the care of the Forensic Pathology Services. The police have opened an inquest docket.

3.2.11 At 0721Z, the ZS-CUU pilot, for the first time after departing FATZ, made a radio transmission to the Lowveld controller on 119.0 VHF, routing from FATZ to FANS at FL075 at 120 KIAS. The aircraft was identified on radar approximately 12nm east of the South African AFB Hoedspruit (FAHS) and was requested to squawk 7414.

3.2.12 At 0745Z, the pilot reported to the controller at Lowveld that he was not feeling well; he was experiencing chest pains and requested to land at the closest aerodrome. The pilot also called Kishugu on his mobile phone informing them that he was not feeling well. He was encouraged to land at the closest aerodrome and to advise when he is safely on ground.

3.2.13 The post-mortem and toxicology reports could not conclusively indicate what was the cause of incapacitation even though the pilot was known to suffer from hypertension and diabetes.

3.3 Probable Cause/s

3.3.1 Uncontrolled flight into terrain due to pilot's loss of consciousness.

3.4 Contributory Factors

3.4.1 According to the toxicology report, the specialists were unable to state with certainty if the physiological changes due to hypertension and diabetes contributed to the pilot's ill health in-flight.

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 None.

5. APPENDICES

5.1 None.

This report is issued by:

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