

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9587	
Aircraft Registration	ZS-OWB	Date of Accident	10 December 2016		Time of Accident	1118Z
Type of Aircraft	Piper PA-28-181		Type of Operation	Private (Part 91)		
Pilot-in-command Licence Type	Private Pilot Licence		Age	20	Licence Valid	Yes
Pilot-in-command Flying Experience	Total Flying Hours		100.7		Hours on Type	100.7
Last point of departure	Kruger International Airport (FAKN), Mpumalanga Province.					
Next point of intended landing	Rand Airport (FAGM), Gauteng Province.					
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)						
At Ngodwana, Mpumalanga in a mountainous area about 30NM west of Kruger International Airport (FAKN) at position GPS 25°30'55.3"S 30°31'30.7"E, elevation 4724 ft AMSL.						
Meteorological Information	Wind direction: 040°, Wind speed: 02 knots, Temperature: 24°C, Dew point: 15°C, Cloud: BKN 025 and Visibility: Good.					
Number of people on board	1 + 2	No. of people injured	0	No. of people killed	3	
Synopsis	<p>The pilot and two passengers were on a private flight from FAKN with the intention to return to FAGM.</p> <p>The pilot filed VFR flight plans for both flights/sectors that he intended to undertake. The aircraft initially took-off from FAKN at about 0830Z and after the take-off the pilot decided not to continue with the flight due to cloud and overcast weather conditions and landed back at FAKN at approximately 0840Z.</p> <p>The second take-off from FAKN was at approximately 1039Z, with the intention to route to Rand. According to FAKN ATC supported by the tower recordings, it shows that the prevailing weather conditions were identified as a concern to the pilot prior to him embarking on both flights.</p> <p>The evidence was that amidst the pilot being advised of the weather conditions, he continued with embarking on the flight. When en route to FAGM and during the cruise overhead Ngodwana, supported by the SAWS report, the pilot encountered cloud and overcast weather conditions. Due to the cloud and overcast weather conditions, the aircraft inadvertently collided with terrain (mountain).</p>					
Probable Cause						
The aircraft collided with terrain in cloudy and overcast weather conditions. Controlled flight into terrain (CFIT) due to adverse weather.						
SRP Date	10 October 2017		Release Date	05 April 2018		

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Belaire Aviation CC
Manufacturer : Piper Aircraft, Inc.
Model : PA-28-181
Nationality : South African
Registration Marks : ZS-OWB
Place : Ngodwana, GPS 25°30'55.3"S 30°31'30.7"E, 4724 ft AMSL.
Date : 10 December 2016
Time : ±1118Z

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 (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 establish blame or liability.***

Disclaimer:

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1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 According to U-Fly Training Academy flight authorisation sheet, on the morning of 9 December 2016 at about 0400Z, the pilot signed out the PA-28-181 aircraft registration ZS-OWB. He indicated that the aircraft will be used on a flight from Rand Airport (FAGM) to Kruger Mpumalanga International Airport (FAKN) and back. Also, that there will be two passengers accompanying him on the flight.

1.1.2 Based on the above, according to ATNS the pilot filed three different flight plans regarding the flights to and from FAKN. The flight plans were filed in terms of the appropriate air traffic control service requirements. The two identified ATSU's (FAGM and FAKN) were regarded as responsible to transmit the relevant flight plans to all other ATSU's concerned with the flight. He filed the flight plans in respect of the aircraft embarking on VFR flights, wherein it would be departing and entering from aerodromes operating in controlled airspace.

- 1.1.3 In terms of the first flight plan which was filed for the flight from FAGM , the evidence shows that the aircraft flew during the morning on 9 December 2016 at approximately 0600Z. It was a private VFR flight i.e. flown with visual reference to surface by day and routing to FAKN. After an uneventful flight of approximately 2 hours long, the aircraft landed safely at FAKN.
- 1.1.4 According to FAKN handling services workers, they indicated that after ZS-OWB landed the pilot requested the aircraft to be refuelled. A total of 63.0 litres of Avgas fuel was then uplifted. After refuelling was completed, the pilot paid for the airport services i.e. refuelling, parking, approach and landing fees. The aircraft was then left overnight on the general aviation parking. The three occupants i.e. pilot and two passengers left FAKN going to Skukuza where they stayed for the night.
- 1.1.5 At approximately 1030Z, prior to the pilot leaving for Skukuza, he first filed a flight plan for an early departure flight the next morning on 10 December 2016 at approximately 0830Z. The investigation determined that the three occupants arrived back to FAKN at approximately 0600Z, carried out a pre-flight inspection on the aircraft.
- 1.1.6 According to FAKN ATC flight strip, supported by the tower recording the evidence is that at approximately 0838Z the pilot broadcasted on tower frequency 119.2 MHz and reported his position on the aerodrome. The pilot then requested clearance to start, taxi and take-off to embark on the flight back to FAGM. However, due to instrument meteorological conditions (IMC) declared at approximately 0615Z by FAKN ATC within the control zone, the pilot was approved to conduct a special VFR flight i.e. to fly below clouds within visibility and distance minima.
- 1.1.7 According to the flight strip, the aircraft flew from FAKN at approximately 0851Z, embarking on the special VFR flight as per ATC instruction. He was required to remain at 4500 ft AMSL or below cloud with ground insight at all times. As per the flight plan the pilot had anticipated that during the flight he would climb out to FL075 but due to the prevailing IMC conditions, the ATC advised him that FL075 was not standard at the time and gave him the opportunity to choose either FL085 or FL065. Consequently he then chose to climb to FL085 instead.
- 1.1.8 According to the tower recordings, prior to commencement of take-off from FAKN the ATC again reminded the pilot that he should climb to FL085 and advised him to keep clear of the instrument flight rules (IFR) traffic. He was instructed to route through the special rules area and facing west bound because according to ATC *“the weather conditions on that side of the mountains were not looking too badly”*. When receiving the information the pilot’s response was *“Copy that mam, we’ll route through the Kruger special rules area and we will be careful, OWB”*. After this communication an uneventful take-off followed and the pilot complied with all ATC instructions.
- 1.1.9 After the departure the ATC instructed the pilot to report back when 7 miles outbound. The pilot flew the aircraft through the special rules area and climbed to the levels as per ATC instructions. During the flight ATC broadcasted to ZS-OWB and requested the pilot to report his distance outbound. The time of the broadcast was ideal, because in response the pilot reported that he was approximately 2 nautical miles (NM) out bound from FAKN and very important he was concerned about the visibility and distance from cloud. He reported that *“the weather conditions was not good at all and requested to return back to FAKN until it improves”*., ATC immediately instructed him to turn around and set heading on a

course routing back to FAKN.

- 1.1.10 However, during the approach with the field insight due to other departing traffic he was requested to hold in an orbit (it was ± 10 minutes long) on the south-westerly side of the field. After the other traffic departed from the airport he was then given instructions to do the landing back at FAKN. At approximately 0900Z the aircraft was safe on the ground and the pilot apologising to ATC stating *"Thanks for accommodating mam, sorry about that"*. The apology was well received by ATC as seen by the response *"OWB, not a problem Sir its better we have you safe on the ground"*.
- 1.1.11 After the landing and taxiing back to the general aviation parking, the three occupants disembarked from the aircraft and went to the airport services office located on the airside to wait for the weather conditions to improve. They waited in the office for duration of approximately an hour for the weather to clear. However, they realised that the weather situation was not improving and decided to go into the terminal building to have lunch. At approximately 1020Z they were seen by the airport services office workers walking to the aircraft. The pilot conducted a pre-flight inspection and all three got on board the aircraft. An engine start was initiated followed by the aircraft taxiing to the runway and take-off. According to the airport services office worker, he was surprised to see the pilot embarking on the flight without paying his landing and parking fees account especially after they agreed payment will be made prior to him flying from FAKN.
- 1.1.12 At approximately 1030Z after the three occupants boarded the aircraft, the pilot broadcasted to ATC again on frequency 119.2 MHz and reported his position stating *"OWB, parked on the general aviation parking, requesting flight as per flight plan, three souls onboard with endurance of 4.5 hours"*. The time when the pilot broadcasted to ATC, the operations within the control zone was declared visual meteorological conditions (VMC) again at approximately 1056Z. Under the VMC condition the pilot was approved to conduct a VFR flight i.e. to fly with visual reference to the surface. Due to the change in the weather conditions from IMC to VMC the pilot was no longer required to comply with the special VFR requirements when embarking on this flight. Hence after he reported his position and at about 1037Z cleared to taxi to the runway, ATC instructed him to do the following *"OWB, you are cleared from Kruger to Rand, after departure route as per flight plan, climb to 7500 ft and squawk 6716"*. The pilot's read back to the instruction was then confirmed to be right and requested to report his position when 20 miles outbound.
- 1.1.13 According to the flight strip, the aircraft departed from FAKN again at about 1039Z. During the flight the ATC realised that ZS-OWB deviated from the flight plan and broadcasted to him as follows *"OWB, confirm your intentions, Sir you seem to be routing for Nelspruit now"*. The pilot responded *"Affirm Sir, we gonna route Tzaneen, then Mbombela Stadium and overhead Ngondwana and through to Rand"*. The pilot response was *"OWB, could we request up to 5500 ft just to stay below the cloud"*. He was experiencing poor weather conditions where he was flying at the time. The ATC then asked if his intentions were to maintain 5500 ft throughout his journey to FAGM. His response was *"we will be maintaining 5500 ft until we exit the terminal control area (TMA) and contact Johannesburg Information Service for 6500 ft, OWB"*. He was then reminded again to report back when 20 miles outbound.

- 1.1.14 At approximately 1041Z, ATC broadcasted to the aircraft and requested that the pilot should report his position. The ATC identified the aircraft position to be approximately 13 NM out at that time. The ATC then cleared him to change altitude as requested and stated *“OWB, you can descend at pilot’s discretion, broadcast on 130.35 MHz for us, 30 miles, and on 124.8 MHz, and contact Johannesburg Information on 127.4 MHz for the climb pass on 6500 ft or above it”* The pilot’s read back to the instruction was again confirmed as right and advised to stay on frequency 124.8 MHz if he remains below 6500 ft.
- 1.1.15 The flight continued as per the pilot request until he exited FAKN area of responsibility. At about 1049Z he was handed over to contact Johannesburg Information (FIS) on 127.4 MHz. The broadcast to FIS was at approximately 1059Z, with the pilot calling *“Johannesburg Information, OWB, 5NM west of Ngodwana on 5800 ft”*. This was apparently the last broadcast received from the aircraft. Johannesburg Information observation was at the time when the pilot broadcasted to them, he was en route from FAKN to FAGM, routing low level and below the radar.
- 1.1.16 At approximately 1118Z, on South African Pulp and Paper Industries Limited (SAPPI Pty Ltd) frequency information report of a helicopter that crashed overhead Ngodwana. At about 1144Z the ATC called Aeronautical Rescue Control Centre (ARCC) reporting to them the accident information. Also at approximately 1145Z, FAKN ATC called Johannesburg Information to advise them that they received a report of an aircraft that may have crashed and requested an update on the status of ZS-OWB. The time that FAKN ATC reported the information to Johannesburg Information they indicated that the aircraft tried to contact them at about 1126Z, but when responded there was no immediate response from the aircraft. Johannesburg Information tried to make contact with the aircraft again but still no response. The pilot of another aircraft with registration ZU-BSV also tried to make contact with the aircraft and receiving no response. At about 1150Z a DESTRESSFA message was then sent for the aircraft in distress.
- 1.1.17 Johannesburg Information indicated that as per the flight plan, the track put the aircraft just east of FAWI. Approximately 1325Z, FAKN ATC received a call from Nelspruit Air Wing enquiring about the aircraft crash. At about 1440Z the ground search and rescue first responders, which include Nelspruit Fire Fighting Services reported that ZS-OWB was indeed involved in a fatal accident. The accident site was on (SAPPI Pty Ltd) property at Ngodwana GPS position S25°30'55.3"E030°31'30.7", elevation: 4724 ft. AMSL.

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	1	-	2	-
Serious	-	-	-	-
Minor	-	-	-	-
None	-	-	-	-

1.3 Damage to Aircraft

1.3.1 The aircraft was destroyed.



Figure 1 indicates wreckage of the destroyed aircraft.

1.4 Other Damage

1.4.1 None.

1.5 Personnel Information

Nationality	South African	Gender	Male	Age	20
Licence Number	0272549791	Licence Type	Private Pilot Licence		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night Rating				
Medical Issue Date	31 December 2015	31 December 2017			
Restrictions	None				
Previous Accidents	None				

Flying Experience:

Total Hours	100.7
Total Past 90 Days	12.7
Total on Type Past 90 Days	12.7
Total on Type	100.7

1.5.1 The pilot's training records show that he was issued with a PPL on 5 August 2016 which was 5 months before the accident. The PPL was valid until 31 August 2017 when revalidation will become due.

1.5.2 Based on the pilot's experience logbook, he recently went through a night rating flight training from U-Fly Training Academy during November 2016. After he successfully completed the night rating training, he got the rating.

1.5.3 The experience logbook also showed that the last time the pilot updated his logbook was on 23 November 2016. On this date, he flew a total of 3.4 hours from FAGM to (Mahikeng International Airport) and back. Based on U-Fly's Authorisation Sheet, it shows that the pilot flew again on 6 December 2016 doing circuits and the flight time is unknown. The next flight he flew was on 9 December 2016 from FAGM to FAKN.

1.5.4 The information of the two documents show that this was the first time that the pilot embarked on a flight to FAKN. The evidence was that he had no previous experience of flying on the route and to the aerodrome. Further substantiation of this can be seen in the broadcast between the ATC and the pilot:

- ATC - *"OWB, Sir confirm you are familiar with Kruger special rules area"*.
- Pilot – *"Uhhh...Uhhh...I am sort of familiar, mam; we flew through the Kruger special area on the way up"*.
- ATC – *"OWB, I remind you to climb into flight level 085 due to IF traffic departing shortly, you will need route through the special rules area facing West bound, and I will definitely speak to you again Sir, because it doesn't look too bad on the West of the mountains"*.

1.5.5 In the last 24 hours the pilot flew approximately 2 hours from 0400Z to 0600Z. He did not fly again until on 10 December 2016 at 0838Z. The evidence was that the pilot rested enough and there was no anomaly found.

1.5.6 Due to the nature of the accident, it was deemed important to reflect on the qualifications, experience and licence of the ATC's on duty at the time:

1.5.6.1 First Flight - Air Traffic Controller:

Nationality	Zimbabwean	Gender	Female	Age	43
Licence Number	ATS 0923	Licence Type	ATS		
Medical Valid	Yes	Class	3		
ATC Licence valid	Yes	Valid Until	4 May 2017		
Ratings Issued	<u>ATSU – FAKN:</u> Aerodrome Control (AD) Approach Control Procedural (APP) Instructor Grade 1				
	<i>The last proficiency was on 12 April 2016 and expires on 11 April 2017.</i>				

Note: The pilot established communication with ATS 0923 at approximately 0838Z and they maintained a continued two-way communication until 1059Z.

1.5.6.2 Second Flight - Air Traffic Controller:

Nationality	South African	Gender	Male	Age	27
Licence Number	ATS 1290	Licence Type	ATS		
Medical Valid	Yes	Class	3		
ATC Licence valid	Yes	Valid until	4 February 2018		
Ratings Issued	<u>ATSU – FAKN:</u> Aerodrome Control (AD) Approach Control Procedural (APP) ATSA/AFIS ATSA/CLD				
	<i>The last proficiency was on 29 July 2016 and expires on 28 July 2017.</i>				

Note: The pilot established communication with ATS 1290 at approximately 1232Z and they maintained two-way communication until 1248Z.

1.5.7 ATNS provided relevant information of the two above identified ATC's duty times and rest periods for the last 48 hours prior to the accident:

Lic No:	8 Dec 16	Rest to next shift	9 Dec 16	Rest to next shift	10 Dec 16
ATS 0923	0445z-1100z	23hrs 15mins	1045z-1730z	11hrs 15mins	0445z-1210z
ATS 1290	1045z-1930z	11hrs 15mins	0645z-1405z	19hrs 40mins	0945z-1700z

Matrix 1 indicating the ATC duty times

1.6 Aircraft Information

Airframe:

Type	PA-28-181	
Serial Number	28-8090281	
Manufacturer	Piper Aircraft, Inc.	
Date of Manufacture	1980	
Total Airframe Hours (At time of Accident)	9665.0	
Last MPI (Date & Hours)	28 October 2016	9656.0
Hours since Last MPI	9.0	
C of A (Issue and Expiry Date)	30 May 2008	29 May 2017
C of R (Issue Date) (Present owner)	12 September 2006	Belaire Aviation CC
Operating Categories	Standard Part 135	

Engine:

Type	Lycoming O-360-A4M
Serial Number	L25734-36A
Hours since New	9665.0
Hours since Overhaul	953.81
Date of Last Overhaul	8 October 2003

Propeller:

Type	Sensenich 76EM8S5-0-62
Serial Number	102577K
Hours since New	852.98
Hours since Overhaul	TBO not reached
Date of Last Overhaul	16 February 2007

1.6.1 Aircraft Documentation: A folder which had all the required aircraft documentation was recovered from the scene during the onsite investigation. All the documents was inspected and found to be valid as per the applicable regulation.

1.6.2 Maintenance Documentation: The aircraft maintenance documentation was provided by the responsible aircraft maintenance organisation (AMO). The maintenance documentation was also inspected to determine if the owner/operator complied with the manufactures and regulatory requirements when performing maintenance. The maintenance records show that the aircraft was maintained according to applicable requirements. The evidence was that the responsible AMO carried out both scheduled and non-scheduled maintenance on the aircraft. The scheduled maintenance i.e. mandatory periodic inspections (MPI) carried out after every 100 hours or within a period of 12 months. The non-scheduled maintenance was the defects or systems malfunctions identified during day-to-day operations.

1.6.3 Fuel Status: According to the Piper PA-28-181 Pilot Operating Handbook (POH), Section 2, Limitations states that the aircraft was certified to use 100 LL grade, aviation gasoline (AVGAS). The aviation fuel delivery receipt INV No. AV 31928 indicated that the right certified type and grade of fuel was uplifted. The total quantity of fuel uplifted was 63 litres.

1.6.3.1 During the first start-up prior to the aircraft embarking on the first flight, the pilot reported to FAKN ATC that his endurance was 4.5 hours. He then embarked on a flight but due to weather returned to land back to FAKN.

1.6.3.2 During the second start-up prior to the aircraft embarking on the second flight, the pilot reported to FAKN ATC his endurance to be 4.5 hours again. The flight was approximately 39 minutes long from (1039Z – 1118Z) when information of the crash was reported for the first time.

Note: The total flight time was calculated to be approximately 40 minutes long. It means that the fuel used for the first flight was approximately 7 U.S.gallons.

1.6.4 According to the pilot operating handbook (POH), Section 5, Performance it states that the endurance of the aircraft is approximately 5.5 hours (with 25 minutes reserve) and 6.1 hours (with no reserve) and Section 1, General states that the fuel capacity is equal to 50 U.S.gallons (48 U.S gallons usable fuel).

1.6.4.1 Based on the above information it means that the aircraft was refuelled to capacity of approximately 40 U.S.gallons as per the pilot stating his endurance is 4.5 hours. In this case when subtracting the fuel used approximately 7 U.S.gallons during the first flight, the total fuel capacity remaining would have been approximately 33 U.S.gallons. However, according to the flight plan the estimated flight time from FAKN to FAGM was predicted to be approximately 2 hours 20 minutes (1039Z – 1300Z). Implying that the fuel used was going to be approximately 20 U.S.gallons and remaining with a quantity of approximately 13 U.S.gallons (including the

reserve fuel). The fuel calculation shows that the aircraft had sufficient quantity of fuel to embark on the flight to FAGM as per the applicable regulations.

1.6.5 Mass Calculation: According to the mass and balance certificate, it shows that the aircraft was last weighed on 15 April 2014. The empty mass was calculated to be 733 kg with maximum certificated mass of 1 156 kg.

Note: The aircraft weight and balance for the flight was calculated:

	Mass	Empty Mass	Max Permissible Mass
Fuel quantity	85 kg	733 kg	1 156 kg
Pilot	85 kg (estimated)	pilot + passengers + fuel + baggage = pay load (85 kg) + (215 kg) + (89.1 kg) + (5 kg) = 394.1 kg Empty Weight + Pay load = y (733 kg) + (394.1 kg) = 1 127.1 kg MTOW – Empty Weight – Pay load = x (1 156 kg) – (733 kg) – (394.1 kg) = 28.9 kg	
Passengers	95kg+120 kg (estimated)		
Baggage	5 kg (estimated)		

Matrix 2 indicating the weight and balance calculation

1.6.5.1 The evidence was that the aircraft was approximately 28.9 kg below the maximum take-off mass (MTOW) and found to be within specified limits. What is important to note with the identified weight information is that the aircraft was loaded within the approved weight range before making the take-off.

1.6.6 There was no evidence of any failed components found related to the accident and neither any defects during the flight. Also, there was no evidence of other abnormalities identified with the aircraft which had any bearing on the accident. The aircraft was determined to be serviceable and airworthy for the flight.

1.6.6 The aircraft flew into terrain when involved in the accident. As a consequence it was determined that there was some navigation equipment which had bearing on the accident. For that purpose it was deemed important to look at the installed navigational equipment. According to the aircraft equipment list, the following navigational equipment was installed:

Equipment	Description	Type No	Serial No
GARMIN GPS	Audio Panel	GMA340	96276933
GARMIN GPS	NAV/COMM	GNS430	97105542
GARMIN	Transponder	GTX327	83721827
KING	NAV/COMM	KX155	13730
KING	ADF	KR87	
KING	DME	KN64	6725

Matrix 3 indicating the navigational equipment on board the aircraft.

1.6.6.1 The evidence was that all the above identified navigational equipment were serviceable. The navigational equipment had the capability to provide the pilot with related information to navigate the aircraft appropriately and safely. However, in order to use the information, the pilot needed to be qualified on instrument flight rules.

1.6.6.2 Garmin Transponder: As indicated above the aircraft had a GTX 327, Mode C digital flight transponder fitted. The transponder had the capability to send a transponder code i.e. VFR squawking feature which if activated could assist ATC to identify the aircraft during the flight. The transponder was important as it will help ATC to monitor the aircraft separation with other traffic in the controlled airspace.

Note: The transponder was important as per the flight plan, because of the pilot's intention to fly in Terminal Control Area (TMA) at altitude of FL085. Based on this request by the pilot, he was requested to squawk on 6716-code.

1.6.6.3 Garmin GPS NAV/COMM GNS 430: The GPS integrates terrain and navigation databases. The GPS in turn provides the pilot with information of his current position and heading. The GPS uses a detailed basemap and displays color coding to graphically alert the pilot when proximity conflicts ahead.

1.7 Meteorological Information

1.7.1 On several occasions on the ground and during the flight in the communication between FAKN ATC and the pilot, weather information was broadcasted on frequency 119.2 MHz.

(i) As indicated above, prior to the first take-off the ATC provided the pilot with information of the weather conditions i.e. surface wind and QNH followed by an instruction *"routing at special VFR remaining 4500ft or below/clear of clouds with ground insight at all times"* However, a few minutes into the flight there was another ATC broadcasted to the aircraft requesting:

- ATC - *"OWB report your distance outbound from Kruger Sir, and confirm you routing to Ngodwana"*.
- Pilot – *"Uh...Mam, we approximately 2NM outbound but uh...the visibility isn't good at all, could we possibly return to Kruger until the weather improves"*.

(ii) During the second flight as well during the time of take-off and in flight the ATC provided the pilot with the appropriate weather information followed by an instruction to *"report 20 miles from Kruger"*. However, when the pilot broadcasted he instead requested *"Tower, OWB, could we request up to 5500 just to stay below the cloud"* it was to notify ATC of the conditions where he was flying.

1.7.2 In terms of the above, according to FAKN Tower Occurrence Log, on 10 December 2016 at approximately 0615Z there was an entry made by the on duty ATC stating *"Item – IMC, Operational Comments – Due Low Cloud. Signal Sent"*.

Note: The on duty ATC submitted a statement to explain what happened. She confirmed that *"It was IMC during the morning; hence the pilot was allowed to fly a special VFR flight"*.

1.7.2.1 At about 1059Z, later in the day the on duty ATC then made another occurrence logbook entry stating *"Item – L.E., Operational Comments – VMC Signal Send T0957Z"*. The meaning of "L.E" in this regard was "late entry". Based on the ATC the entry in question referred to two activities: *"VMC Declared"* and *"VMC Signal Send"*. The anomaly identified was the actual time 0955Z at which the entry was

supposed to be written into the Occurrence Log. The on duty ATC indicated that she forgot to write the entry at 0955Z.

1.7.2.2 The on duty ATC stated “During the handover of watch at approximately 0955Z she and another ATCO declared VMC. When she came back after her break at about 1055Z they realised that the VMC signal had not been sent. She then requested that the other ATSO send a VMC signal while she made the entry in the Occurrence Log. However, the entry showed the time (1059Z) when the signal was sent and time (0957Z) that the VMC was declared. She realised that the entry was not as clear as it should be. She somehow inadvertently put the wrong hour in the occurrence log and then corrected it”. However, in order to resolve the matter of the IMC and VMC the ATCO referred the investigation to the hourly METAR which indicates that at the time of taking over, the conditions of the CTR were in actual fact VMC.

Note: For the purpose of understanding the following descriptions are important:

- (i) Instrument Meteorological Conditions (IMC): Reference <https://en.wikipedia.org> states that “IMC is an aviation flight category that describes weather conditions that require pilots to fly primarily by reference of instruments, and therefore under instrument flight rules (IFR), rather than by outside visual references under visual flight rule (VFR)”.
- (ii) Visual Meteorological Conditions (VMC): Reference <https://en.wikipedia.org> states that “VMC is an aviation flight category in which visual flight rules is permitted, which pilots have sufficient visibility to fly the aircraft, maintaining visual separation from terrain and other aircraft.”

1.7.3 The meteorological information below was provided by South African Weather Service (SAWS). Based on the SAWS Report referenced: ZS-OWB-2016-12-14, stated: “The data below was recorded at Kruger Mpumalanga International Airport (FAKN) on the 10th December 2016 at/around the time of the accident. The data is extracted from AWS (Automatic Weather System) situated at FAKN”.

1.7.3.1 Referencing the SAWS Report, the times indicted on the report coincide with the two out-bound flight plans i.e. FPL – ZSOWB-VG, DTG: 091030 for flight from FAKN0838 and DTG: 101020 for flight from FAKN1056 the weather conditions were the following:

- (i) SAWS Report information related to FPL – ZSOWB-VG, DTG: 091030, FAKN0838;

Wind direction	100°	Wind speed	05KT	Visibility	9999
Temperature	20°C	Clouds	SCT015 - 3/8 to 4/8 of sky covered OVC020 - 8/8 of sky covered		
Dew point	15°C				

Note: The METAR was FAKN 100900Z 10005KT 9999 SCT015 OVC020 20/15 Q1020 NOSIG=

- (ii) SAWS Report information related to FPL – ZSOWB-VG, DTG: 101030, FAKN1056;

Wind direction	040°	Wind speed	02KT	Visibility	9999
Temperature	24°C	Clouds	BKN025 (5/8 to 7/8 of sky covered)		
Dew point	15°C				

Note: The METAR was FAKN 101100Z 04002KT 9999 BKN025 24/15 Q1018 NOSIG=

1.7.1.2 The SAWS Report concluded that *“The surface wind was light easterly, with cloudy to overcast conditions reported between 2000 – 3000 feet above ground level. The data also agrees with the satellite data in terms of presence of cloud”*.

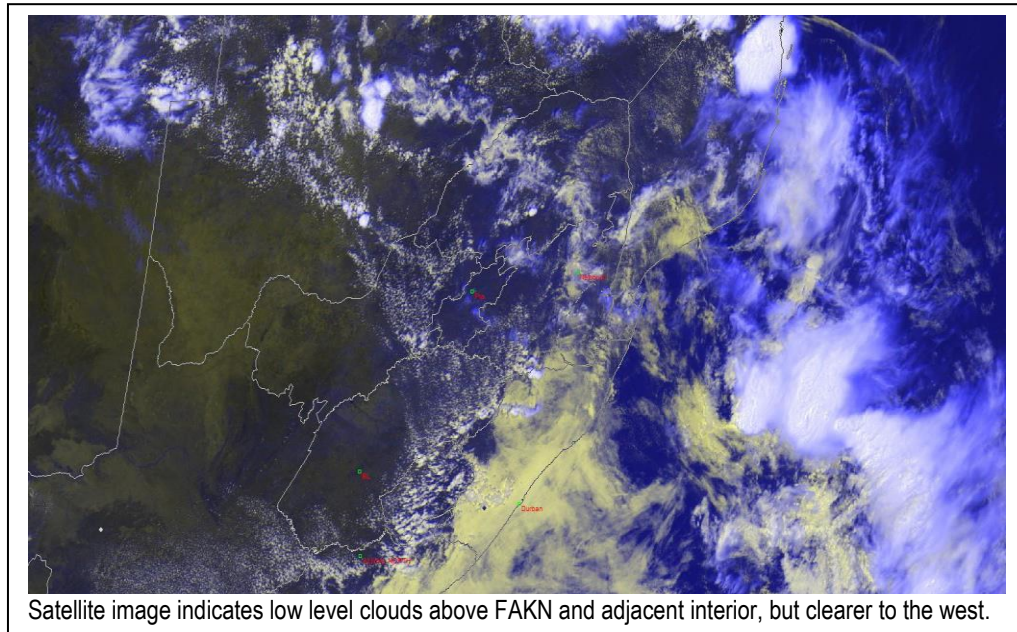


Figure 2 indicating the satellite image of the area of FAKN

1.7.4 Witness account of the weather conditions experienced en route to FAKN: Based on weather conditions observation made by a pilot that flew in ZS-HKA from FAOR to FAKN, he stated that:

“On 10 December 2016 he embarked on a flight to position an AW119Kx helicopter to FAKN for a scheduled passenger transfer to Timbavati. He was routing via the Baberton Valley to Nelspruit flying over the escarpment to FAKN.

Prior to departure, the pilot contacted a friend which resides on a farm at Kaapse Hoop area to obtain weather observation. The friend reported to him that it was overcast and high mountains obscured by cloud.

The pilot stated that at the time when he was passing Belfast to the south a lot of cloud was observed on the high ground stretching to the horizon in the north. He managed to follow his planned route to the south and could remain VFR under low overcast conditions. At approximately 0818Z he landed on the farm of his friend under solid overcast with the mountains to the west obscured in cloud.

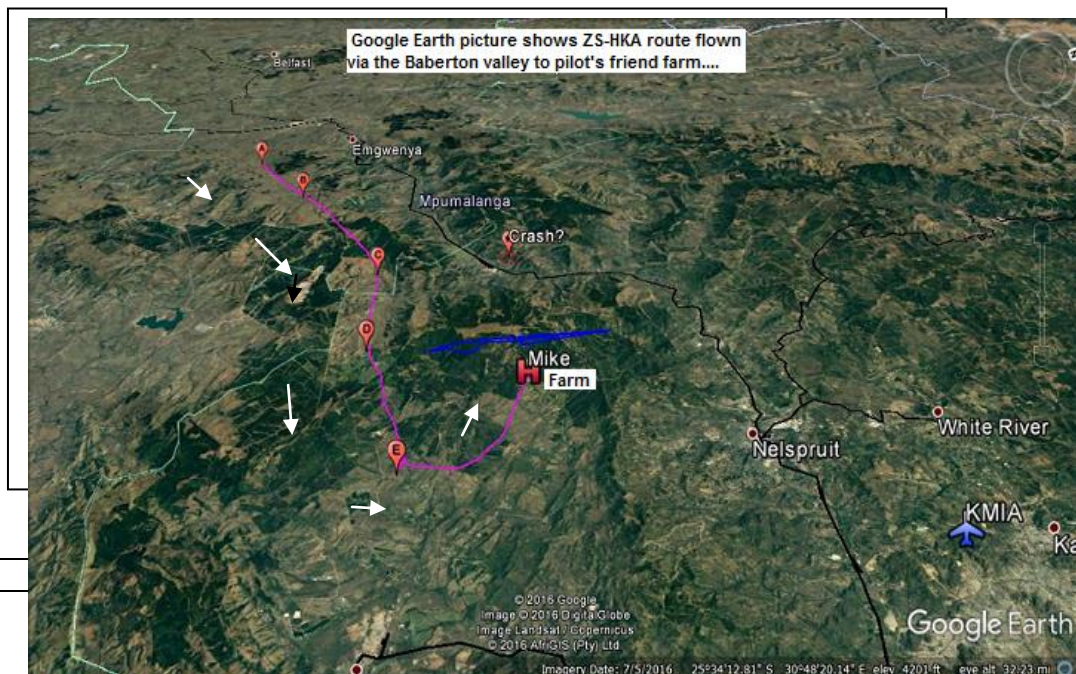




Figure 4 showing the clouds obscuring the mountains

After about 1007Z (± 3 hours 9 min time) on the ground visiting his friend, he took off for FAKN to the north. His observation was that the ridge line between the Barberton Valley and Nelspruit was open under overcast and broken cloud. The mountain tops towards Ngodwana/Kaapse Hoop were still obscured at this time. He flew to FAKN without incident and landed there at about 1021Z. Whilst waiting to be refuelled, he observed a light aircraft (possibly ZS-OWB) taking off. It should be noted that due to deteriorating weather condition Wx on route he decided to do a night stop at FAKN”.

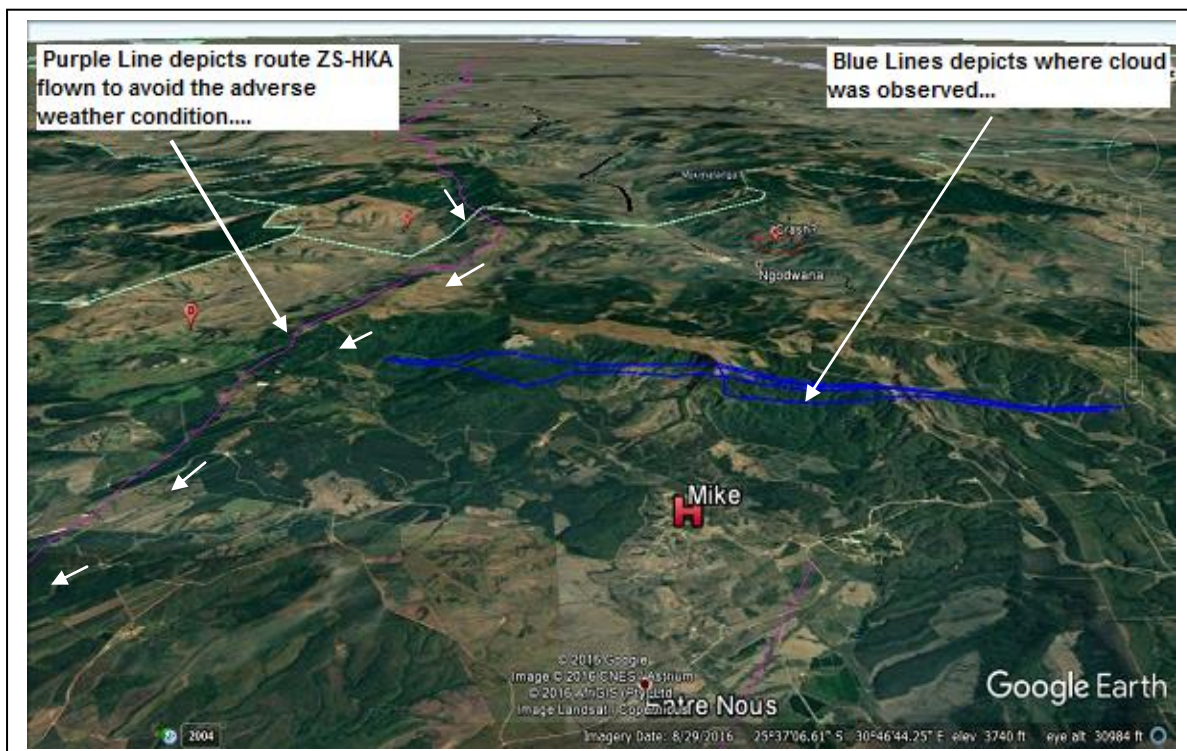


Figure 5 indicating the route taken by ZS-HKA and the area which was covered by clouds.

1.8 Aids to Navigation

1.8.1 The navigation and landing aids at Kruger Mpumalanga International Airport (FAKN) were as follows:

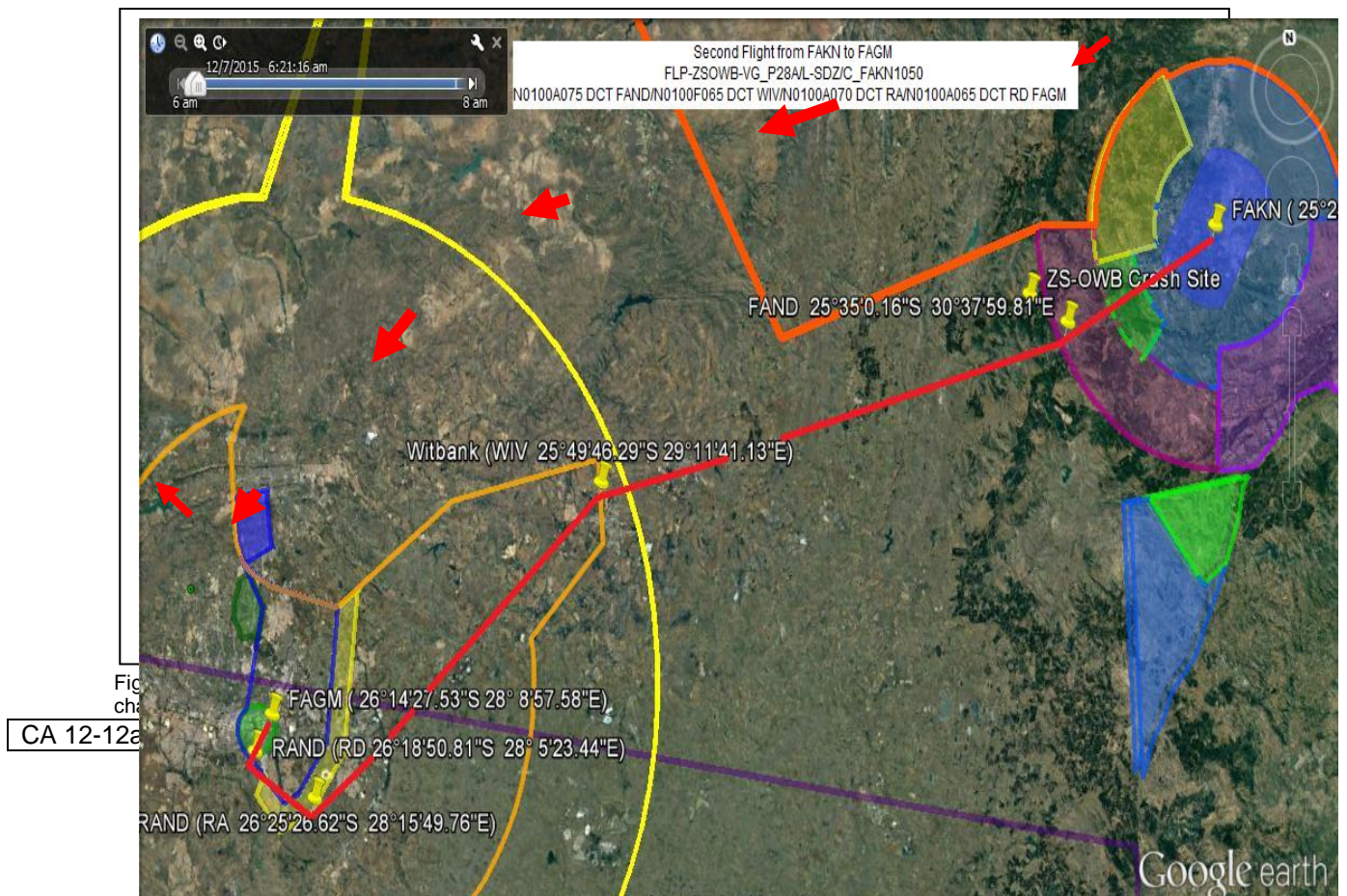
- (i) Very High Frequency Omni Directional Radio Range (DVOR) type, PKV on frequency 112.5 MHz.
- (ii) Non-directional Radio Beacon (NDB) type, PK on frequency 405.0 kHz.
- (iii) Instrument Landing System (ILS) co-located with Distance Measuring Equipment (DME) type, PKI on frequency 109.1 MHz.
- (iv) Runway centrelines and identification markings.
- (v) The above identified navigation and landing aids were in a good condition and serviceable.

1.8.1.1 According to the Aeronautical Information Publication (AIP), FAKN published two routes i.e. departure and arrival for pilot to use when visiting the aerodrome.

1.8.2 The aircraft was fitted with standard navigation equipment which was approved for the type. Other navigation equipment installed was included on the SACAA approved aircraft avionics equipment list. The evidence was that the PIC did not report any information of him experiencing any defect or system malfunction with the aircraft navigation equipment during the flight. The aircraft navigational equipment was considered to be serviceable prior to and during the flight.

1.8.2.1 In order to comply with navigation requirements, the pilot filed two flight plans i.e. FPL-ZS-OWB-VG Reference numbers: #0335 and #0648 to notify ATC of his intentions when flying to FAKN.

- (i) In terms of the first flight plan (#0335) the intention was as follows: N0100A070 DCT FAND/N0100F075 DCT WIV/N0100A070 DCT RA/N0100A065 DCT RD DCT FAGM0220;
- (ii) In terms of the second flight plan (#0648) the intention was as follows: N0100A075 DCT FAND/N0100F065 DCT WIV/N0100A070 DCT RA/N0100A065 DCT RD DCT FAGM0220;

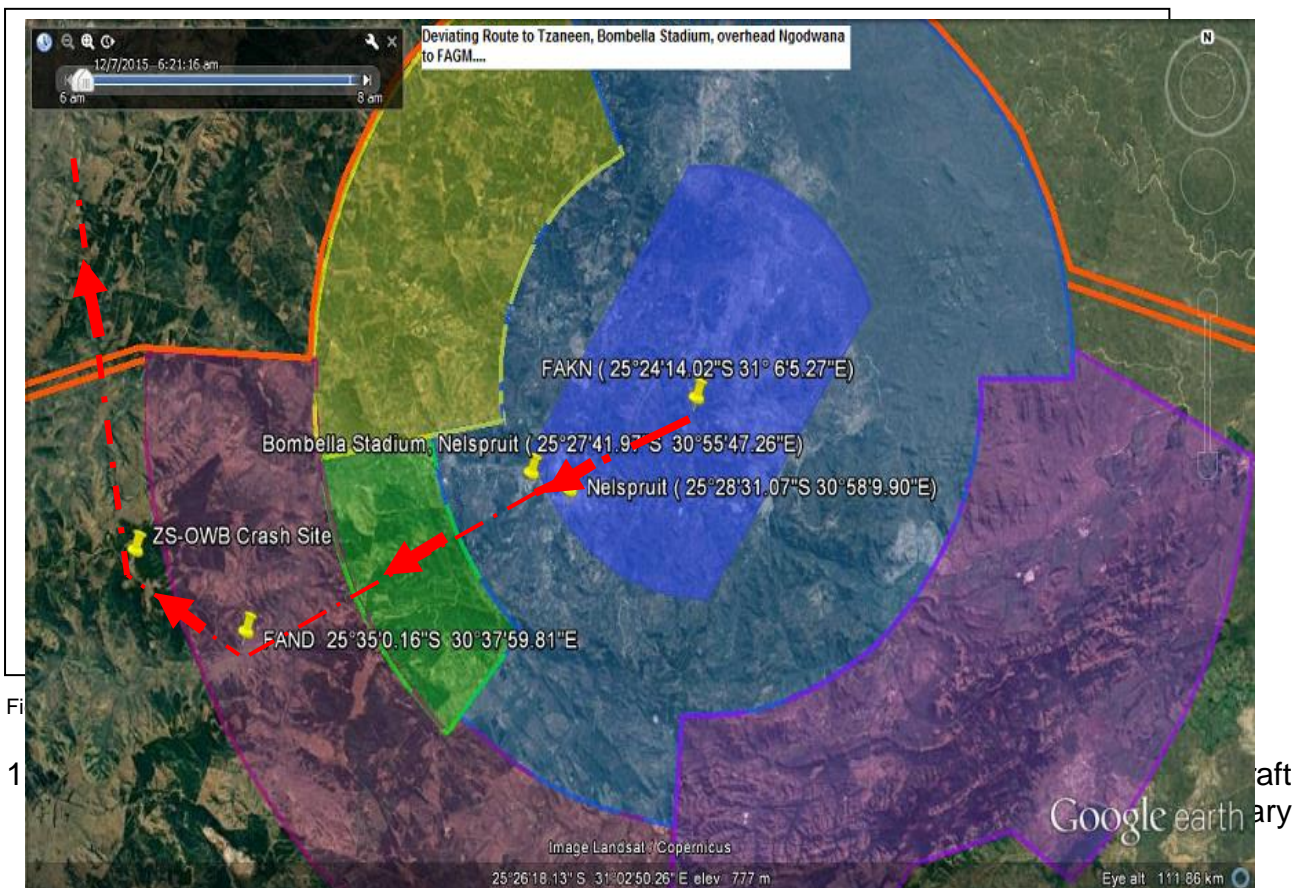


1.8.2.2 According to the Aeronautical Information Publication (AIP), FAKN AD 2.22 – Flight Procedures, the procedure for VFR flights within FAKN TMA are the following:

- (i) VFR traffic to remain west of the national roads linking the city of Nelspruit, Whiteriver (R40) and the Kruger entry gate (R538) to the Kruger National Park, not above 4000 ft Alt. This is to allow the transiting of VFR traffic through that part of the FAKN CTR which is then deemed to be separated from departing and arriving traffic at FAKN and subject to the conditions set by the ATC.
- (ii) A second VFR route between the city of Nelspruit and Malelane south of the national road N4, not above 3500 ft Alt was created to allow the transiting VFR traffic through that part of the FAKN CTR and which is deemed to be separated from departing and arriving traffic at FAKN.

Note: These clearances shall only be valid during daylight and VMC operations.

1.8.2.3 As per the recordings the following evidence became known which is that at the time when the aircraft was still in the climb to reach the altitude of 7500 feet/FL075 as per ATC instructions, the ATC became concerned about the aircraft deviating toward Nelspruit and enquired that the pilot should indicate his intentions. The pilot did confirm that he was now “routing to Tzaneen, Mbombela Stadium, overhead Ngodwana and to Rand”.



Note: Reference <https://en.wikipedia.org> which states that “VFR, the pilot use eyesight while flying and IFR, the pilot use instruments for navigation purposes, both are sets of flight rules under the applicable regulations which a pilot operates an aircraft in different weather conditions”.

1.9 Communications.

- 1.9.1 Kruger Mpumalanga International Airport (FAKN) is a manned aerodrome. The communication in the airspace was controlled by the Air Traffic and Navigation Services (ATNS). Based on the AIP, the aerodrome communication facilities available are tower/approach on 119.2 MHz and apron service on 122.65 MHz:
- 1.9.2 According to the AIP, *“all aircraft routing to and from FAKN must contact the Tower on frequency 119.2 MHz on start with flight details to arrange inbound or outbound clearances”*. The evidence was that ATC was contacted by the pilot when inbound on 9 December 2016. He contacted the tower again on 10 December 2016 when departing on the two flights intending to route to FAGM. As a result ATNS was then requested to provide AIID with tower communication recordings of the pilot and ATC.
- 1.9.3 The aircraft was fitted with VHF King KX 170/A/B type radio communication transmission equipment. The PIC did not report any defect or malfunction being experienced with the radio communication equipment. The radio communication equipment was determined to be in a good serviceable condition prior to the accident.
- 1.9.3.1 As indicated above, the pilot used the aircraft radio communication equipment to broadcast his intentions to FAKN ATC. The evidence was that all the radio communication transmissions between the pilot and ATC were recorded on the tower recording equipment. See appendix A which is copy of a transcript made to show the two-way communication between the pilot and ATC.
- 1.9.4 There was other communication between the pilot and his parents about the weather condition preventing him to return to FAGM. Based on a telephone message sent at approximately 0519Z, it shows the pilot confirming to one of his parents that he did make contact with U-Fly Training Academy that morning and requesting that they provide him with the prevailing weather conditions at FAGM. The time he called U-Fly it was before working hours; hence he was told that the information will be provided to him during office hours.
- 1.9.4.1 At approximately 0900Z, one of the parents send him a message *“You back, yet”* enquiring if the pilot have arrived at FAGM. At this time the pilot was also advised to do the following *“be careful, rather book into a hotel for the night”* upon which his response was *“Yea will see what happens later”*. At approximately 0923Z, the parent sent another message to encourage the pilot to book into a nearby hotel stating *“There is a hotel that is not too far from the airport but I am sure if you ask they can help you”*. This time he responded *“Okay if we can’t get out by today then will go”*.
- 1.9.4.2 Thereafter the pilot called the parent after 1000Z and asked if the parent could look-up the weather for him in Germiston. The parent called the pilot back after looking at Wind Finder Pro and told him they expect rain after 1300Z. The pilot then called the parent again for the last time at 1022Z and told them he had spoken to his instructor and he told him the same about the weather and recommended he try take off one more time. That was the last time the pilot spoke to him.

- 1.9.5 The pilot's instructor was also given an opportunity to explain what happened. The instructor stated that at approximately 1039Z he received a telephone call from the pilot. The pilot informed him of what happened in the first flight and him having to return back to FAKN due to weather concerns. The pilot asked whether the instructor thinks it would be a good idea to take-off again. The instructor asked him if it was VMC or IMC at Kruger, which his response was VMC. The instructor asked him about the cloud base and visibility, his response was the visibility 10 km and cloud base scattered (SCT) at 1500 ft and broken (BKN) at 2500 ft.
- 1.9.5.1 The last question concerning the weather from the instructor was for the pilot to indicate his observation whether the weather conditions was actually improving or deteriorating. The pilot indicated that the weather was improving. The instructor then told the pilot that if he take-off two things could possibly happen, either he will possibly take-off and the weather will improve and clear and he will get a gap to continue back to Rand, or he will take-off and the weather will be like in the morning and he will have to return back to FAKN. However, he advised him to rather wait it out for an hour or so and check the weather again. The evidence of the ATC recordings show that at approximately 1038Z, the pilot broadcasted on the tower frequency 119.2 MHz requesting start, taxi and take-off clearance.
- 1.9.6 ATNS provided a copy of telephone communication recording between the pilot and ATSO – Licence No: ATS 1290. Based on the communication the evidence was that at approximately 1007Z before the pilot could embark on the second flight, he called the tower and spoke to the ATSO. He was enquiring whether or not the control zone was IFR or VFR. The ATSO responded by stating that the conditions were VFR with cloud base scattered at 1500 FT and broken at 2000 FT. After the pilot received the indicated information, he proceeded to the aircraft ready to embark on his flight.

1.10 Aerodrome Information

- 1.10.1 Departure Aerodrome: The information of the departure aerodrome was taken from the South African issued Aeronautical Information Publication (AIP). The below identified aerodrome was the last point of departure prior to the accident. The pilot flew to the aerodrome on Friday, 9 December 2016. After landing the aircraft was left at the general aviation parking overnight until on 10 December 2016.

Aerodrome Location	Kruger Mpumalanga International Airport (FAKN)
Aerodrome Co-ordinates	25°23'00"S 31°06'20"E
Aerodrome Elevation	2,829 ft./862 m
Runway Designations	05/23
Runway Dimensions	3380 m x 300 m
Runway Used	05
Runway Surface	Asphalt
Approach Facilities	CAT 1 ILS co-located DME, NDB and DVOR

- 1.10.2 Based on the AIP, the aerodrome is located 11NM north east of Nelspruit in Mpumalanga Province. The aerodrome operator operational hours are from Monday to Friday 0500 – 1700 (After HR call out). However, the Air Traffic Services (ATS) are from Monday to Sunday: 0500 – 1700. The aerodrome facility is used for scheduled passenger flights to other South African cities as well as regional destinations.

1.10.3 In terms of rescue and fire fighting services, the AIP indicates that Kruger has been approved under CAT 8 and operational hours are from Monday to Sunday: 0500 – 1700. They have suitable rescue equipment and in addition have entered into an MOU with other local authorities to assist in an emergency. According Kruger’s MOP, their area of responsibility include where *“an incident or risk of one, within the airport zone of responsibility (a ten kilometre radius around the airport) involving one or more aircraft etc.”* In instances where an accident has occurred but off the airport premises *“the aerodrome rescue and fire fighting services will respond to the alarm with appropriate rescue and fire fighting vehicles, personnel and equipment to assist the local authorities emergency services. If further services or assistance is not needed they will return to the airport and notify ATC that the airport fire services are back to normal”*.

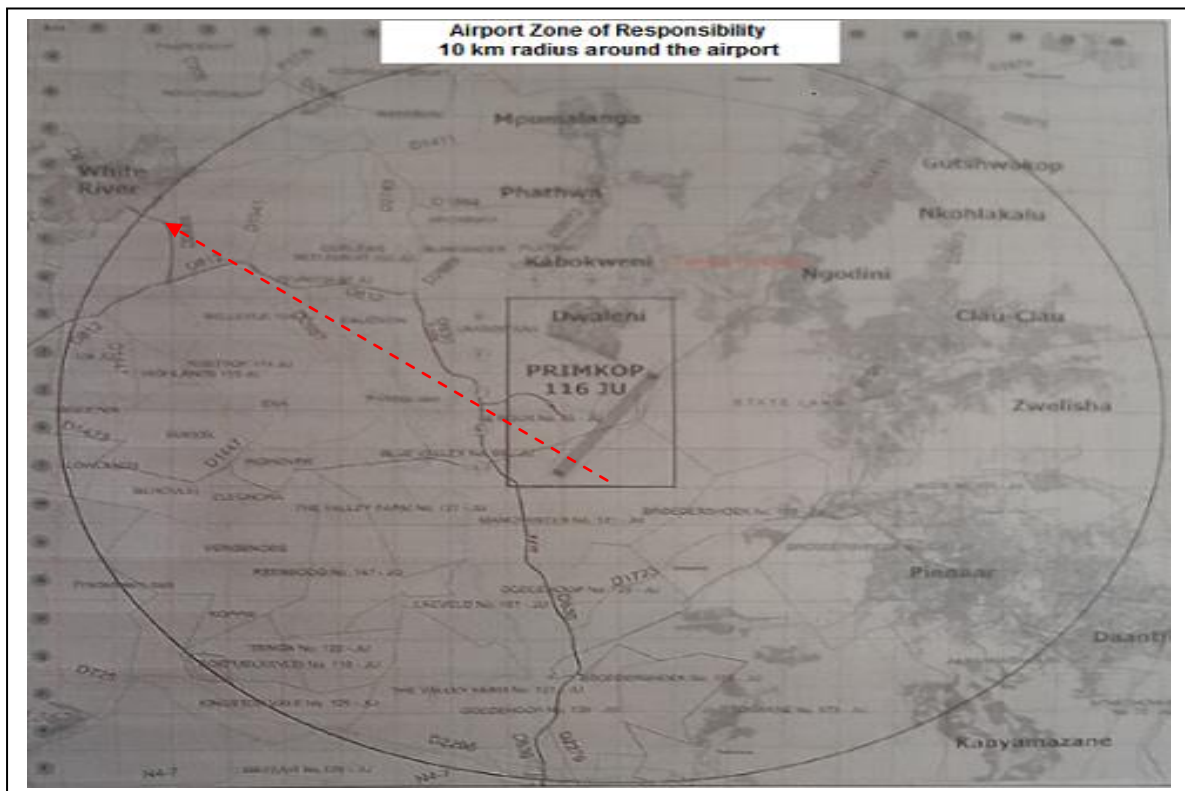


Figure 8 indicates the airport zone of responsibility

1.10.3.1 The map length from Kruger to a measurement distance of 10 km radius around the airport includes Ngodwana and also the crash site. It means that the aerodrome rescue and fire fighting services was required to provide emergency rescue assistance to ZS-OWB.

1.10.4 Aerodrome Air Traffic and Navigation Services - Airspace Area of Responsibility:

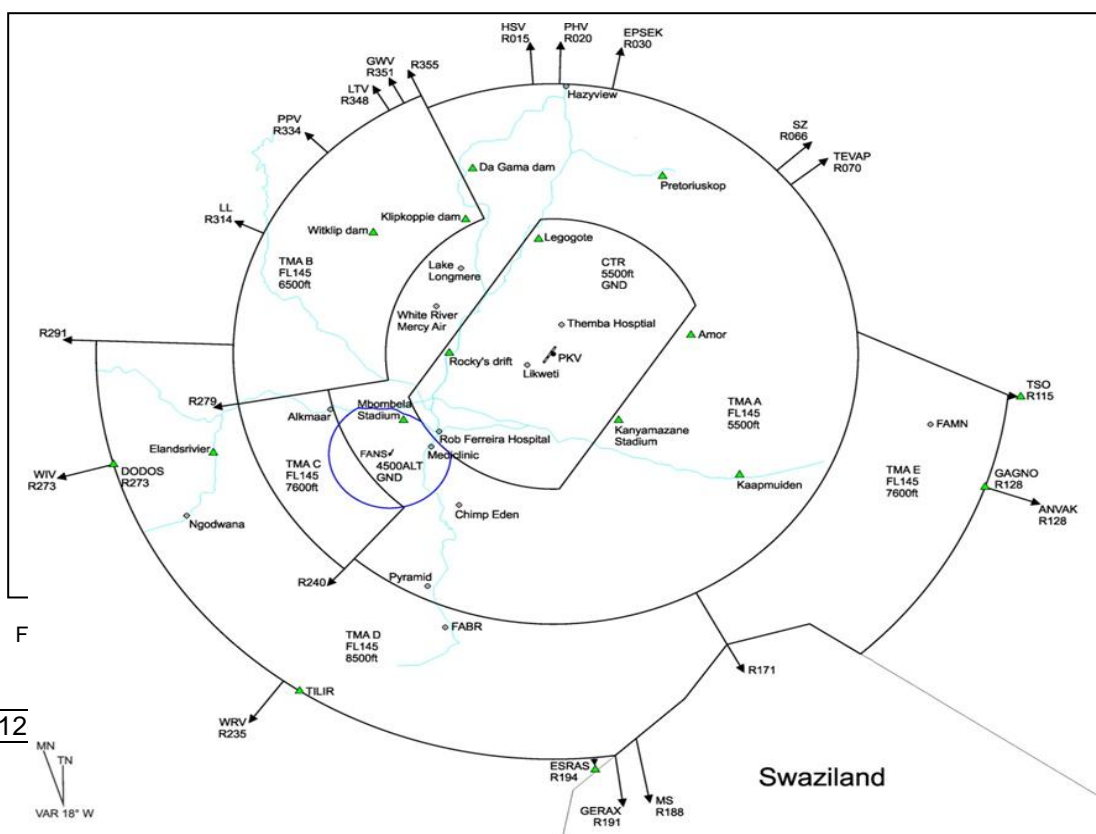
1.10.4.1 According to FAKN ATSU Station Standing Instructions (SSI), the above identified diagram shows the location of TMA and CTR and vertical limits thereof:

- (i) TMA Vertical Limits: TMA A - 5500 FT ALT/FL145; TMA B - 6500 FT ALT/FL145; TMA C - 7600 FT ALT/FL145; D - 8500/FL145; TMA E - 7600 FT ALT/FL145.
- (ii) CTR Vertical Limit: GND/5500' ALT, call sign “Kruger Tower” on frequency 119.2 MHz.

1.10.4.2 Based on the SSI, when departing from Runway 05 the following procedure is required:

- (i) Leaving the Kruger CTR to the North East, Amor 05 VFR Departure, after departure Runway 05, maintain runway track to 3300 FT ALT, then turn right track 140 degrees, and climb 4000 FT ALT, at 4000 FT ALT set course to route Amor. Passing Amor, set course as per flight plan. Report passing Amor.
- (ii) Leaving the Kruger CTR to the South West, White River 05 VFR Departure, after departure runway 05, maintain runway track to 3300 FT ALT, then turn left track 320 degrees and climb to 3500 FT ALT. At 3500 FT ALT set course and join the SRA VFR route. Report passing White River.
- (iii) Leaving the Kruger CTR to the North West, Hazyview 05 VFR Departure, after departure runway 05, maintain runway track to 3300 FT ALT, then turn left track 320 degrees and climb 4000 FT ALT, at 4000 FT ALT proceed west of Legogote and join the VFR route to Hazyview. Report passing abeam Legogote.
- (iv) Leaving the Kruger CTR to the South East, Kanyamazane 05 VFR Departure, after departure runway 05, maintain runway track to 3300 FT ALT, then turn right track 140 degrees and climb to 4000 FT ALT. At 4000 FT ALT set course to Kanyamazane. Report passing Kanyamazane.
- (v) The airspace below the Kruger TMA, excluding that part of the Kruger National Park, between ground level and 2500 FT ALT, which falls below the Kruger TMA, is declared as a Special Rules Area and termed as the “KRUGER SPECIAL RULES AREA”.

Note: This is to promote safety, efficiency and orderliness in the Kruger Special Rules Area. All aircraft operating in the Kruger Special Rules Area should maintain a listening watch and broadcast regular position reports on frequency 130,35 MHz. Pilots operating below the Kruger TMA should therefore ensure that they do not exceed the applicable Altitude restriction as stipulated on SRA routings and also to remain below the Kruger TMA. Pilots are encouraged to squawk 2000, Mode C, at all times.



1.10.5 The accident occurred at a location away from an aerodrome. The accident site was located in a SAPPI forest at Ngodwana District, Mpumalanga Province. The position of the accident site was about 30 NM west of FAKN at GPS 25°30'55.3"S 30°31'30.7"E, elevation 4724 ft AMSL.

1.11 Flight Recorders

1.11.1 The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR); neither were required by regulations.

1.12 Wreckage and Impact Information

1.12.1 The impact and destruction of the aircraft indicated that the aircraft collided with the mountain during a straight and level flight. There was no indication of an in-flight break up or component/part separation prior to the collision with the mountain. The aircraft was completely intact prior to the accident.

1.12.2 The wreckage investigation indicated that the pilot experienced what is believed to be a controlled flight into terrain (CFIT) condition.

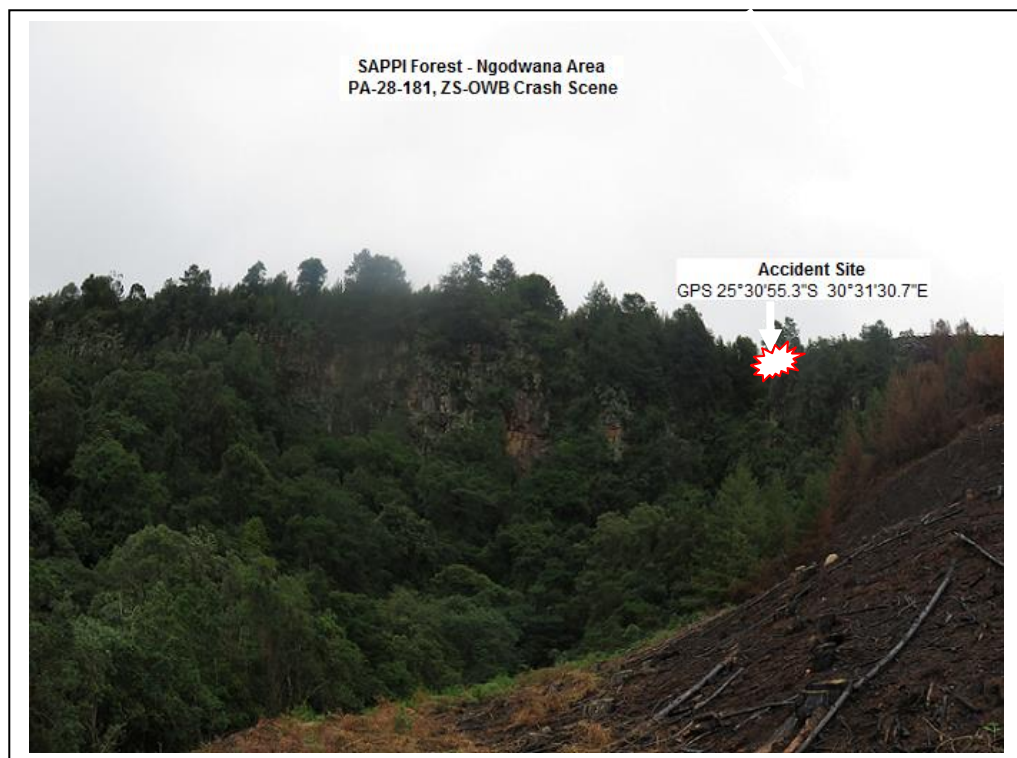


Figure 10 indicates the accident site

1.12.3 During the on-site investigation, the following observations were noted:

Structures

- (i) The aircraft collided with the mountain with its nose section first and wings level attitude. The evidence on the propeller indicated that the engine was producing power at the time of it impacting the mountain. Due to extend of damage caused to the engine and propeller, it is reasonable to assume that the aircraft had sufficient power at the time of impact.

(ii) Further evidence of this can be noted by the impact marks on the rocks and damage caused to the two bladed propeller. The aircraft over turned and ended up in an inverted position. The airframe structure was destroyed by impact and post impact fire. (See figure 10-14 below)

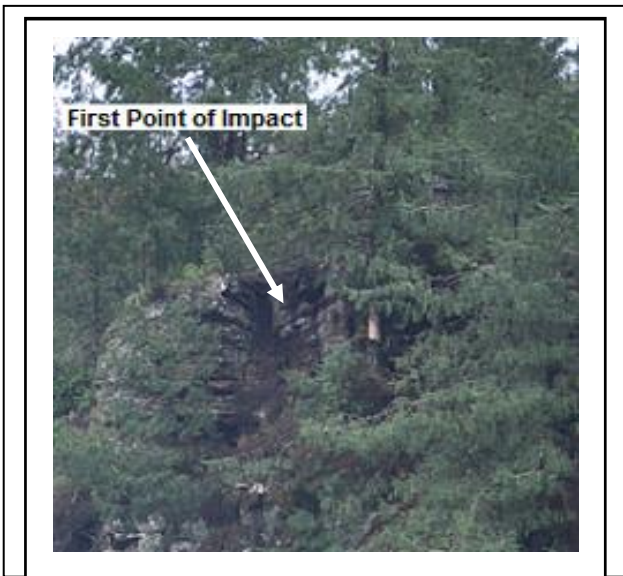


Figure 10

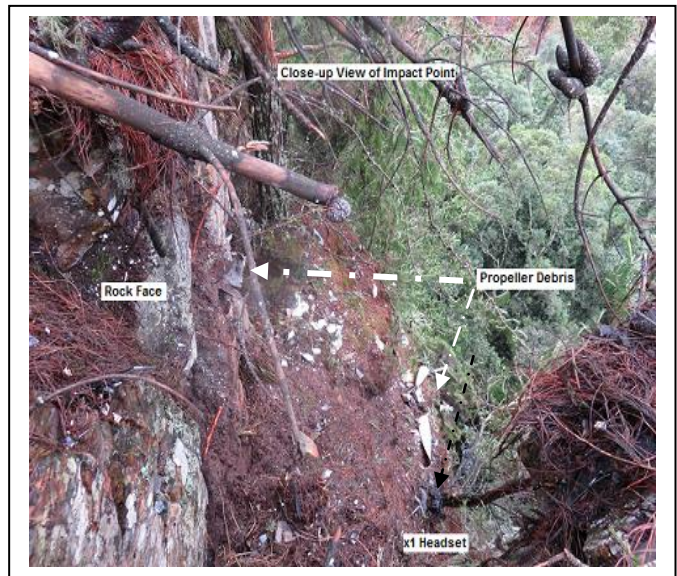


Figure 11





Figure 14

1.13 Medical and Pathological Information

1.13.1 The report number PM 593/2016 was submitted by Department of Health Province of Mpumalanga Forensic Pathology Services. The medical post mortem report concluded that the cause of the pilot death was consistent with multiple blunt force injuries.

1.13.2 At the time the report was concluded, the toxicology results were not available. Should it be noted that whenever the toxicology findings become available and found to have contributed to the accident, this investigation will be reviewed.

1.14 Fire

1.14.1 The wreckage was examined and found that the fuselage was completely burned. The debris of burned pieces of tree branches found at the collision point indicates that the post impact fire started from the nose section in the engine compartment. The trail of the fire damage was caused to the trees tops down to where the wreckage settled on the ground. (See figure 15 below indicating the presence of a post impact fire damage)



Figure 15

1.15 Survival Aspects

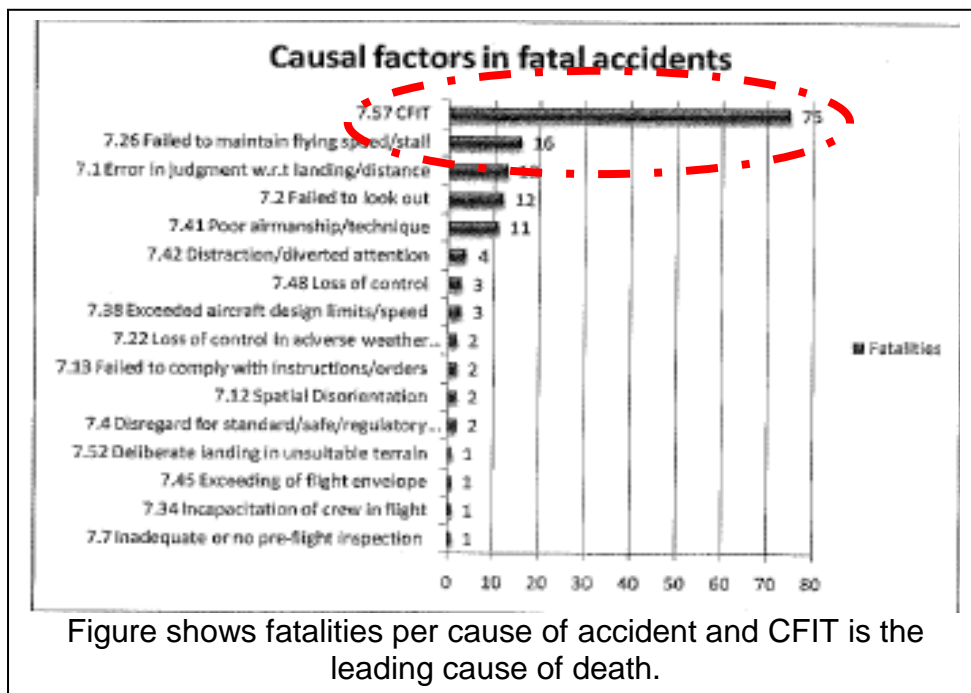
- 1.15.1 The accident was considered to be not survivable under any circumstances. The aircraft inadvertently collided with a mountain, impacting it at level flight attitude and at a very high velocity (most probably maximum cruise speed = 125 KIAS). The deceleration forces transmitted to the occupants (pilot and two passengers) notably have exceeded that of human tolerance, hence they were fatally injured. The aircraft was destroyed during the collision sequence and subsequent post-impact fire that erupted.
- 1.15.2 The PA-28-181 South African Search and Rescue (SASAR): The pilot had submitted a flight plan at FAKN ATC for the flights from FAKN to FAGM. The pilot had filed the flight plan, knowing that he would be flying in controlled or advisory airspace and for the purpose of alerting search and rescue action, if required. This implies that search and rescue action would be instituted automatically in the event of a missed position report while the aircraft is flying within controlled airspace or in the event of non-arrival at destination. According to the flight plan, for the flight to FAGM the pilot was required to cancel the search and rescue action within an hour after the estimated time of arrival at the destination. The flight plan indicated SAR Normal because the flight was bound for a licensed aerodrome with an operational ATC. However, the time when the communication between the pilot and ATC stopped (pilot not responding) the issue of the aircraft was referred to South African Search and Rescue (SASAR). According to SASAR, due to bad weather it was not conducive for aerial search but SAPS Air wing was put on standby. SASAR resources activated to help with the search and rescue operation were ORRU Nelspruit, Mpumalanga Disaster Management and Mountain Rescue. The wreckage was located by SAPPI personnel.

- 1.15.3 According to FAKN ATSU, they indicated that on SAPPI frequency at approximately 1118Z they received a call reporting an aircraft crash overhead Ngodwana. The ATC reported the occurrence to the aeronautical rescue co-ordination centre (ARCC) at approximately 1144Z, thereafter at approximately 1150Z send a DETRESSFA message. At approximately 1440Z, the DETRESSFA was cancelled when the accident site was eventually located by SAPPI personnel.
- 1.15.4 The aircraft was fitted with a serviceable AMERIKINK AK451 type, serial number: 21487 Emergency Locator Transmitter (ELT) beacon. The evidence found show that the owner of the aircraft was maintaining the ELT according to its servicing requirements. According to SASAR the ELT did transmit an emergency signal when involved in the accident. Hence after identifying who the owner was they immediately called him to ascertain the whereabouts of the aircraft.
- 1.15.5 According to the representative of the owner, at approximately 1230Z they received a call from ATNS enquiring about the aircraft. The owner informed ATNS that to his knowledge the aircraft was at Kruger International Airport scheduled to return back to Rand Airport. However the owner was not sure if the aircraft had already taken off or if still on the ground. The owner made a couple of calls to U-Fly Training Academy and FAGM ATC enquiring about the aircraft. FAGM ATC advised the owner that the second flight plan was filled and according to their records the aircraft took off at approximately 1039Z.
- 1.15.5.1 The ATNS asked if the ELT of the aircraft was serviceable. The owner wanted to know if something happened with the aircraft and told that there was reports of an aircraft or helicopter down somewhere close to FAKN. The owner heard that the only aircraft in the area with which ATC lost radio communication was ZS-OWB. The owner wanted to know the exact location where people reported seeing something. The ATNS replied that it was about 40 to 50 kilometres west of FAKN. The owner asked that search and rescue must be activated immediately due to the terrain in that area. The ATNS replied that SAR teams had already been dispatched. However, at approximately 1330Z the SACAA called the owner confirming that ZS-OWB was involved in an accident about 60 kilometres west of FAKN and there were no survivors.

1.16 Tests and Research

- 1.16.1 SACAA past intervention related to CFIT: The SACAA published a research article during 2010 wherein they discussed the issue of controlled flight into terrain (CFIT) which its intention was to appeal to all pilots, commercial organisations, training schools and flying public to put safety first. Rather be late than not arriving at all to your destination due to issues relating to CFIT. The SACAA's article discusses under the heading "*Just how many lives have we lost to CFIT*" indicating that the SACAA causal factors list for accidents in the flight crew/pilot category (sub-heading 7 of the list) that for the period under review (2006-2010) a total number of 75 people have lost their lives under CFIT category out of the grand total of 115 fatalities on record for the active category (see list below). This resulted from 24 CFIT accidents.

1.16.2 The SACAA article further stated that according to their database, most CFIT accidents occurred in the Mpumalanga Province followed by KwaZulu-Natal, then Limpopo and Western Cape. These are the area that topographically contains the most mountainous terrain in the country.



Note: In the article, the SACAA asked the question: Why does it happen? They answer themselves giving the following answers, stating:

- Poor flight planning by the pilot/crew;
- Lack of experience by the pilot/crew;
- Disregard for standard safe operating procedures;
- Poor decision-making;
- Lack of knowledge of the area and associated weather phenomena;
- Deliberate VFR into IMC conditions;
- Commercial/operational pressures.

1.16.2.1 To evaluate whether or not the SACAA article had any impact in terms of changing behaviour, it was deemed important to check again what the SACAA database into CFIT accidents will show. According to the SACAA database into CFIT accidents, the evidence was that for the period from 2011 to 2016 a total of 161 people have lost their lives and total of 22 fatalities were as a result of 9 CFIT accidents.

1.16.2.2 After the CFIT article, according to SACAA Safety Link Magazine, First Edition 2015, it makes reference to a safety programme called “*Hello Summer/Hello Winter Workshops*” held in all the major provinces around the country to meet with the general aviation fraternity. The workshop highlights the incredible high demand to enhance safety within general aviation sector, where the majority of accidents and fatalities occur each year. The content was presented in such a way as to empower pilots for the weather season and in turn influence decision-making and behaviour and bring about the right safety culture within the local aviation industry. The article shows that the workshop reached out a total of 1300 pilots around the country bringing to them the safety awareness message, in order to influence their behaviour in terms of good airmanship.

1.17 Organizational and Management Information

1.17.1 FAKN Airports Management:

1.17.1.1 Primkop Airport Management (Pty) Ltd is responsible for managing FAKN. According to the SACAA records, FAKN was issued with a valid Category 8 Aerodrome Licenses. For the purpose of the investigation, FAKN management provided information of services rendered i.e. landing, parking, approach and fuel uplift when the aircraft arrived and departed from FAKN.

- (i) Document No: INV94593 shows that the aircraft was refuelled at FAKN when arriving on 9 December 2016 at approximately 0610Z. After the refuelling was completed, the aircraft was left parked on the general aviation parking area overnight. The duration that the aircraft was parked at the airport, it was safe and secure under the protection of the airport security.
- (ii) Document No: INF98489 shows that the pilot made a payment for the landing, parking and approach services of 9 December 2016. Due to the fact that the airport services fees had been paid, there were no restrictions imposed on the pilot departing from FAKN on the first flight on 10 December 2016.
- (iii) However, seen that the flight was discontinued and returned back to the airport after experiencing bad weather conditions of low cloud, the pilot was expected to pay again airport services fees when embarking on the second flight. There was a principle agreement between the pilot and the airport services workers that he will make payment only when he is sure to leave FAKN that day. The evidence shows that the pilot did not keep to the agreement; he flew the aircraft on the second flight from FAKN without paying for the service.

Note: Apart from the above events there were no other engagements between the pilot and Kruger Airport Management related to the accident.

1.17.2 The Aircraft Owner Information:

1.17.2.1 According to the aircraft file the owner was Belaire Aviation CC. The owners' principle place of business was at Rand Airport (FAGM) in Johannesburg, Gauteng Province.

1.17.2.2 In terms of applicable regulations, the owner was responsible to ensure that the aircraft is serviceable and airworthy for operation. In order to comply with the regulation the owner entered into an agreement with an aircraft maintenance organisation (AMO) by the name of Skytech Aviation to be responsible for the maintenance. Based on the AMO file, the evidence shows that they had a valid approval certificate issued in terms of CAR, Part 145. The AMO certificate had all the appropriate category ratings which authorised them to conduct maintenance on the aircraft. The AMO records were checked and there was no anomaly found related to the manner in which they conducted maintenance which may have contributed to the aircraft being involved in the accident.

1.17.2.3 The owner revealed that there was a hire-and-fly agreement between them and the pilot. According to the owner's insurance, the aircraft was insured under Belaire Aviation CC and U Fly Training Academy/Africa Skies Aviation. In terms of the insurance it stipulates that "*Open pilot warranty in respect of hire and fly,*

and any type rated PPL and/or higher licensed pilots, as approved by the owner”.

1.17.2.3 The Operator Information: Belaire Aviation CC handed over a copy of a Lease Agreement Contract between them as the “Owner” and U Fly Training Academy referred to as the “Renter” signed on 1 October 2007. Item 4 of the Agreement states that *“The Renter shall ensure that the aircraft is only flown by fully qualified and authorised pilots (as stipulated in the insurance policy) fully familiar with the aircraft and its operation and who possess such a licence as may be required by Law”*. Based on the personnel information above the evidence shows that the pilot complied with the agreement.

1.17.2.4 Due to the existence of the Lease Agreement between the two parties, U Fly SAFARIS CC trading as U Fly Training Academy provided a copy of their Aviation Training Approval Certificate (ATO No: CAA/0291, Part 141) as proof to show that they are duly authorised to operate as an aviation business. According to the ATO operations specifications, listed under the item identified as type and/or registration of aircraft the registration ZS-OWB was included for operation.

Note: According to U Fly Training Academy, the ATO provided the PPL training to the PIC. The PIC indicated to them that his intention was to embark on a private flight, carrying two passengers from FAGM to FAKN.

1.17.3 FAKN Air Traffic Services Unit (ATSU):

1.17.3.1 The South African Civil Aviation Act, supported by the applicable regulation mandates ATNS to be responsible for air traffic and navigation services in the country. In compliance with the applicable legislation, the ATNS has a list of ATSU’s which includes FAKN control tower. The investigation determined that the control tower was issued with a valid ATSU Approval. In terms of the applicable regulation, ATNS employed several air traffic controllers – ATC’s to provide services to the aviation industry from the control tower.

1.17.3.2 Based on the investigation it was deemed important to have a look into the performance of the ATC’s at FAKN. The issue of visual meteorological condition (VMC) and instrument meteorological condition (IMC) was considered as important:

- In relation to VFR condition, the investigation determined that in terms of the flight plan ZS-OWB departed two times from FAKN. The pilot’s intentions were to embark on a VFR flight to FAGM. However, according to the ATC recordings the evidence was that the first flight was flown under Special VFR conditions due to the control zone being IMC.
- Based on the ATSU Occurrence Log, the chronological events indicate that the control zone was declared IMC at 0615Z. The responsible ATSO – License No: ATS 0923 wrote in the log that the control zone was IMC due to low cloud conditions. The ATSO resolved that the IMC declaration was made based on the available METAR information. The METAR information was then confirmed to be consistent with the ATSO decision of IMC. However, in terms of the METAR information the control zone was IMC from 0600Z already. As long as the pilot adhered to the instructions of the ATSO to route on Special VFR for Rand and remaining at 4500 FT ALT or below and clear of clouds with ground insight at all

times, he was sure to remain safe. The low cloud conditions, resulted in him turning back to execute a safe landing at FAKN.

- The investigation determined that the aircraft flew again on a second flight later during the afternoon. However, this time around the weather conditions had improved. The pilot was cleared to depart from FAKN on a VFR flight as per his flight plan. The control zone was no longer IMC but VMC. It appears as though during the hand-over watch process at 0957Z, the two ATSO's declared the control zone VMC.
- However, the Occurrence Log chronological events indicate that the VMC was declared at 1059Z. It was a *"late entry"* made by the ATSO – Licences No: ATS 0923. The issue with the late entry was that it confused matters unnecessarily. It became apparent that clarity was required to resolve the confusion. In the words of the ATSO, she indicated that when she came back from her break at 1055Z, they realised that the VMC signal had not been sent to notify other stations of the Kruger's conditions. Hence the late entry which is the time it was written in the Occurrence Log. The ATSO indicated that they inadvertently forgot to make the write-up much earlier at 0957Z.
- According to FAKN Station Standard Instructions (SSI), it states that *"Prior to taking over an operating position, personnel should ensure that they have a full understanding of the air traffic situation including an awareness of clearances issued but not yet acted upon and any developing situation requiring early attention"* and *"Adequate hand-over is required at all times. A thorough and complete description of the current and pending traffic situation is required during a hand-over in order to ensure the total comprehension of the traffic scenario by the incoming controller"*.
- Further to the above issue the hand-over watch (HOW) procedure requires that the ATSO who is reporting on duty should before taking over watch (TOW), must use the Pre-Briefing Check-List which have included on it an item *"Occurrence Log - Read occurrence log since last sign-off, then sign-on for shift"* this is to ensure that he/she is updated with current operations in the tower. At the time when the actual hand-over happen, they shall make use of the Hand-Over/Take-Over Watch Check-List which included an item *"Weather - IMC/VMC - warnings such as wind shear, temp inversion etc."*

Note: Based on the above information, it would seem that when ATSA – Licence ATS 2029 signed on duty at 1045 and familiarising herself with what has been happening in the morning shift. She is most probably the one that realised the omission of the VMC entry in the Occurrence Logbook and communicated it to the ATSO.

- Based on the Occurrence Log, during the morning there was only two ATC personnel (ATSO – Licence No: ATS 0923 and ATSA – Licence No: ATS 0849) doing duty in the tower. The two ATC's shift was scheduled to be from 0445Z to 1210Z (07.25 hours) with an expected one hour break in between. According to the Occurrence Log, the entries shows that at 0840Z to 0940Z the assistant (ATSA – ATS 0849) went off on an hour long break. Consequently, the tower operations had to be combined and for the duration of the break time were carried out by ATSO – ATS 0923 alone. There is no entry showing that the ATSO took any break during that shift.

Note: The reason why the above sequence of events is so important is because of the operational requirements of VMC/IMC conditions. Whenever the information is not communicated properly, the risk to aviation safety increases. Evidently in this instance the risk if any was limited to the way in which the ATC's performed their tower administrative duties only.

1.17.4 South African Civil Aviation Authority (SACAA):

1.17.4.1 The SACAA is charged with the mandate to control, promote, regulate, support, develop, enforce and continuously improving levels of safety and security throughout the civil aviation industry. Within the SACAA there are different departments, sections and divisions responsible to carry out oversight on the industry to realise the mandate. Based on the information found during the investigation, the evidence shows that some of the SACAA departments under Aviation Safety Operations (ASO) like Airworthiness (AWD) and Flight Operations (FOD) had an important role to play ensuring that the aircraft was in an airworthy state and the pilot was licenced with appropriate skills and experience to operate the aircraft safely.

1.17.4.2 The aircraft, pilot, AMO and Operator files which content gives a perfect reflection of the quality of SACAA oversight capability were inspected during the investigation. The aim was to check all the records on file to determine if the oversight was carried out appropriately to ensure compliance to the applicable regulations. All the files were found to be compliant and no anomalies were identified.

1.17.4.3 In terms of the above information of CFIT Statistical Research Data of 2006 to 2016 shows that a total of 97 people lost their lives in CFIT related accidents. Due to the critical nature of CFIT accidents, the AIID had made several safety recommendations over the years and forwarded them to the SACAA for consideration. Amongst others as an example, here are two recommendations made to the SACAA:

- (i) *Ref: ACCID ZS-RMR/2011 recommendation was "It is recommended that the SACAA require operators involved in this type of operation to obtain detailed weather reports from the SA Weather Services prior to any flight, especially in coastal areas, and that the safety officer should ensure that pilots are familiar with the interpretation of such reports before commencing any flights".*
- (ii) *Ref: ACCID ZS-JYB/2011 recommendation was "The SACAA should in its safety promotions programme, safety seminars and other method of information distribution, make pilots aware of the danger of flying without proper planning of the selection of routes and altitudes. The limitation of GPS-information and dangers of relying solely on GPS-information without taking safe altitudes in consideration should be emphasised".* There were preventative actions taken by the SACAA, implementing several initiatives with safety promotion and workshops to communicate the CFIT accidents information to the aviation industry.

1.18 Additional Information

1.18.1 The AIID statistical information on the database shows that all the CFIT accidents happened in the General Aviation (GA) sector of South African civil aviation. The numbers shows that the CFIT accidents were mostly in non-commercial operations wherein the flight was reported as being a private flight. Majority of the pilots were issued with a private pilot licence (PPL) and using small utility aircraft like Piper and/or Cessna types.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1 Man Issues: The pilot in command (PIC)

Experience and Competency:-

2.1.1 The investigation determined that the pilot which was involved in the accident had a valid private pilot licence (PPL) and the Piper PA-28-181 aircraft type rating was endorsed on it. The PPL duly authorised him to act as pilot in command (PIC) in accordance with applicable regulations. The pilot's training and proficiency checks history were reviewed in the investigation to determine if it had any effect on his performance. There were no anomalies identified in relation to how he finished his PPL training program. Due to the fact that he was issued with a PPL recently on 5 August 2016 he was required to do revalidation within 12 months on or before 31 August 2017. As the situation stand the pilot was involved in the accident before the PPL revalidation due date. However, he was still considered to be proficient to exercise the privileges of the licence.

2.1.2 The pilot also had a valid Class 2 aviation medical certificate with no restrictions or limitations. There was no evidence indicating that any medical fitness condition existed that may have affected his ability to perform.. In terms of his flying experience, the evidence shows that he received appropriate training to safely operate the aircraft. As per his experience logbook, he had adequate flight time (100.7 hours) accumulated on the PA-28-181 type acting as PIC. There was no record found of him ever being involved in an accident or serious incident before this time. Neither was there any evidence of him found guilty of any aviation related transgression in the past by the regulator.

2.1.3 According to CAR, Part 61, the PPL authorises the pilot to exercise the privilege to conduct private flights flown under visual flight rules (VFR) by day. Notably when VFR flights are flown the pilot is solely dependent or relies mostly on his own eyesight to identify all the natural danger areas on his flight path.

2.1.4 The pilot's flight on duty time and rest period was also investigated to determine if it had an effect on him in terms of fatigue. It should be noted that the pilot was not subject to an approved flight time and duty period. However, the applicable regulation requires that he shall fly only 10 hours within a 24 hour period. According to the pilot's experience logbook, the evidence was that he flew a total of 2.3 hours

only within the last 24 hour's period. This information clearly shows that fatigue did not play any role in the accident. In fact it is evident that the pilot had sufficient resting time between his flights and there were no anomalies identified relevant to the issue of fatigue and he complied with the applicable regulation.

- 2.1.5 The pilot's radiotelephony performance was assessed during the investigation. The evidence found shows that he passed a written examination and skills test in radio procedures when issued with his PPL. The investigation focused on the manner in which he performed the following i.e. ground use, take-off, en-route, arrival and circuit radio procedures when flying the aircraft at FAKN. The evidence shows that the pilot demonstrated a very high level of competency in the practical use of the radio. The use of the radio assisted and supported him to execute safe and efficient flight operations.
- 2.1.6 There was no evidence of him experiencing any difficulty when communicating with the ATC. All radio transmissions made by the pilot to ATC was according to applicable radiotelephony procedures. He had the radio tuned to the right frequencies i.e. FAKN ATC on 119.2 MHz and JHB/FAOR IFR on 127.4 MHz. The manner in which he broadcasted information to ATC, reporting his situation and reading-back whatever ATC was said to him was found to be in compliance to radiotelephony procedures. There was no anomaly identified with his ability to communicate with ATC.
- 2.1.7 In terms of the applicable regulations, it is deemed very important that the pilot in command (PIC) should take responsibility for the safe operation of the aircraft while he is in command. Based on this responsibility, the pilot of the accident aircraft was required before he could commence with the flight to ensure that proper flight planning was carried out. In respect of the report, he was expected to look at the weather conditions along the route he intended to fly by getting an official weather briefing that may potentially affect his flight. He was to plan for instances where unexpectedly the weather became an issue during the flight and he had to divert from the original route to an alternative route and/or destination. However, in case of the latter happening; the pilot had to do a re-planning to proceed along a new route or destination other than the originally planned route. The pilot is required to make his intention known to ATC.
- 2.1.8 Based on the investigation it was determined that the pilot embarked on a first flight from FAKN to FAGM. The radio communication recordings indicated that during his read-back to ATC, it seems like he was aware that the flight was going to be flown as a "Special VFR Flight". The ATC provided him with the following information: *"OWB, clearances Kruger to be controlled ***, Special VFR for Rand after departure runway 05, we have left turn out routing as required, routing at special VFR remaining 4500 feet or below/clear of clouds with ground insight at all times, Standby for squawk"* and to which the pilot read back *"Uh...Special VFR will remain 4500 feet or below *** Standby the squawk, OWB"*. His read back was confirmed by ATC to be correct and asked *"OWB, Sir confirm you are familiar with Kruger Special Rules Area"* which his answer was *"Uhhmm...Uhhmm...I am sort of familiar mam, we flew through the Kruger special area on the way up"*.
- 2.1.9 Even though his response of being familiar with the Kruger Special Rules Area was a bit apprehensive, the important thing in this regard is his awareness with what is expected. This is probably the reason he decided to continue to embark on the flight and drawn the risk upon himself as his own. The evidence shows that the flight was

uneventful until when he was approximately 2 NM outbound from FAKN and encountered bad weather conditions (low cloud and reduced visibility). In the interest of aviation safety he immediately reported the hazardous weather conditions to ATC, requesting to return back to FAKN. In this regard the pilot can be commented for his decision-making, by taking such a bold stance to return back.

- 2.1.10 The flight back was also uneventful but with a small delay of having to give way to other departing traffic first before being cleared to land. After the landing his response to ATC was quite strange saying: *“thanks for accommodating mam, sorry about that”* which was a modest apology. It does seem that he felt a little embarrassed having to fly back; possibly thinking his actions in that instance was an inconvenienced to ATC. However, the ATC response to his apology was *“OWB, not a problem Sir its better we have you safe on the ground”* showing to the pilot that his safety and that of the passengers is much more important.
- 2.1.11 The time they were on the ground and waiting for the weather to improve, the evidence was that the pilot contacted a few people in Johannesburg using his cellular phone to talk to them about the weather conditions. The conversations he had with them show that he was not entirely sure what to do with the prevailing weather conditions. Also, he wanted to find out what the weather condition was en-route to the destination. He was seeking help to assist him to make the right decision with respect to the weather conditions. In response he was advised to do a full and thorough assessment of the prevailing weather conditions at FAKN. He was supposed to establish whether or not the weather conditions were improving or deteriorating. When found that the conditions have improved the decision is easy because it means that the risk is reduced or it has been completely removed. But if the condition deteriorated he was advised not to attempt to fly but in the interest of safety stay overnight instead. The evidence was that the pilot in principle has agreed with the advices but he was more open to the idea of the weather conditions improving so that they could fly back home to FAGM.
- 2.1.12 During the time he embarked on the second flight out to FAGM the weather condition had improved from IMC to VMC. The time when he established contact with ATC he was cleared to fly as per flight plan, receiving the instruction *“OWB, you cleared Kruger to Rand, after departure Runway 05, route as per flight plan, climb to 7500 ft and squawk 6716”*. On departure the pilot was told to report his position when 20 NM outbound from FAKN. However, while outbound between FAKN en route to Mbombela Stadium (less than 10 NM out) the ATC realised that the aircraft was deviating from the flight plan route. The ATC ask the pilot: *“OWB, confirm your intentions, Sir seem to be routing for Nelspruit now”* and he responded *“Affirm Sir, we gonna route to Tzaneen, then Mbombela Stadium, Uh...overhead Ngodwana and Uh...through to Rand”*.
- 2.1.13 The deviation was confirmed by the pilot, as indicated above intending to route to Tzaneen via Mbombela Stadium, overhead Ngodwana to Rand Airport. He was still heading to Mbombela Stadium (approximately 10 NM away) at that time. The flight from FAKN to Mbombela Stadium and then to Ngodwana is a straight line facing in a south-westerly direction. Ngodwana is approximately 20 NM away from FAKN. Based on the path followed; the evidence shows that after the aircraft passed Ngodwana, a right bank/turn was initiated into a north-westerly direction possibly with the intention to route to what is believed to be Tzaneen. It is evident that the pilot did not communicate his intentions with ATC before acting on the decision to fly this new route. The decision to fly the Tzaneen route was made probably at a time after take-off out of FAKN en route to Nelspruit. The following

should be noted:

- His original plan was to embark on the route (FAKN to FAND to WIV to RA to RD to FAGM). There was never any talk of them flying to Tzaneen prior to take-off when communicating with ATC. The idea to change the plan “deviation” must have come to mind immediately after the take-off. Tzaneen only came up when ATC made an enquiry about Nelspruit.
- It should be noted that the deviation to Tzaneen would have had an impact on the flight. The impact in this regard was that the track would have increased by 149 NM to approximately 316 NM compared with the original flight plan route which is approximately 167 NM.
- The fuel usage would have also increased. Taking into account the aircraft fuel status at the time, the Tzaneen route would have required 10.6 US gallons of fuel for the extra 1.2 hours flight time.

Note: Based on the information one gets a sense that he was trying to avoid the threat of the bad overcast weather, as a result, this influenced the decision to take the Tzaneen route around the danger zone.

2.1.14 Immediately after the pilot made his intentions of flying to Tzaneen known to ATC, he requested clearance to stay on 5500 FT ALT. He must have been still heading to Mbombela Stadium (+10 NM away) this time. It should be noted that earlier during take-off the pilot was given instructions to climb to 7500 FT ALT and report 20 NM outbound from FAKN. The fact that he requested to remain on 5500 FT ALT shows that for some reason, most probably due to weather (low cloud) he could not climb to 7500 FT ALT as instructed by ATC. If indeed weather was the cause, it means he was concerned about staying clear of the clouds with the surface in sight.

2.1.15 After the ATC cleared him to remain on 5500 FT ALT, the pilot confirmed that he will maintain that level until he exited the TMA. The time when the pilot requested 5500 FT ALT he had not reached the 20 NM outbound reporting point. He was at approximately 13 NM outbound from FAKN. This means the aircraft had flown directly pass overhead Mbombela Stadium (+3 NM) en route to Ngodwana. It appears as though the low cloud conditions deteriorated while still en route to Ngodwana. The pilot had no option but to request an even lower level 5000 FT ALT stating: *“Uh...Sir, would it be fine to request up to 050 by any chance, OWB”*. He was then asked to declare his position *“Report your distance from Kruger, Sir”* which his response was *“approximately 13 NM”*. The remaining distance to Ngodwana was approximately 15 NM and an additional 3 NM to exit the TMA immediately after flying overhead Ngodwana.

2.1.16 Based on the sequence of events, the time when the pilot encountered the low cloud conditions, there was no indication of him making a decision to return back. His actions suggests that he had a strong desire to reach his destination at all costs this time around compared to what happened in the first flight. It seems that during this time he was overcome by the life-threatening *“get-home-itis syndrome”*. He is willing to do everything practically possible to achieve his goal of getting home. He goes so far as to request an even lower level of 5000 FT ALT to try to maintain visual and external reference with ground. However, as he goes lower the situation of the low cloud condition further deteriorated.

- 2.1.17 It is important to be aware that the ATC's decisions are based on what they get from the pilot at that stage in the flight. However, in this instance all they could depend or rely on was good decision-making from the pilot. Everything which the pilot did concerning the flight was at his own discretion. The confirmation of this fact can be seen by the ATC instructing him to "*descend at pilot's discretion*". The pilot read back the instruction correctly which shows that he clearly understood what was expected from him. This is also the time he received the instruction to "*contact Jo'burg Information for the climb onto 6500 FT ALT or above*". Once ATC confirmed his read back as correct, he was then told to do the following "*switch to 124.8 MHz if you remaining below 6500 FT ALT*".
- 2.1.18 After the pilot descended to 5000 FT AMSL he continued onward to Ngodwana which was approximately 15 NM away at that point during the flight. The time when he reached Ngodwana, instead of proceeding straight on to Witbank (WIV) as per flight plan, the pilot initiated a right turn/bank to head to what is believed to be Tzaneen. The new route flown to Tzaneen was deviating from the planned route. However, due to the fact that the destination to FAGM did not change there was no need to file a new flight plan.
- 2.1.19 The pilot was instructed to broadcast on 130.35 MHz, 124.8 MHz and 127.4 MHz. According to the SSI, the broadcasting 130.35 MHz was for Kruger special rules area below the TMA. When operating in the special rules area, Kruger ATC is not responsible for separation of traffic. On the other hand though, the frequency 124.8 MHz is another special rules area but outside controlled airspace. Once exiting Kruger TMA he was to broadcast on 127.4 MHz which is Johannesburg North FIS when passing through 6500 FT AMSL. Based on the above as evidence by the ATC recordings, the pilot did try to make contact with Johannesburg North FIS. However, the time when the ATC responded there was no answer.

2.2 FAKN Air Traffic Control (ATC)

- 2.2.1 The investigation determined that the ATC's involved with the flight and manning the tower were properly certificated with valid ATC licences and appropriately rated. Based on their licence information the evidence is that they were properly qualified and experienced. Every ATC was duly authorised to execute duties as full-time performance controllers at FAKN ATSU. Also, in terms of training and proficiency checks, it was determined that they had no role to play in the circumstance of the accident.
- 2.2.2 Furthermore the ATC's also had valid Class 3 Aviation Medical Certificates. At least one of the medical certificates was issued with a restriction or limitation requiring the use of corrective lenses. Nonetheless it was evident by the medical certificates that all of them were medically fit. There was no evidence found of any medical condition which they may have had and affected their ability to perform.
- 2.2.3 There were a total of four controllers on duty in the tower on the day. Two of the controllers; ATSO – Licence No: ATS 0923 and ATSA – Licence No: ATS 0849 were on duty during the morning shift from 0445Z. The other two controllers; ATSO – Licence No: 1290 and ATSA – Licence No: 2029 were on duty during the afternoon shift starting from 1200Z. Based on their licences, the two ATSO controllers were more senior in terms of their training and experience. They were authorised to provide both aerodrome (AD) and approach (APP) control services to the aircraft, whereas the two roles and responsibility was to provide them with required assistance.

- 2.2.4 For the purpose of the investigation, focus was put on the performance of the three ATSO's – ATS 0923 and ATS 1290 and ATSA – ATS 1290. These three controllers performance were deemed important due to their engagement with the operation of the aircraft. Based on the evidence, the ATSO – ATS 0923 had declared the control zone IMC. She was also the one that communicated with the pilot during his first flight that morning. All the issues relating to the control zone declared IMC and the communication with the pilot relevant to the IMC was investigated.
- 2.2.5 The ATSO – ATS 0923 indicated that prior to the aircraft being cleared to embark on the first flight, she asked the pilot whether or not he was “familiar with FAKN airspace” and by his response she realised that in fact “they were not very familiar with it”. This was the reason why she decided to caution him due to the weather to look out for the mountains to the west in the vicinity of Ngodwana. It should be noted that the caution gesture from the ATC was done purely in the interest of aviation safety and good airmanship. In actual fact there is no direct obligation on the ATC to do such because it is expected of the pilot to do proper flight planning of his route. Nonetheless, the pilot showed his appreciation by him acknowledging the caution stating “we will be careful” which he acted upon later when deciding to route back to FAKN due to weather.
- 2.2.6 It should be noted that there was no anomaly identified with her performance in this instance. All the standard procedures followed by ATC in relation to the flight under IMC conditions were found to be complied with appropriately. Fortunately the pilot decided to turn back and return to FAKN when finding the situation being not suitable for flight. However, the impact was that ATSO had to accommodate him. Due to the interventions made by the ATSO in this regard the aircraft managed to land back safely at FAKN.
- 2.2.7 Based on the evidence, the ATSO – ATS 0923 gave the ATSA – ATS 0849 permission to take an hour long break at 0840Z. At this time the control zone was still restricted to IMC operations only. According to ATNS procedures, the ATC's are allowed to take an hour break within their shift. The break lasted until 0940Z and all tower activities were combined for the period. The daily statistics provided by ATNS shows that the ATSO handled a total of 8 movements (3 arrivals and 5 departures) during the indicated time. Even though it is not identified in the report, seen that the airspace was combined she was expected to do the work of the ATSA while absent from her station.
- 2.2.8 The evidence found shows that during the handover watch (HOW) process when ATSO – ATS 1290 started his shift at 0945Z, thereafter a takeover watch (TOW) process was carried out at approximately 0955Z. It was during this time allegedly that they declared the airspace VMC. The dilemma was that both ATC's omitted to write-up the VMC declaration information in the Occurrence Log. The ATSO – ATS 1290 continued to control VFR traffic including ZS-OWB under VMC not realising that no write-up was made nor any signal send to the other stations.

- 2.2.9 The investigation determined that the pilot and passengers were stranded at FAKN not able to take-off due to the weather. They had no option but to wait until the time when the weather started to clear up. However, according to some witnesses they reported seeing the pilot and passengers walking to the aircraft with the intention to fly. The witnesses questioned themselves whether or not it was a good idea for the pilot to fly. Obviously the witnesses did not know that the control zone was VMC again. Further investigation shows that prior to the second flight, the pilot used his mobile phone to call the tower. The ATSO – ATS 1290 answered the call and spoke to the pilot. Based on the recording the pilot enquired if the control zone was IFR or VFR. The ATSO response was that the control zone was VFR. He reported that the cloud base was scattered (SCT) at 1500 FT and broken (BR) at 2000 FT. The pilot was satisfied with the information and decided to take-off.
- 2.2.10 The information shows that during the time of the take-off, no one in the tower realised the mistake as yet. Nonetheless, seeing that the control zone was already declared VMC, the aircraft was cleared to take-off and embark on a VFR flight as per flight plan. The recording shows that the communication between the ATSO and pilot was uneventful prior to the take-off. There were no anomalies reported or experienced by both of them. Only after about an hour four minutes (0955Z – 1059Z) they realised their mistake, which was that the write-up and signal requirement had not been complied with at that point. By this time the aircraft ZS-OWB was already airborne. Nevertheless the situation of the VMC write-up and signal was then corrected by ATSO – ATS 0923 as a late entry “L.E.” in the Occurrence Log. The ATC in question indicated that it was an omission on her side; she had “forgotten” to do the write-up and signal hence the late entry.
- 2.2.11 According to a statement received from ATSO – ATS 0923, therein she indicated that “when she came back after her break at 1055Z, they realised that the VMC signal had not been sent”. The information shows that she possibly went on break immediately after the handover at 0955Z for it to be an hour long. The evidence shows that while she was away on break, the ATSO – ATS 1290 continued to control the air traffic procedurally without any anomaly. It appears as though he was left with the two ATSA’s – 0849 and 2029 to assist him. The Occurrence Log shows that ATSA – ATS 0849 had returned from her break already at 0940Z and ATSA – ATS 2029 reported on duty at 1045Z. Surprisingly none of these individuals saw that no write-up or signal was complied with, they proceeded with work until when ATSO – ATS 0923 returned from her break and requested that VMC signal be sent. On top of it all, more mistakes were made of wrong signal time at 1059Z but corrected to 0957Z. The reason for the wrong time was that they inadvertently put the wrong hour.
- 2.2.12 The evidence shows that ATSO – ATS 0923 and ATSA – ATS 0849 remained on duty till the end of their shift assisting ATSO – ATS 1290 and ATSA – ATS 2029 at 1211Z. During this time the communication with the pilot continued as per the applicable procedures. The ATSO controlling the traffic at that time gave the pilot clear and unambiguous instructions. What stands-out is that the pilot read back correctly all the instructions which clearly showed that he fully understood what was expected from him.

- 2.2.13 Nevertheless, the evidence shows that after the aircraft departed from FAKN the ATSO observed that it was deviating from the flight plan route. Apparently the ATC could make the observation from the variable direction finder (VDF) homing device inside the tower. The time when the observation was made the aircraft was on route towards Nelspruit according to the ATC. The ATC did not waste any time and immediately asked the pilot to indicate his intentions. After the pilot reported his intentions, the ATSO continued to provide him with services. All the information which ATC communicated to the pilot was with the provision that he is doing it at the pilot's discretion.
- 2.2.14 As indicated with ATSO – ATS 0923, when she cautioned the pilot to look out for the mountain, stating that it was purely a gesture of good airmanship. Now with the second flight, we can see that ATSO – ATS 1290 is not doing the same. It is because they are not mandated to. The ATSO just cleared him to take-off, climb to 7500 FT, squawking 6716 and route to FAGM. There was nothing said to him about the mountains, as he is expected to know it from his flight planning. However, similarly as in the first flight the pilot flew into bad weather of low cloud and reduced visibility. The time when this happened, the pilot was flying on flight level 5500 FT ALT and requesting to remain there. His intention was not to remain on that level throughout his flight, but to climb to 6500 FT ALT after speaking to Johannesburg Information. Seen that the pilot was doing all this at his own discretion, the ATSO allowed him to continue.
- 2.2.15 In order to track the pilot's progress the ATSO requested that he report his position when at 20 NM outbound from FAKN. However, it seems like the weather conditions where the aircraft was flying did not hold for the better. The weather conditions deteriorated as evidenced by the pilot coming back to ATC, requesting to descend to a lower level of 5000 FT ALT. He was told to descend to the lower level still with the provision that it is done at pilot's discretion. In the interest of safety, looking at the situation of the pilot, the ATSO instructed him to broadcast on the special rules area (SRA) on frequency 130.35 MHz at 30 NM outbound, transmission between aircraft (TIBA) on frequency 124.8 MHz, Johannesburg Information on frequency 127.4 MHz for climb passing 6500 FT ALT. But if he was to remain below 6500 FT ALT, he should remain on FAKN frequency 124.8 MHz. The pilot read back the information correctly and that was it. There were no further transmissions received from him.
- 2.2.16 Based on Johannesburg Information Occurrence Log entries made by ATSO – ATS 1265 at 1223Z, it states that the accident aircraft was initially routing on a low level, under radar. At 1226Z the pilot called the ATSO on frequency 127.4 MHz, but when he responded to him there was no response. It appears that this might be the approximate time when the aircraft collided with the mountain. According to the ATSO, the accident aircraft called when he was at about 5 NM west of Ngodwana having initiated a climb (± 300 FT) to 5800 FT ALT from level 5000 FT ALT where he was during the time when he spoke to FAKN.

2.3 Machine Issues:

- 2.3.1 The aircraft was found to be properly certificated, equipped and maintained in accordance with applicable regulations. All the aircraft documentation that was carried on board in terms of CAR, Part 91 was inspected in the investigation and found to be valid. The aircraft maintenance documentation was also inspected and found complying with CAR, Part 43 requirements.
- 2.3.2 Even though the aircraft was destroyed during the collision with the mountain, the evidence found indicates that there was sufficient quantity of Avgas 100LL fuel on board when embarking on the planned flight. Based on calculations made there was a total of approximately 40 US gallons of fuel carried on board the aircraft when taking off to embark on the first flight. The quantity of 40 US gallons are substantiated when the pilot reported to FAKN ATC his endurance was 4.5 hours when cleared for the first flight (approximately 8.8 US gallons per hour). The duration of the first flight was determined to be approximately 10 minutes long (0838Z – 0900Z) which translate to fuel usage of approximately 7 US gallons. Due to bad weather conditions the pilot had to turn back to FAKN which resulted in him flying the aircraft again later on a second flight.
- 2.3.3 At the time of landing after the first flight, the remaining quantity fuel was determined to be about 33 US gallons (subtract 7 from 40 US gallons). The aircraft flew again on the second flight which was approximately 39 minutes long (1039Z-1118Z). The fuel usage of the second flight was determined to be approximately 3.5 US gallons. It means that the remaining fuel on board the aircraft at time of accident was probably approximately 29.5 US gallons. Nonetheless, according to the flight plan Ref: #0335 the flight time from FAKN to FAGM was estimated to be approximately 2 hours 20 minutes long. In order to complete the flight, in terms of the applicable regulations the fuel quantity required was approximately 20 US gallons. Based on the above fuel calculations the evidence was that a total quantity of 13 US gallons (including reserve) would have been remaining on board the aircraft if there was a successful landing at FAGM.
- 2.3.4 The aircraft mass was also checked in the investigation with the aim to determine that it was within limits as prescribed by applicable manufacturers and regulating requirements. Based on the mass calculation it was determined that the aircraft was approximately 28.9 kg less than the MTOW. This is evidence that the aircraft was operating within the required mass limitations and it had no effect on the accident.
- 2.3.5 Notwithstanding the fact of the aircraft mass being within the required limits, it should be noted that there were two items i.e. a bottle of Whisky and medication with inscription “Optisulin” found inside the personal belongings (Sports bag) carried on board the aircraft. It was deemed important to look into the alcohol and chronic medication being carried on board the aircraft because of the potential to affect the pilot’s performance.
- 2.3.6 The South African Police Service (SAPS) took specimens from the pilot for toxicology testing with the aim to identify if the pilot experienced any adverse effects (undesired harmful effect) resulting from any substance including alcohol. The toxicology report was not ready when the accident report was concluded.

- 2.3.7 In terms of the Optisulin medication, the pilot's medical record shows that he does not suffer from any diabetic medical condition. In fact the evidence was that one of the passengers was suffering from diabetes. The medication was used by the passenger and it had no effect on the performance of the pilot.
- 2.4 Issues related to the environment: Ngodwana Mountainous Area
- 2.4.1 The investigation determined that the pilot flew the aircraft into the mountainous area of Ngodwana. Based on Google Earth and research information about Ngodwana mountain showed that the arrangement of the natural and artificial physical features thereof consist of approximately: Low 2 300 ft AMLS, Moderate 2 300 – 4 000 ft AMSL and High 4 000 – 6500 ft AMLS peaks. The mountainous area was found to be highly weathered with bad weather conditions of low cloud and reduced visibility that varied from one location to another on the day. Due to the risks involved with mountain flying, it was important for a pilot to have adequate training and planning before he decided to fly in the area. It should be noted that without proper training, there was a narrow window of opportunity open for the pilot to explore to safety.
- 2.4.2 In terms of the above, based on the ATC recordings it shows that the pilot selected to fly the mountain route when diverting to Tzaneen. The flight level indicates that he was following the contours of the landscape which was at his own discretion. The flight in the mountains was potentially dangerous because there was a strong likelihood of the pilot experiencing an emergency during the flight. In case of an emergency happening, the pilot was expected to think and respond quickly without exposing himself, passengers and aircraft to danger.
- 2.4.3 The urge of the pilot to ignore all potential dangers and to continue with the flight in the mountainous area was quite alarming. However, it is possible that his thoughts about the bad weather situation was that it will improve for the best if he just continue a little bit further. But he soon discovered that the weather situation in and around him was not changing which may have been the worst thing to have to face at that time. He had a window of opportunity to make proper decisions about the terrain and weather conditions when he asked ATC to remain on 5500 ft AMSL and later descend to 5000 ft AMSL. Nonetheless, as circumstances have it the weather drastically started to deteriorate consequently reducing his options to make a good decision.
- Note:** It is important to note that when the pilot flew the aircraft at 5500 ft ALT and 5000 ft ALT, he was in a potentially hazardous position already, flying approximately 1000 – 1500 ft below the highest peak 6500 ft on the flight plan route in the area. More precisely based on the wreckage investigation information, the evidence shows that the aircraft collided the mountain having descended to an even lower level of 1440m/4724 ft (± 276 ft) below 5000 ft ALT. (ALT to AMSL)
- 2.4.4 Theoretically the option open to him was to divert to an alternative aerodrome, to return back to the departure aerodrome or do an off aerodrome landing. The safer option was to return back to FAKN, but he instead selected to fly the alternative route to Tzaneen. However, the consequence was that as he continued on this new route to the alternative aerodrome, the weather condition of low cloud and reduced visibility in the mountainous area started to close-off the option to return back. The last option of landing off the aerodrome was not possible because there was no suitable place to land. Prospectively as the situation has it, the pilot was in a situation of having no way out. All that remained was for him to declare an

emergency to ATC to receive help. Unfortunately even this last option to declare an emergency he did not use.

2.5 Overcast Weather Conditions:

2.5.1 Also, it is because IMC conditions prevailed that the pilot was required to fly the aircraft as a Special VFR flight. The role of ATC in this regard was to provide clearance with the provision that the flight will be flown in daylight conditions, have sufficient visibility to maintain visual separation from terrain and other aircraft. The evidence is that after 2 NM outbound the pilot could not continue with the flight due to poor weather of low cloud and visibility conditions. The pilot was not taking any chances as it was not particularly safe and life threatening. Had he continued with the flight, most probably he would have exposed the aircraft to risk of colliding with terrain or obstacles due to the reduced visibility.

2.5.2 The time when the pilot embarked on the second flight, the conditions seem to have cleared up from IMC to VMC. The change in conditions indicated that the pilot could now fly the aircraft as a VFR flight. There was sufficient visibility to maintain visual separation from terrain and other aircraft. The pilot's licence authorised him to fly a VFR flight, hence he was entitled to fly the aircraft without any restrictions. According to available information, before he reached Mbombela Stadium he reported experiencing low cloud conditions which forced him to stay at 5500 ft ALT. He encountered weather conditions which were comparatively worse than what he expected for him to conduct a VFR flight. However, instead of turning back again he continued on that approved flight level until before Ngondwana when the low cloud conditions further deteriorated and he was forced to request an even lower flight level 5000 ft ALT. It does not seem as though the pilot had any intention to make a similar decision as before due to the weather in the first flight wherein he decided to turn back. Instead he carried on straight ahead trying to reach his destination to FAGM.

2.5.3 As indicated before, somewhere along the line during the flight the pilot made a decision to divert from the flight plan route and re-route the aircraft towards Tzaneen. The decision was made in the interest of aviation safety, with the aim to fly away from or around the area of bad weather and visibility. It would seem like that the conditions on this new route did not improve as anticipated by him to ensure a safe flight further. However, it is important to note that the highly variable mountainous terrain in front of him coupled with the bad weather of low cloud ended up exacerbating the situations. Notwithstanding the fact that the low cloud possibly at that time had completely obscured the mountains with the effect of him losing situational awareness “not knowing what was going on around him” and inadvertently collided with the mountain.

2.5.4 The weather service report indicates that “cloudy to overcast conditions between 2000 -3000 ft above ground level”. The conditions reported by the weather service seem to be agreeing with the information from a witness – a pilot flying a helicopter ZS-HKA. During his flight he called a friend residing in Kaapse Hoop area asking him about the weather and he was told that it was “overcast and high mountains were obscured by cloud”. As he flew pass Belfast to the south he observed a “lot of cloud on the high ground stretching to the horizon in the north”. The time he reached Kaapse Hoop by his friend's farm it was “solid overcast with the mountains to the west obscured in cloud”. He was on ground for duration of approximately 3 hours but when he decided to continue with the flight heading north between Barberton Valley and Nelspruit which he described being “open

under overcast and broken cloud". However, the mountain tops towards Ngodwana/Kaapse Hoop were still obscured that time.

- 2.5.5 Based on the above information it is clear that FAKN ATC had no knowledge that such bad weather conditions were present in the area of Ngodwana. It should be noted that Ngodwana is approximately 20 NM outbound from FAKN which makes it quite impossible for ATC to know what's happening out there in the distance and need other external sources of information.

3. CONCLUSION

3.1 Findings

- 3.1.1 The pilot became doubtful about his ability to visually avoid terrain and obstacle along the route and made the right decision to advise ATC immediately and he took action to reach a safe lower altitude.
- 3.1.2 The pilot did not receive nor did he request any radar services during the flight and he was depending on the communication with ATC throughout the flight to provide him appropriate weather information to maintain a safe flight. However, in this regard the ATC could only assist him when they noticed a hazardous situation developing based on the communication but they would have not been able to recognise that the VFR aircraft was dangerously close to the terrain.
- 3.1.3 The aircraft had a global positioning system-based terrain awareness unit (GPS) fitted on board the aircraft to assist him to improve his ability to safely fly the aircraft.
- 3.1.4 According to the South African Weather Service (SAWS) report, there is an automatic weather system (AWS) situated at FAKN which provides an accurate and reliable automated method of reporting aviation meteorological conditions 24 hours a day. For the purpose of the investigation, ATC used the AWS METAR information to declare the FAKN control zone as operating under visual meteorological conditions (VMC) and instrument meteorological condition (IMC) on the day of the accident.
- 3.1.5 Based on FAKN ATSU Occurrence Log, the control zone was visual meteorological conditions (VMC) until 0615Z when the ATSO – ATS Licence No: 0923 declared it instrument meteorological condition (IMC). However, later in the day during the ATC's hand-over watch (HOW) process at about 0955Z, they found by METAR information that the prevailing weather condition have improved and declared the control zone back to visual meteorological conditions (VMC).
- 3.1.6 According to the ATC records, supported by the tower recordings, the evidence shows that for time the control zone were restricted to IMC operations the time when the pilot embarked on the first flight out of FAKN at about 0838Z. The flight plan #0335 was as follows: N0100A070 DCT FAND/N0100F075 DCT WIV/N0100A070 DCT RA/N0100A065 DCT RD DCT FAGM0220 but due to the control zone being restricted to IMC the pilot was cleared to fly the aircraft under Special VFR only. However, regrettably at about 2 NM outbound from FAKN the pilot was forced to decide not to continue the flight due to bad overcast weather conditions which he experienced on the route and in the interest of aviation safety

he turned back to FAKN.

- 3.1.7 According to the tower recordings the evidence shows that the pilot decided to deviate from the flight plan route and follow a new route to Mbombela Stadium, overhead Ngodwana, Tzaneen and Rand Airport. He notified ATSO – ATS Licence No: 1290 of the deviation in-flight when he was requested to report his intention seen that he was observed routing to Nelspruit. The information indicates that the flight plan #0648 was effectively cancelled by him following this new route. Also, there was no new flight plan filed for the Tzaneen route with ATC.
- 3.1.8 According to the tower recordings, the evidence shows that the pilot broadcasted to ATSO – ATS Licence No: 1290 when he was approximately 10 NM outbound from FAKN, requesting clearance to remain on 5500 FT ALT to stay below the low cloud conditions which he was experiencing at that time. The ATC cleared him to remain on 5500 FT ALT until exiting the TMA and to report his position at 20 NM outbound from FAKN. However, all indications are that the weather condition must have deteriorated for the worst because at about 13 NM outbound from FAKN (between Mbombela Stadium and Ngodwana), the pilot requested clearance and he was approved to descend to a lower level of 5000 FT ALT.
- 3.1.9 According to applicable regulations, when operating under VFR conditions the pilot is required to comply with the following: To have sufficient visibility to fly the aircraft and maintain adequate visual separation from terrain and other aircraft. Based on the requests made by the pilot, the information shows that the deteriorating weather conditions may have been well below the VFR minima as stipulated by the regulations.
- 3.1.10 The evidence seems to suggest that when overhead Ngodwana the pilot changed his heading and executed a turn/bank to the right and redirecting the aircraft to fly to what is believed to be Tzaneen. While on this new track to Tzaneen, he exited the TMA and broadcasted to JHB Information on frequency 127.4 MHz with the intention to report his position as per FAKN ATSU instructions. The time he made contact with JHB Information he is perceived to be still on flight level 5000 FT ALT.
- 3.1.11 According to FAKN ATSU SSI it is stated that the airspace below the Kruger TMA, excluding that part of the Kruger National Park, between ground level and 2500 FT ALT, which falls below the Kruger TMA, is declared as a Special Rules Area and termed as the “KRUGER SPECIAL RULES AREA”. This is the reason why in the interest of aviation safety that the pilot was advised by ATC to maintain a listening watch and do broadcast at 30 NM position report on frequency 130,35 MHz while at the same time squawking 6716.
- 3.1.12 According to the aircraft equipment list, it shows that the aircraft was fitted with a Garmin GTX 327, Mode C digital flight transponder fitted. The transponder had the capability to send a transponder code with VFR squawking feature which if activated could assist ATC to identify the aircraft during the flight; hence the pilot was requested to squawk 6716.
- 3.1.13 The accident occurred at Ngodwana District, Mpumalanga on SAPPI private property at GPS 25°30'55.3"S 30°31'30.7"E. The aircraft wreckage was inspected and found that it collided with the mountain at approximately 1440m/4724 FT AMSL, in a straight and level flight attitude. The aircraft was destroyed after the collision.

- 3.1.14 All the occupants carried on board the aircraft sustained fatal injuries in the accident. The pathology report findings were that the cause of death was as a result of multiple injuries.
- 3.1.15 The pilot and two passengers flew the aircraft on what is believed to be a private flight from FAKN to FAGM on Saturday, 10 December 2016 the first time at about 0839Z. They were seen by the airport personnel boarding the aircraft and take-off was at about 0851Z, but shortly after approximately ± 10 min landed back at the aerodrome at about 0900Z. The evidence was that the pilot decided to discontinue the flight because of the weather (low cloud and reduced visibility).
- 3.1.16 After the aircraft landed, the PIC and passengers disembarked the aircraft and gone to the airport services office to wait there until the adverse weather conditions clear up. According to the airport services office personnel indicating that the PIC and passengers were there in the office for duration of one hour until about 1000Z before they decided to go to the airport restaurant "*Wimpy*" for lunch.
- 3.1.17 Due to the fact that the aircraft returned to FAKN, the PIC was required to pay approach, landing and parking service fees to the airport management. According to the airport services personnel, they indicated that due to the adverse weather conditions issue and the PIC not entirely sure whether or not he will eventually fly out to FAGM on that day, the decision was made that they will not be paying the airport service fees at that time until it becomes apparent that they will actually fly out.
- 3.1.18 According to the airport services personnel, after about an half-hour (± 30 min) the PIC and passengers was seen returning to the parking bay and boarded the aircraft to embark on a flight without settling their second airport services bill as they agreed before going to lunch. FAKN ATC reported that the take-off time for this flight was at about 1039Z.
- 3.1.19 According to FAKN ATC tower recording, the evidence shows that prior to them embarking on the flight the PIC radio transmitter his intension on the tower/approach frequency 119.2 MHz. The exact time of the transmission was at about 1030Z.
- 3.1.20 FAKN ATC Tower Occurrence Log was inspected during the investigation. According to the occurrence log, an entry made at 1154Z which was about ± 1 hour 55 min after the take-off time, it shows that the ATC received a call on SAPPI frequency to the tower at 1118Z (± 1 hour 19 min after take-off time) reporting a crash overhead Ngodwana.
- 3.1.21 FAKN ATC Tower Occurrence Log shows that after the aircraft crash was reported to ATC, the on duty controller called and reported the matter to the aeronautical rescue co-ordinator centre (ARCC) at about 1144Z (± 26 min after SAPPI reporting time). Thereafter a DETRESSFA message was sent at about 1150Z (± 6 min after reporting it to ARCC). Due to the DETRESSFA message, under the control of the ARCC a search and rescue operation was activated involving different significant emergency services role-players dispatching to the reported location of the aircraft accident scene.

3.2 Probable Cause/s

The aircraft collided with terrain in cloudy and overcast weather conditions. Controlled flight into terrain (CFIT) due to adverse weather.

4. SAFETY RECOMMENDATIONS

- 4.1 In terms of the human factors issues raised in the report, the DCA and Stakeholders to set up a workgroup or task team to urgently look into carnage which is happening as a result of CFIT accidents. The following mitigating strategy to improve and maintain pilots' knowledge, awareness and competence by introducing a comprehensive CFIT training model within the PPL syllabus, with the aim to expand the student pilots' knowledge of aircraft systems, aircraft performance and normal/abnormal procedures to ensure that they do not find themselves in unexpected situations from which they cannot immediately recover. Article
- 4.2 The DCA to develop a mandatory CFIT training program into the PPL syllabus that includes realistic simulator exercises. The training program should empower student pilots with crew resource management (CRM) exposure, specifically structured for General Aviation (GA) operations with the aim to assist them with good decision-making skills and competencies. This way the PPL pilots operating in GA environment awareness will be developed so much that they have the ability to identify risks involved with CFIT, the circumstances in which such risks are greatest and execute best decision-making to maintain a close to accurate picture of their horizontal and vertical situation. Ultimately the aim is that a PPL should have been empowered with necessary skills and competencies to assist him/her to timeously recognise and effectively respond to potential CFIT risk.SA to adopt the US methodology of addressing CFIT accidents.
- 4.3 In terms of FAKN ATSU administrative issues raised in the report related to the Occurrence Log, it is recommended that ATNS should conduct quality control measures to remedy the anomalies.

5. APPENDICES

- 5.1 Appendix A: A copy of the SAWS Report Reference No: ZS-OWB-2016-12-14;
- 5.2 Appendix B: Copy of ATC transcript from;
- 5.3 Appendix C: SACAA Research Article into CFIT;



AIRCRAFT ACCIDENT WEATHER REPORT

Record Reference: ZS-OWB-2016-12-14
Document Type: Report
Version: 1

Document Control

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Version and Amendment Schedule

Report: Aircraft accident

Version	Version Date	Author	Description of Amendments
1	2016/05/31	Ntobeko Nkangane	Document Created

Scope

The meteorological information provided in this report includes the following:

1. Observational weather data in the vicinity of the aircraft accident/incident closer to the time of occurrence. These include but are not limited to:

- (i) Remote sensing data such as Satellite and/or RADAR imagery;
- (ii) Surface data in the form of METARS or SYNOPS which contain weather elements such as:
 - dry-bulb and dew-point temperatures;
 - wind speed and direction;
 - cloud cover;
 - visibility;
 - weather; and
 - the QNH.

2. Forecast data at/or in the vicinity of the aircraft accident/incident at the time of occurrence. These include but not limited to:

- (i) Sigweather chart
- (ii) Wind charts

Purpose

To provide the South African Civil Aviation Authority (SACAA) with meteorological information required for their inquest into an aircraft accident/incident closest to the time of occurrence.

Background

On Saturday, 10 December 2016, aircraft ZS-OWB, PA28A, flying VFR at FL 5800 feet from FAKN to FAGM crashed approximately 47km west of FAKN at approximately 1100Z. The GPS coordinates were S25° 30' 55", E 30° 31' 30".

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Document Template Reference: AWC-

Report: Aircraft accident

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SUMMARY OF THE OBSERVED WEATHER CONDITIONS AT THE TIME OF THE ACCIDENT

(i) Surface observations

The data below was recorded at Kruger Mpumalanga International Airport (FAKN) on the 10th December 2016 at/around the time of the accident. The data is extracted from AWS (Automatic Weather System) situated at FAKN.

The surface wind was light Easterly, with cloudy to overcast conditions reported between 2000 – 3000 feet above ground level. The data also agrees with the satellite data in terms of presence of cloud.

The relative humidity was between 55-60%, and the dew point depression was 8 to 9 degrees.

METARs

FAKN 100900Z 10005KT 9999 SCT015 OVC020 20/15 Q1020 NOSIG=

FAKN 101000Z 21004KT 9999 OVC020 23/15 Q1019 NOSIG=

FAKN 101100Z 04002KT 9999 BKN025 24/15 Q1018 NOSIG=

FAKN 101200Z 36002KT 9999 BKN025 24/15 Q1017 NOSIG=

FAKN 101300Z 11005KT 9999 SCT025 BKN065 24/14 Q1016 NOSIG=

FAKN 101400Z 10005KT 9999 SCT025 24/14 Q1015 NOSIG=

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FAKN						
PARAMETERS	TIMES					
	0900Z	1000Z	1100Z	1200Z	1300Z	1400Z
Wind (True)	10005KT	21004KT	04002KT	36002KT	11005KT	10005KT
Temperature	20°C	23 °C	24°C	24 °C	24 °C	24
Dew-point	15 °C	15 °C	15 °C	15 °C	14 °C	14
Humidity	73%	61%	57%	57%	54%	54%
Pressure	1020 HPa	1019 HPa	1018 HPa	1017 HPa	1016 HPa	1016 HPa
Weather	Nil	Nil	Nil	Nil	Nil	Nil
Clouds amount and height	SCT015 OVC020	OVC020	BKN025	BKN025	SCT025 BKN065	SCT025

SCT = 3/8 to 4/8 of sky covered

BKN = 5/8 to 7/8 of sky covered

OVC = 8/8 of sky covered

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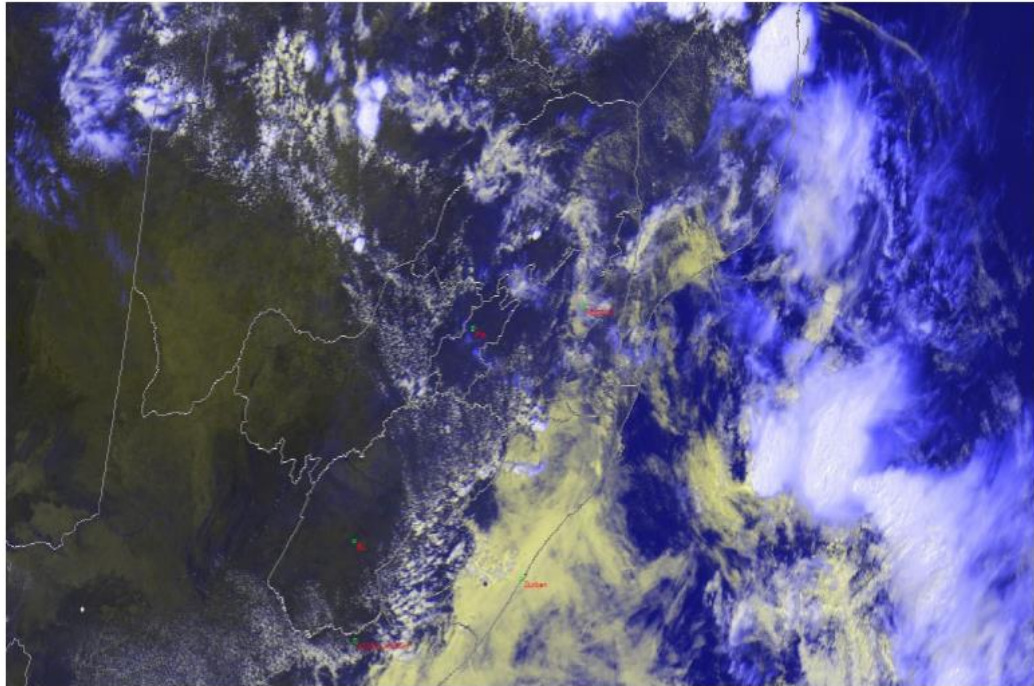
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(ii) Satellite image

The satellite image in Attachment A indicates low level clouds above FAKN and adjacent interior, but clearer to the west.



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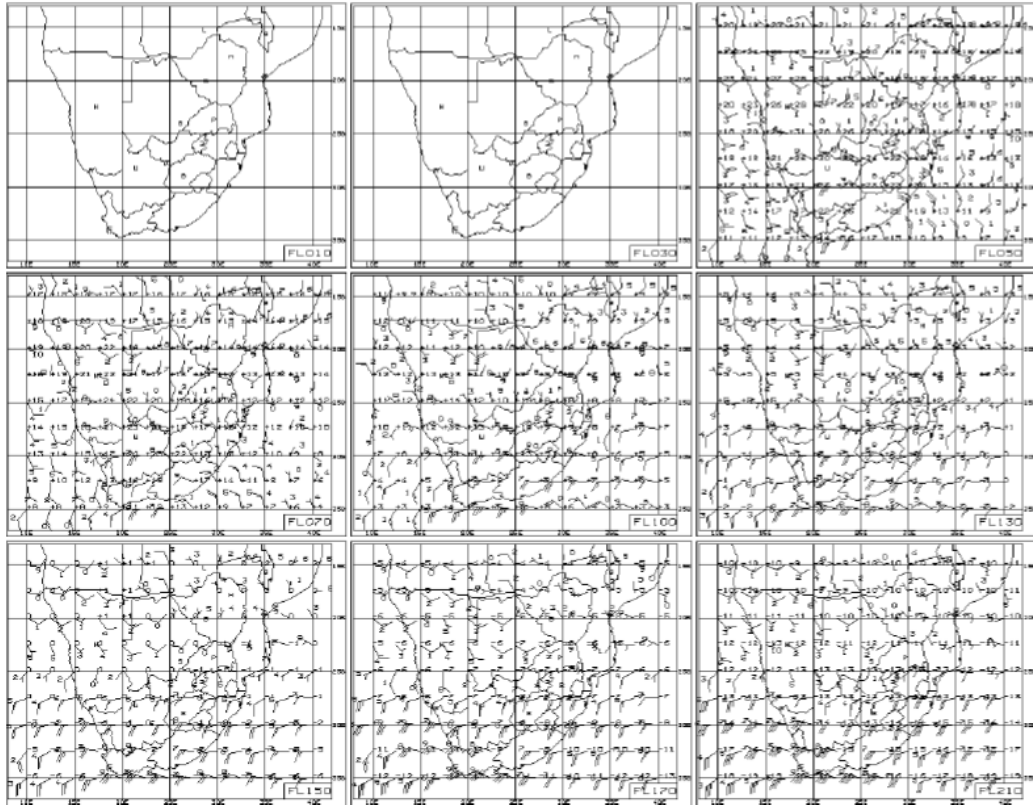
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Attachment B: UPPER WIND

UPPER WINDS & TEMPERATURES VALID FOR 20161212 12UTC. Derived by SWS From WFS, Broadcast: 20161212 00UTC.



The forecast wind at F050 was 04005KT

The forecast wind at F070 was 05005KT

The forecast wind at F100 was 12005KT

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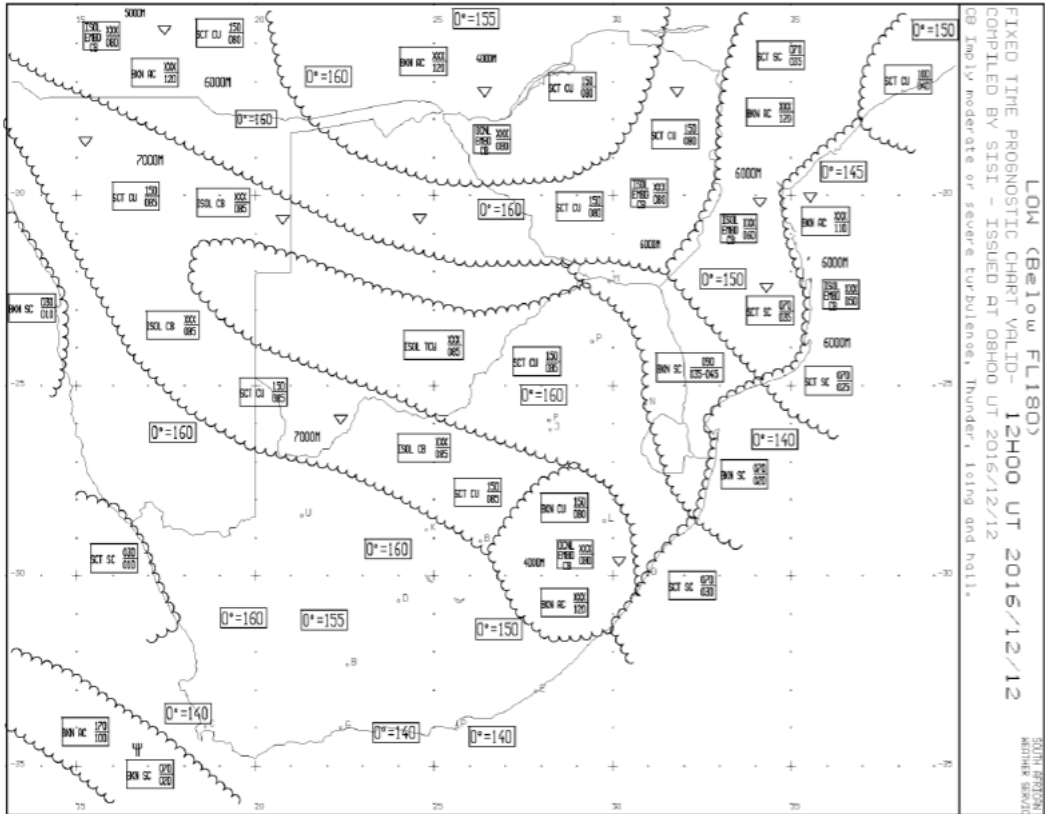
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The data above was from 2 aircraft departing from Cape Town (1700Z and 1748Z respectively). There a temperature inversion from the ground to +/-1500 feet, as well as wind-shear that may have caused some turbulence.

ATTACHMENT C: 12Z Significant Weather Chart



The forecast valid at 1200Z: Broken low cloud (Stratocumulus) was forecast with bases at 3500-4500 feet above MSL with tops at 9000 feet, but clearing westwards to Scattered Cumulus with bases at 8500 feet and tops at 16000 feet

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Abbreviations	Symbols for Significant Weather
<p>MON = Mountains ESC = Escarpment CIT = City/Urban Areas VAL = Valley HIV = Highveld LOV = Lowveld COT = Coastal LOC = Local/Localised</p> <p>BR = MIST FG = FOG HZ = HAZE FU = FUME DU = DUST DR = DRIZZLE RA = RAIN TS = Thunderstorm SA = SAND GR = GRAZ GS = GRAZ (small)</p> <p>BC = Patches BL = Blowing WE = Shallow PR = Partial SH = Showers VC = Vicinity</p> <p>AC = Altostratus AL = Altostratus CB = Cumulonimbus CU = Cumulus NS = Nimbostratus SC = Stratocumulus ST = Stratus</p> <p>FEW = 1 to 2 Octas SCT = 3 to 4 Octas BKN = 5 to 7 Octas OVC = 8 Octas</p> <p>NSC = No significant Cloud NSW = No significant Weather NIL = NSC and NSW LVR = Layered</p> <p>ISOL = Isolated OCNL = Occasional FRQ = Frequent</p> <p>ISOL CB: Individual Cells OCNL CB: Well Separated Cells FRQ CB: Little or no separation</p> <p>ENBB = Embedded (in Cloud/Haze) OBSO = Obscured</p>	<p>CB Thunderstorm (TC) Tropical Cyclone Shower Rain Snow Drizzle Widespread Fog Widespread Mist Haze Smoke</p> <p>Slight Aircraft Icing Moderate Aircraft Icing Severe Aircraft Icing Moderate Turbulence Severe Turbulence Mountain Waves Severe Sand or Dust Haze Severe Sandstorm or Dust Storm Widespread Blowing Snow Freezing Rain</p> <p>Line Squall - Above FL 100 refers to Severe Line Squall Freezing Level Tropopause Height Tropopause High Tropopause Low</p> <p>Warm Front Cold Front Cloud Boundary Jetstream</p> <p>Cloud Box: AAA = Amount CLD = Type TTT = Top BBB = Base</p> <p>CAT AREA 380 230</p> <p>FL=380 FL=390 FL=390 Jetstream Height</p> <p>Double bar denotes a change in wind speed of 20kt or more and/or change in height of 3000ft or more</p>

Note: Height on charts are AMSL (Above Mean Sea Level) unless otherwise indicated. Copyright © South African Weather Service

End of document

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Appendix B : FAKN ATC TOWER/APPROACH and PIC TWO-WAY COMMUNICATION

RECORDING:

WARNING: The reader of this report is cautioned that the transcription of an ATC recorder audio recording is not a precise science but is the best product possible from the investigation group's investigative effort. The transcript or parts thereof, if taken out of context, could be misleading. The transcript should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the transcript as the sole source of information.

Location: South Africa, Ngodwana, at position GPS 25°30'55.3"S 30°31'30.7"E

Date: 10 December 2016

Aircraft: PA-28-181, ZS-OWB

* - Unintelligible word; TWR – Tower controller; PA-28 – the aircraft involved in the accident;
Italic –Afrikaans language; Voice 1 – Male Voice (pilot) & Voice 2 – Female Voice (ATC).

FIRST FLIGHT		
ATC & PIC communication of flight between FAKN to FAGM, Freq: 119.2 MHz		
	Source	Content
	Pilot	Kruger Tower, ZS-OWB, good day.
	Tower	OWB, good morning, go ahead.
	Pilot	OWB, parked in the general aviation parking, requesting taxi for our flight as per flight plan, three people on board and endurance of 4 hours 30 minutes.
	Tower	OWB, runway 05 in use, surface wind 060 degrees, 6 knots, QNH 1019, time check 0834, confirm your altitude or level on request for Rand and confirm the number on board is one crew two passengers.
	Pilot	Affirm, one crew two passengers and the flight level on request for Rand is 075, OWB.
	Tower	OWB, clearances Kruger to be controlled ***, special VFR for Rand after departure runway 05, we have left turn out routing as required, routing at special VFR remaining 4500ft or below/clear of clouds with ground insight at all times, Standby for squawk.
	Pilot	Uh...special VFR will remain 4500ft or below *** Standby the squawk, OWB.
	Tower	OWB, read back is correct taxi on the apron, hold abeam service road to the heli-stop.
	Pilot	Taxi on the apron and where should we do our run-up checks, Mam.
	Tower	You can do it abeam the service road to the heli-stop, Sir are you familiar with the airfield.
	Pilot	Negative, OWB.
	Tower	Commence your taxi along *** alfa, I give you a shout when you do stop.
	Pilot	Copy that, OWB.
	Tower	OWB, Kruger.
	Pilot	No response.
	Tower	OWB, Kruger.
	Pilot	Uh...go ahead, OWB.
	Tower	OWB, so far flight level 075 is not standard, would you prefer flight level 085 or flight level 065.
	Pilot	Uh...085, OWB.
	Tower	OWB, you can hold your present position for your run-ups.
	Pilot	Copy that, OWB.
	Pilot	Tower run-up checks are done, OWB.
	Tower	OWB hold position Sir and squawk is 0671.
	Pilot	0671, hold position, OWB.
	Tower	OWB, you can expect a three minutes to the four minutes delay Sir.

	Pilot	Copy that, OWB.
	Tower	OWB, you can continue taxi, alfa holding point holding short of the runway.
	Pilot	Contitue taxi, alfa holding short of the runway, OWB.
	Tower	OWB, continue to taxi, enter, back track, line-up on weight, runway 05.
	Pilot	Enter, back track on runway 05, OWB.
	Tower	OWB, Sir confirm you are familiar with Kruger special rules area.
	Pilot	Uhhmm...Uhhmm...I am sort of familiar, mam, we flew through the Kruger special area on the way up.
	Tower	OWB, I remind you to climb into flight level 085 due to IF traffic departing shortly, you will need route through the special rules area facing West bound, and I will definitely speak to you again Sir, because it doesn't look too bad on the West of the mountains.
	Pilot	Copy that mam, we'll route through the Kruger special rules area, and we will be careful, OWB.
	Tower	OWB, standby for departure.
	Pilot	Standby for departure, OWB.
	Tower	OWB, runway 05, surface wind 080 degrees, 5knots, clear to take-off, report 7 miles outbound from Kruger.
	Pilot	Clear to take-off, runway 05, report 7 miles outbound, OWB.
	Pilot	Tower confirm left hand turn out, OWB.
	Tower	I confirm left hand.
	Pilot	Left hand, OWB.
	Tower	OWB on 119 decimal 2 do you read.
	Pilot	Kruger Tower, OWB.
	Tower	OWB report your distance outbound from Kruger Sir, and confirm you routing to Ngodwana.
	Pilot	Uh...Man, we approximately 2NM outbound but uh...the visibility isn't good at all, could we possibly return to Kruger until the weather improves.
	Tower	OWB, you can make a right turn to route back toward the airfield to join a left down wind, runway 05, I have traffic lined up on the runway now for departure.
	Pilot	I will join on the left downwind for runway 05, OWB.
	Tower	OWB, Kruger.
	Pilot	OWB, go ahead.
	Tower	Sir are you please orbit in your present position.
	Pilot	Affirm, Mam we can commence right orbit, OWB.
	Tower	OWB, orbit in your present position, standby for onward clearance, traffic departing now.
	Pilot	Orbit in current position, OWB.
	Tower	OWB, runway 05, surface wind 080 degrees, less than 5 knots, clear to land.
	Pilot	Clear to land, runway 05, OWB.
	Tower	OWB, 190 back track, vacate right on alfa.
	Pilot	Back track, vacate right on alfa, thanks for accommodating Mam, sorry about that.
	Tower	OWB, not a problem Sir its better we have you safe on the ground.
	Tower	OWB, you can continue with the marshal to the northern end of the airfield.

ECOND FLIGHT - ATC & PIC communication of flight between FAKN to FAGM

Time	Course	Content
	Pilot	Kruger Tower, ZS-OWB, good day.
	Tower	OWB, good day, go ahead Sir.
	Pilot	OWB, parking in the general aviation parking, requesting flight as per flight plan, three souls on board with endurance of four and half hours.
	Tower	OWB, confirm your flight plan reference number, Sir and destination.
	Pilot	Uh...Standby, OWB.
	Pilot	Reference number is 648 and destination is Rand Airport, FAGM, OWB.
	Tower	OWB, copied ***start at pilot's discretion, QNH 1018, report ready for the taxi and ***after the departure clearance.

Pilot	QNH 1018, and we are ready for taxi, OWB.
Tower	OWB, taxi golf holding point, runway 05.
Pilot	Golf holding point, runway 05, OWB.
Tower	OWB, you cleared Kruger to Rand, after departure runway 05, route as per flight plan, climb to 7500 ft and squawk 6716.
Pilot	Climb to 7500ft and squawk 6716, OWB.
Tower	OWB, read back right, continue taxi course to alfa holding poin, runway 05.
Pilot	Continue to alfa holding point, runway 05, OWB.
Tower	OWB, report ready for departure and *** offer is available.
Pilot	Uh... we are ready for departure, OWB.
Tower	OWB, copied, on runway 05, surface wind 360 degrees, 05 knots, cleared to take-off, report 20 miles from Kruger.
Pilot	Cleared for take-off, runway 05, and will report 2 miles from Kruger, OWB.
Tower	OWB, that's 20 miles, Sir.
Pilot	20 miles, OWB, just confirm it is a left hand turn out.
Tower	OWB, Affirm.
Tower	OWB, Kruger.
Pilot	OWB
Tower	OWB, confirm your intentions, Sir seem to be routing for Nelspruit now.
Pilot	Affirm Sir, we gonna route to Tzaneen , Mbombela Stadium, Uh...overhead Ngodwana and Uh...through to Rand.'
Tower	OWB copied, Sir.
Pilot	Tower, OWB.
Tower	OWB, good morning again go ahead Sir.
Pilot	OWB, could we request up to 5500 just to stay below the cloud , OWB.
Tower	OWB, confirm you'll be maintaining 5500 ft throughout your journey, Sir.
Pilot	Uh... we will be maintaining 5500 until we exit the TMA and I'll contact Joburg Info for 6500, OWB.
Tower	OWB, copied, report 20 miles from Kruger.
Pilot	Report 20 miles from Kruger, OWB.
Pilot	Tower for OWB.
Tower	OWB, go ahead.
Pilot	Uh...Sir, would it be fine to request up to 050 by any chance, OWB.
Tower	OWB, report your distance from Kruger, Sir.
Pilot	We are approximately 13NM from Kruger, OWB.
Tower	OWB, confirm that's 13 miles from Kruger.
Pilot	Affirm, OWB.
Tower	OWB, you can descend at pilots discretion, QNH 1018, broadcast 130.35 for us, 30 miles, 124.8, you can contact Joburg Info on 127.4 for the climb pass on 6500 ft or above it.
Pilot	Uh...descend at pilot's discretion, broadcast on 13.35 and contact Joburg Info on 127.4 for the climb out, OWB.
Tower	OWB, read back correct on 124.8 if you remaining below 6500 ft.
Pilot	124.8 if we remaining below 6500, OWB.



Controlled Flight into Terrain

Accidents and Incidents Investigations Division
Research and Data Analysis Section
Ms Bongzi Mtshkwa



The aircraft collided with mountainous terrain during Instrument Meteorological Conditions (IMC).



The aircraft collided with mountainous terrain during Instrument Meteorological Conditions (IMC) on a flight from Nelspruit Aerodrome to Rand Aerodrome.

Both the aircraft represented above collided with terrain during controlled flight. In both these accidents several occupants perished. From these two accidents the investigation teams found that the aircraft were serviceable prior to flight.

Why does it happen?

Poor flight planning by the pilot/crew;

Lack of experience by the pilot/crew;

Disregard for standard safe operating procedures;

Poor decision-making;

Lack of knowledge of the area and associated weather phenomena;

Deliberate VFR into IMC conditions;

Commercial/operational pressures.

These are but a few of the factors that should be considered that might have played a direct or an indirect role in these types of accidents.

What exactly is Controlled Flight into Terrain (CFIT)?

CFIT is described as an accident in which an airworthy aircraft, under pilot control, is unintentionally flown into the ground, a mountain, water, or an obstacle. The pilots are generally unaware of the danger until it is too late. According to worldwide statistics, CFIT is the major cause of loss of life in aviation accidents. According to available SACAA data applicable for the period January 2006 to December 2010, twenty-four (24) CFIT accidents occurred in which seventy-five (75) occupants perished.

Why do CFIT accidents occur?

Pilots find themselves in this situation due to various reasons, but encountering inclement weather conditions en route to an intended destination without taking evasive action timeously (returning to point of departure, or an alternate aerodrome) remains one of the main causes for these types of accidents. In most cases poor flight planning could be regarded as the primary cause for this type of accident, together with the fact that the pilot was not familiar with the area and associated weather conditions/phenomena. Another very profound cause of these types of accidents is the 'Get-There' syndrome; where the pilot, or in many cases his or her passengers/cargo must be at a certain location at a certain time, irrespective of whether safety is compromised and regulatory requirements and procedures are not met.

Contrary to more advanced transport aircraft, aircraft in the general aviation sector in most cases do not have terrain awareness warning systems (TAWS) on board, which in many cases could prevent these types of accidents if the pilot(s) adhere to the warning command of such a device. Weather radar is another important piece of equipment, and is found more commonly on general aviation aircraft than TAWS. However, if your aircraft is equipped with all these warning and information systems, it does not mean that a CFIT accident will necessarily be avoided. History has shown us that from some of the most advanced aircraft in the world to some much less advanced, have been involved in CFIT accidents. The pilot/cockpit crew needs to believe and adhere to the warning signals displayed by these warning units to avoid these types of accidents. A very prominent aircraft accident that occurred in South Africa with an aircraft that was equipped with all these warning devices was the Hawker HS748 that collided

with the Outeniqua Mountains to the north of George on 1 June 2002, in which two crew members and well-known cricketer Hansie Cronje perished. The crew of that aircraft received the command to 'Pull Up', 'Pull Up' several times from the GPWS (Ground Proximity Warning System) but failed to adhere to it, resulting in the tragic CFIT accident.

The majority of flights are being flown utilizing GPS as the primary navigational reference. In certain instances pilots will fabricate their own let down plates based on GPS. These you find to be more common amongst pilots who fly into known aerodromes on a regular basis where the weather conditions from time to time do not favour VFR flight (i.e., his/her home aerodrome, or holiday destination, farms or game lodges, which in most cases are unlicensed aerodromes). It is very seldom that faulty equipment plays a role in these types of accidents, but this cannot be ignored, nor ruled out. Human factors remain the primary factor resulting in these types of accidents.

Just how important is flight planning and what is flight planning?

Flight planning can be described as the process of planning your route, includes several safety-critical aspects and is essential to ensure a successful flight.

The pilot/crew must ensure that they obtain an accurate weather forecast for the time and route to be flown, with special emphasis on winds and possible inclement weather conditions that might be encountered en route (i.e., thunderstorms), which might require a possible deviation or turning back.

Accurate fuel calculations are essential to ensure that the aircraft can safely reach its intended destination with adequate reserves for an alternate aerodrome should it be required.

Compliance with air traffic control requirements/routings, which might require extended approaches or going into the hold for some time, can play a role.

Ensure aircraft performance criteria are not compromised (i.e., weight and balance, centre of gravity, density altitude) and are within the Aircraft Flight Manual limitations.

Ensure the pilot and/or crew are fit for the flight and are appropriately licensed and rated in accordance with regulatory requirements to perform such a flight.

Ensure the aircraft is airworthy and properly certified for the intended flight.

CFIT accidents are mostly caused by poor flight planning and decision making on the part of the pilot/flight crew members.

As a pilot, you need to make a decision as to whether to proceed with the flight or abandon it prior to departure or turn back en route and divert to an alternate aerodrome. In recent years during provincial safety seminars that were conducted by the accidents investigations division, pilots had a discussion about the challenges that come with being a freelance commercial pilot. Scenarios where fare paying passengers, cargo, company aircraft or EMS (Emergency Medical Services) flights need to be flown were highlighted under these risks. Commercial operators have to look after the financial interest of the business, while the pilot needs to look after his credibility and ensuring that he does not jeopardize his 'lifeline'/employment opportunities as well as the safety of the operation, which is of paramount importance.

It is a well-known fact that certain pilots end up being placed under severe pressure to perform flights even if they know that conditions are not favourable and that safety might be jeopardised. This gets done in the interest of commercial demands and satisfying the customers' needs, and not in the interest of aviation safety. Pilots end up deviating from procedures and regulations (taking chances) to meet commercial demands. Some pilots make it to the other side, and in doing so develop a habit of non-compliance to procedures and regulations, which one day when he or she least expects it, fails to beat the odds, resulting in an accident. As a pilot, ask yourself, how you would respond if you were faced with such a scenario? Is the decision that you make a safe one or not, and should you proceed?

Procedures and regulations which include adherence to minimum heights where written and documented in the interest of aviation safety and should be adhered to, to ensure that each and every flight is being performed as safely as possible. A disregard of these procedures and regulations could be fatal.

Certain aircraft and certain pilots are not certified nor rated to fly in instrument meteorological conditions (IMC). They can only fly in visual meteorological conditions (VMC). It sometimes happens that a pilot finds himself/herself entering IMC conditions. This is once again a decision that was made by the pilot, a decision which in most cases is dependent on his or her experience and knowledge of the area. This could be very dangerous if you are not instrument rated, or if the aircraft is not equipped to be flown under these conditions. It is therefore of paramount importance to plan your flight properly and avoid any fatal traps, for example entering IMC conditions not knowing if you will be able to remain clear of terrain ahead.

Being an instrument-rated pilot, flying an IFR certified aircraft does not make you immune to CFIT accidents. The SACAA has investigated several CFIT accidents where both these requirements were met, yet the aircraft still collided with terrain. One of the major aspects leading to these types of accidents is failing to adhere to procedures. Example: Pilot/crew initiate their descent prematurely, by deviating from the published letdown procedure for a licensed aerodrome, which might be surrounded by mountainous terrain, resulting in a CFIT

accident. You may find the same type of scenario with pilots that create their own letdown plates and deviate from it.

Additional factors which contribute to CFIT accidents

There are unforeseen situations that do arise during flight where the pilot or crew member might suffer from a medical condition, or have eaten food just prior to or during the flight that caused sudden illness (food poisoning) that could impair his performance to such an degree that he can no longer apply his mind to the complexity of the flight. These types of situations, although rare, do manifest themselves from time to time. It is therefore essential for all flight crew members to ensure that they are in good health prior to every flight and that a proper diet (proper eating routine) is followed, and that situations of glucose intolerance (associated with diabetics/fluctuating blood sugar levels) be avoided at all costs, as an example. From a medical perspective, cardiovascular conditions were found to have been the cause of several CFIT accidents in South Africa, and remain the number one medical condition resulting in accidents.

There have also been a few CFIT accidents associated with the "Black Hole" effect. All these accidents occurred at night, with very little or any celestial illumination or any lights on the ground. The pilots in all of the cases were flying VFR, and he/she lost his/her visual reference (horizon) and as a result started to descend and collided with terrain. One such an accident occurred while the pilot was positioning for landing and had to approach his landing zone while flying over a lake. There was a power failure in the area and he had no visual cues with reference to the shore/landing zone (no lights). The pilot, however, had decided to continue with the approach as he had flown it several times before. He descended too low and flew into the water. He managed to survive the accident and swam to shore.

The CAA also has on record a CFIT accident where the pilot was found to be intoxicated during the flight. This accident also occurred at night, resulting in inadequate terrain clearance. Even though the aircraft was equipped with an auto-pilot, it is believed that the hold function of the auto-pilot ALT (altitude) was not working properly (numerous maintenance entries in the aircraft logbook to rectify the auto pilot ALT hold) and the aircraft was slowly descending without proper monitoring on the part of the pilot, who failed to detect this happening and correct it timeously.

There have been one or two CFIT accidents in South Africa where the pilot experienced technical problems during flight, which required him/her to divert or return to the aerodrome of departure and in doing so, collided with terrain. These types of situations require quick decision-making on the part of the pilot and in most cases he becomes fixated in dealing with the emergency instead of flying the aircraft. During such a deviation the pilot mostly refers to the GPS (there could be more than one unit installed in use) as his primary navigational reference. In some instances the aircraft might be on an official flight plan, under radar control. Being under radar control the aircraft might be vectored to a certain aerodrome with the assistance of the radar controller. It remains the pilot-in-command's responsibility to ensure that the flight is conducted safely, and terrain clearances en route are adhered to, as terrain

does not get displayed on the controller's screen and he/she can therefore not advise the pilot/crew as such.

Just how many lives have we lost to CFIT?

The SACAA causal factor list for accidents in the flight crew/pilot category (sub-heading 7 of the list) indicates that for the period under review, 75 people have lost their lives under the CFIT category out of the 115 fatalities on record for the entire category (see list on next page). This resulted from 24 CFIT accidents.

CFIT accidents are usually associated with more than one fatality apart from the pilot/crew. The second highest cause on the list of high fatalities is that of stalling/failure to maintain flying speed in an aircraft.

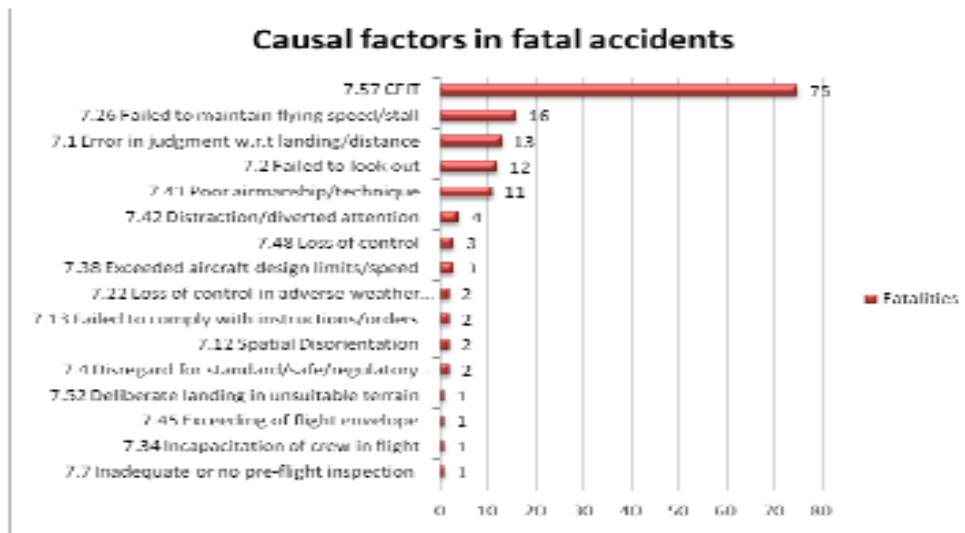
The survival rate associated with these types of accidents is minimal, with only two CFIT accident survivors who lived to share their experiences on record.

Where do CFIT accidents occur?

According to our database, we found that most CFIT accidents occur in the Mpumalanga province followed by KwaZulu-Natal, Limpopo and the Western Cape provinces. These are the areas that topographically contain the most mountainous terrain in the country. Several South African Registered aircraft have also been involved in CFIT accidents in countries outside the borders of South Africa, with most of these accidents occurring in the sub-Saharan African region.

It is interesting to note that very few of the CFIT accidents that have occurred outside the borders of this country, involving South African Registered aircraft, were in the general/private aviation category. Most of these aircraft were either on a wet or dry lease to a relief/humanitarian organisation or a licensed operator (Part 127 or 135) in these countries.

It should be noted that CFIT accidents are not only associated with mountainous terrain or high ground but could also occur during an approach to land in conditions of low visibility, where the aircraft is allowed to descend below minimum heights before a go-around is performed. In some instances the aircraft will collide with level terrain on the approach, and instances have been recorded where the aircraft collided with terrain while executing a go-around due to a deviation from the missed approach procedure for the aerodrome in question. Most of the medical-related CFIT accidents on record occurred on flat open remote land or water (aircraft crashing into the sea/lake/dam).



This graph indicates fatalities per cause of the accident. It is clear that CFIT is the leading cause of death. It must be noted that we are only considering accidents of which the accident reports were approved during the 5-year period (2006 – 2010) only, meaning that the numbers could be significantly higher.

How to avoid CFIT Accidents

1. Conduct proper flight planning, especially with regard to weather conditions en route, fuel endurance and alternate aerodromes, should you need to divert.
2. Avoid VFR into IMC, especially flights being conducted below the TMA.
3. Adhere to procedures and regulatory requirements.
4. Ensure that you (the pilot) are fit for the flight.
5. Ensure that the aircraft is airworthy and properly equipped for the flight.
6. Do not allow commercial pressures to jeopardize aviation safety.
7. Display sound judgment and decision-making skills.

These are but a few of the important factors to keep in mind to ensure a safe flight.

Conclusion

Remember to put safety first. We are appealing to all pilots out there, commercial organisations, training schools and the flying public to put safety first. Rather be late than not arrive at your destination. Let us be a safety-conscious community. The Accidents Investigations Division, together with the SACAA is hoping that this article will bring awareness to the flying community and also to get debate going with regard to safety issues. You are welcome to invite accident investigators to share some of the lessons learned during aircraft investigation activities.

In the next article, we will briefly discuss the remaining causes of accidents and later explore other safety factors uncovered during the research activities.

Until next time!

We would love to hear from you; comments and enquires can be directed to Ms Bongji Mtlokwa at mtlokwab@caa.co.za, Tel: 011 545 1238, Fax: 011 545 1466.