AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9286		
Aircraft Registration	**ZS-NTY**	**Date of Accident**	06 February 2014		**Time of Accident**	0730Z	
Type of Aircraft	Cessna A188B (Aeroplane)		**Type of Operation**		Commercial		
Pilot-in-command Licence Type	Commercial Pilot Licence		**Age**	22	**Licence Valid**	Yes	
Pilot-in-command Flying Experience	Total Flying Hours		602.9		**Hours on Type**	352.0	
Last point of departure	Joubertina aerodrome: Eastern Cape province.						
Next point of intended landing	Joubertina aerodrome: Eastern Cape province.						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
On the mountain lee side at GPS coordinates determined to be S 33°47.201´ E 25°32.618´.							
Meteorological Information	Dry-bulb temperature, 21ºC: Temperature 15ºC: Wind speed@ 07 knots: No clouds.						
Number of people on board	1 + 0	**No. of people injured**	1		**No. of people killed**	0	

Synopsis

The pilot being the sole occupant on-board the aircraft departed from Joubertina aerodrome on a crop spraying detail. Before departure 37 gallons of aviation gasoline Avgas LL 100 was uplifted followed by a thorough pre-flight inspection, with no technical snags being noted in the aircraft documentation. Subsequent to that 600 litres of crop chemical was uplifted in the aircraft hopper and everything was normal. Spraying on the first field was uneventful and the aircraft proceeded to another field just closer to the previous one. The first two flight passes and chemical spraying were uneventful but in an attempt to execute a 180 degree turn close to the mountain site at approximately 300 feet above ground level, the aircraft could not maintain flying speed. The aircraft steadily lost height and the pilot immediately jettisoned the remaining chemical with the intention to get rid of additional weight and recover the aircraft, but was unsuccessful. The aircraft propeller made contact with tall trees and nosed over coming to a halt in a bushy area. The aircraft was destroyed and the pilot suffered minor injuries. Investigation revealed mountain wave turbulence on the aircraft flight path, which is believed to have affected the aircraft airspeed and altitude, rendering ground impact inevitable.

Probable Cause

Failure to maintain flying speed.

IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Sand River Crop Protection CC
Manufacturer : Cessna Aircraft Company
Model : Cessna A188B
Nationality : South African
Registration Marks : ZS-NTY
Place : S 33°47.201´ E 25°32 .618´
Date : 06 February 2014
Time : 0730Z

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997) this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to establish legal liability****.*

Disclaimer:

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

1. FACTUAL INFORMATION:

1.1 History of Flight:

1.1.1 On Thursday 06 February 2014 the pilot being the sole occupant on-board ZS-NTY Cessna A188B aircraft departed from Joubertina aerodrome situated in the Cacadu district municipality of the Eastern Cape Province on a crop spraying detail. Telephonic conversation with the pilot revealed that Visual Meteorological Condition (VMC) prevailed and no flight plan was filed. Before departure 37 gallons of Aviation gasoline Avgas LL 100 was uplifted followed by a thorough pre-flight inspection with no technical snags being noted in the aircraft documentation. The pilot further stated that he did strain the fuel tanks to check for contamination prior to the flight but did not observe anything.

1.1.2 Subsequent to that, 600 litres of crop chemical was uplifted in the aircraft hopper and everything was normal. He then boarded the aircraft and flew to a nearby apple field situated at Louterwater where he commenced spraying. Spraying the first field was uneventful and the aircraft proceeded to another field just closer to the previous one. The first two passes and spraying were uneventful but in an attempt to execute a 180 degree turn close to the mountain site at approximately 300 feet above ground level (AGL) the aircraft couldn't maintain flying speed.

1.1.3 The aircraft steadily lost height and the pilot immediately jettisoned the remaining chemical (approximately 460 litres) with the intention to get rid of additional weight and recover the aircraft, but was unsuccessful. The aircraft propeller made contact with tall trees and nosed over coming to a halt in a bushy area. The aircraft was destroyed by impact and no fire was reported.

1.1.4 The pilot who was wearing his safety harness sustained minor bruises to his shoulders and jaw. The farmer who was located approximately 400 metres from the accident site immediately drove to the site and rescue the pilot from the wreckage. The pilot was then taken to a nearby private hospital where he received medical attention.

1.1.5 The accident happened in the morning on the lee site of the mountain at GPS coordinates determined to be South 33°47.201 ´ East 25°32 .618´.

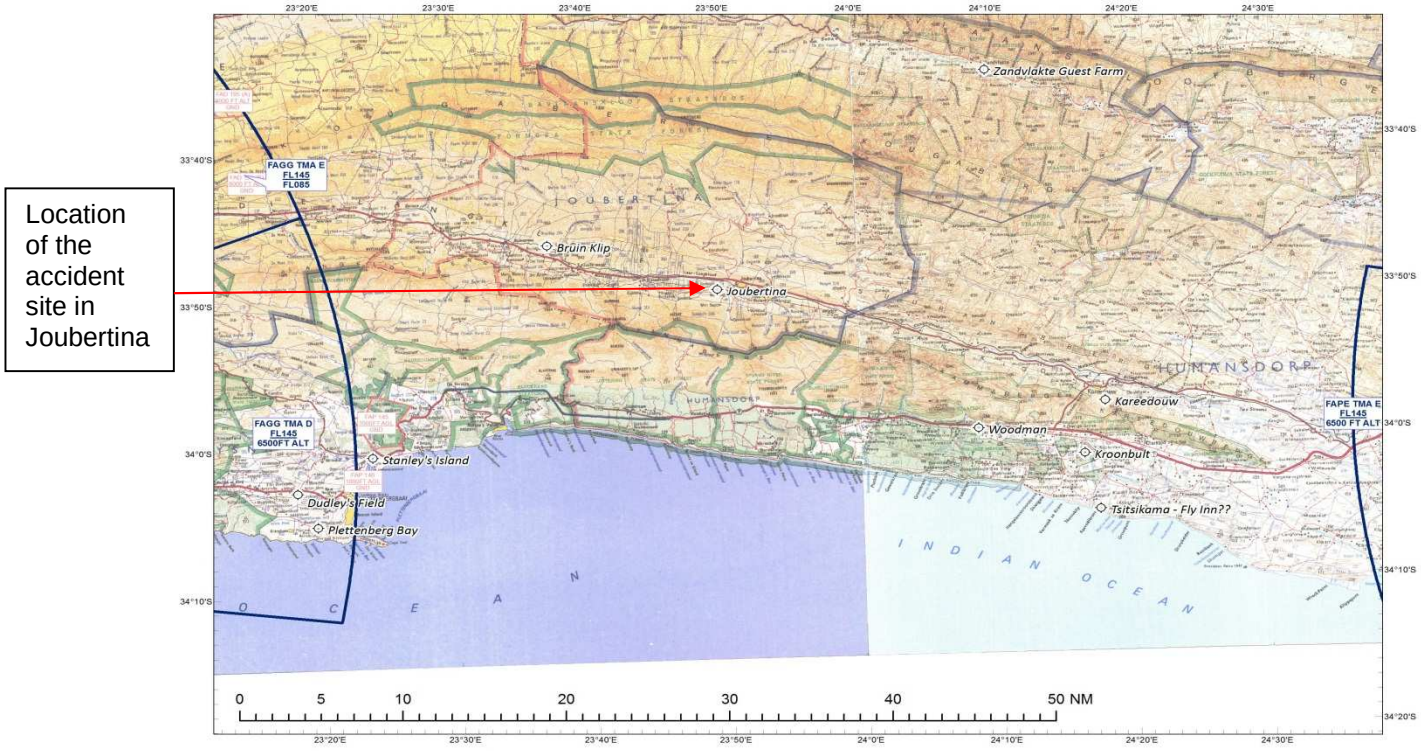

Figure 1: Location of the accident site on shown on the area chart.

1.2 Injuries to Persons:

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

1.3 Damage to Aircraft:

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

Figure 2: The wreckage as found at the accident site.

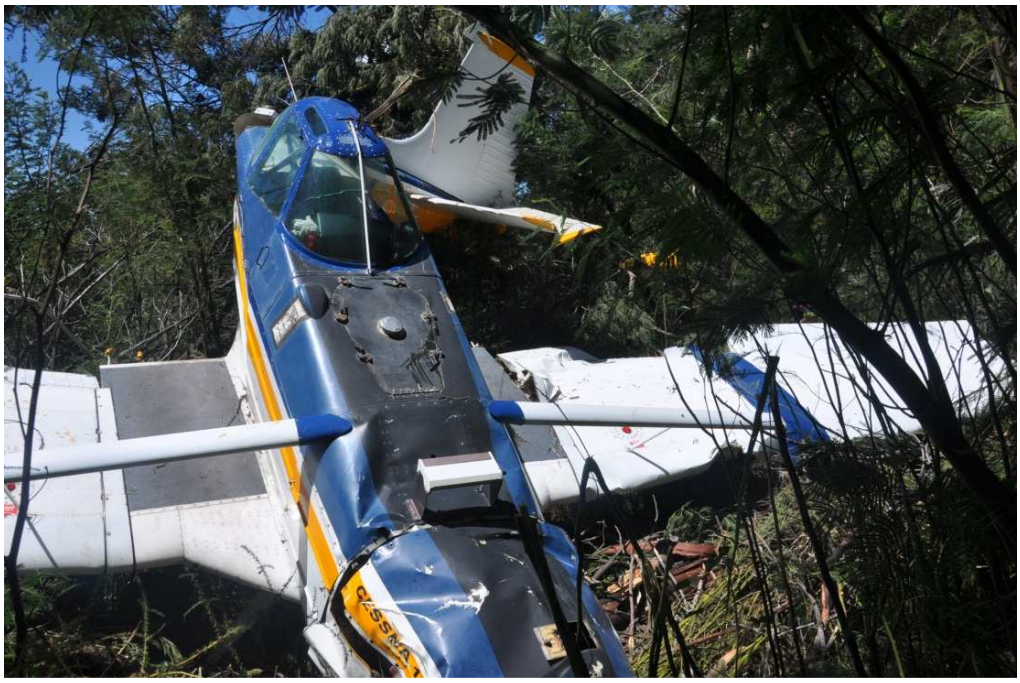

Figure 3: Top view of the wreckage from the front.

1.4 Other Damage:

1.4.1 Damage was limited to the tall trees at the accident site.

1.5 Personnel Information:

Nationality	South African	Gender	Male	Age	22
Licence Number	0272345745	Licence Type	Commercial		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night Rating				
Medical Expiry Date	21 March 2015				
Restrictions	Nil				
Previous Accidents	None				

*NOTE: The pilots profile revealed no accident or incident history, enforcement actions, pilot certificate or rating failure, or retest history. Examination of the SA CAA pilot file revealed that the pilot was not rated to perform agricultural operations however; he was rated on the aircraft type and had accumulated a total of 352.2 hours flying hours.

Experience:

Total Hours	602.9
Total Past 90 Days	59.0
Total on Type Past 90 Days	59.0
Total on Type	352.2

1.6 Aircraft Information:

1.6.1 The A188B Agwagon is a single engine, single seat light agricultural aircraft produced by the US-American manufacturer Cessna Aircraft Company.

Figure 4: The photo shot during crop spraying before the accident.

Airframe:

Type	Cessna A188B	
Serial Number	188-02551	
Manufacturer	Cessna Aircraft Company	
Date of Manufacture	Unknown	
Service Ceiling	7 800 feet	
Maximum take-off Weight	3 300 lbs	
Total Airframe Hours (At time of Accident)	4 356	
Last MPI (Hours & Date)	4257.6	13 August 2013
Hours flown before the accident	98.4	
C of A (Issue Date)	13 September 2012	
C of A (Expiry Date)	12 September 2013	
C of R (Issue Date) (Present owner)	20 November 2013	
Recommended fuel used	Avgas LL 100	
Operating Categories	Standard Part 137	

*****NOTE: The Aircraft Maintenance Organisation (AMO) that performed the last mandatory periodic inspection (MPI) on the aircraft prior to the accident flight was in possession of a valid AMO Approval certificate No 1148. All relevant aircraft documentation such as the Certificate of Registration, the Certificate of Airworthiness, the Radio Station Licence, the Mass and Balance Certificates were inspected during the investigation. All were found to be valid except the certificate of airworthiness which expired on the 12th of September 2013.

Further investigation of the CAA aircraft profile showed no proof of currency fee made by the owner. The aircraft maintenance documentation such as airframe logbooks, the engine logbook, and work packages were obtained from the aircraft maintenance organisation and inspected. All maintenance entries made in the logbooks were appropriately certified in terms of applicable regulations CAR, Part 43 which covers general maintenance rules requirements.

Engine:

Type	Continental IO-520-X49 (CD)
Serial Number	295471-R
Hours since New	Unknown
Hours since Overhaul	22.4

Propeller:

Type	Hartzell
Serial Number	PHC-C3YF-IRF
Hours since New	Unknown
Hours since Overhaul	98.7

The aircraft was carrying the pilot who weighed 85kg (187lb). The aircraft had 37 gallons (247lb) of fuel and 600 liters (1 056lb) of chemical at take-off. The gross weight at take-off was calculated to be 1 490 pounds. The maximum allowable weight was 3 300 pounds. A weight and balance calculation determined that the aircraft was being operated within its load limits.

1.7 Meteorological Information:

1.7.1 Weather information as supplied by the South African Weather Service.

Plattenburg (FAPG) is the closest reporting weather station. The METAR's from 0700Z to 0800Z for this automatic weather station are included in figure 5. There is no cloud amount and visibility report since this is an automatic weather station. The 0700Z METAR closest to the time of accident contains the following weather variables:

Dry-bulb temperature: 21^{o}C

Dew-point temperature: 15^{o}C

Wind speed: 07 Knots

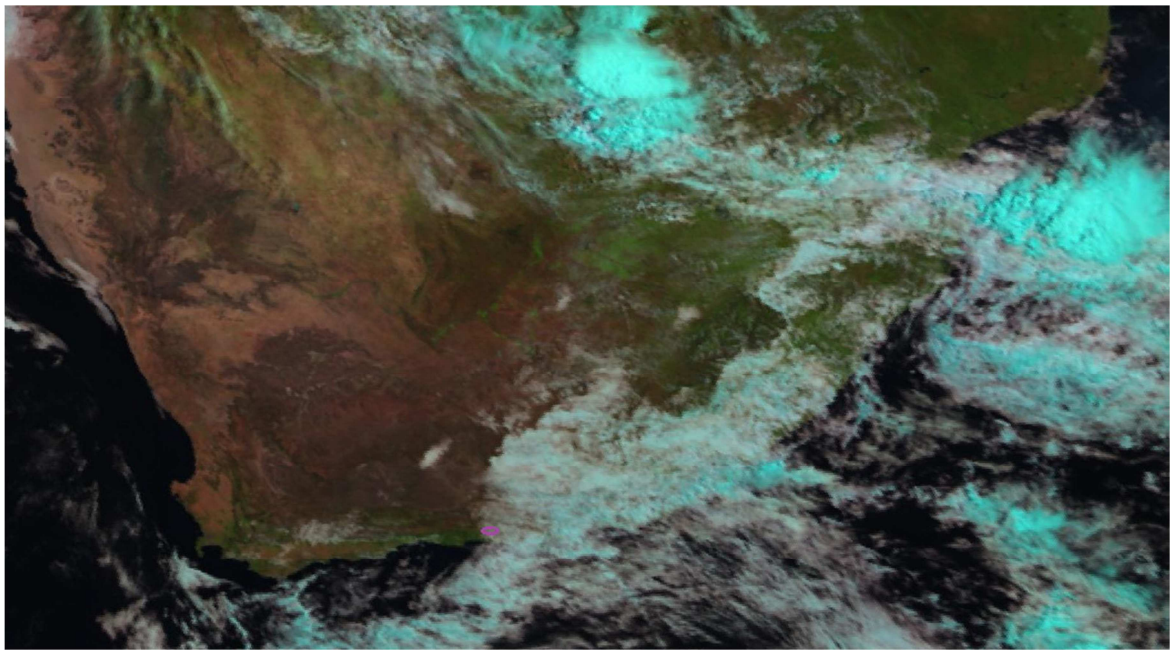

Figure 5: Satellite observational data for FAPG.

1.8 Aids to Navigation:

1.8.1 The aircraft was fitted with standard navigational equipment certified for the aircraft type. There were no defects or malfunctions reported prior to or during the flight with the equipment.

1.9 Communications:

1.9.1 The aircraft was fitted with standard communication equipment certified for the aircraft type. There was no recorded failure of the equipment prior to or during the flight.

1.9.2 At the time of the accident the aircraft was being operated outside controlled airspace. The pilot was therefore not in contact with any air traffic control facility.

1.10 Aerodrome Information:

1.10.1 The accident did not happen at or near the aerodrome.

1.11 Flight Recorders:

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

1.12 Wreckage and Impact Information:

1.12.1 The wreckage was located in the bush in a nose down attitude. The left wing was substantially damaged and the tail section severed during the accident sequence. The wing spars were still secured to their respective attachment points and intact. The spinner was still attached to the propeller and the engine was still secured to the cradle. The engine fire wall and cowlings suffered minor damage as a result of the impact. The cockpit area was intact and the pilot seat was still secured to its anchors with the safety harness still intact. Part of the wind shield or wind screen was smashed by the impact but all aircraft instruments were secured to their mounting points and intact. The aircraft landing gear was still intact and the spray boom was destroyed.

1.13 Medical and Pathological Information:

1.13.1 Considered not necessary.

1.14 Fire:

1.14.1 No fire was reported.

1.15 Survival Aspects:

1.15.1 The accident was considered to be survivable because the pilot was wearing the aircraft safety harnesses and the aircraft cockpit area remained intact.

1.16 Tests and Research:

1.16.1 On-site investigation indicated clear visibility at the time of the accident and post-accident examination of the wreckage revealed no pre impact engine or airframe anomalies, which might have affected the aircraft performance. There was no evidence of an in-flight structural failure but flight control continuity could not be established at the accident site due to damaged flight controls surface and control cables. Inspection of the fuel tanks revealed enough fuel for the planned flight and the fuel was free from contamination. According to the available aircraft documentation, no defects were recorded since the last mandatory periodic inspection was conducted. The propeller blades showed evidence of rotation and collision with tall trees prior to impact. Below is the picture of the trees as shown.

Figure 6: View of the aircraft flight path prior to the accident.

Figure 7: View of the engine and the propeller.

1.16.2 Examination of the cockpit revealed that the aircraft was fitted with an AG-Nav Guia geographical positioning system (GPS) designed to accurately guide the pilot to fly on the pre-planned flight lines and at the same time trigger the camera when the aircraft was closest to a camera point. This system provides the pilot with all services or advantages to do necessary things from flight planning to data handling. The camera points can be generated automatically on the flight lines by the GPS navigation system based on the predefined distance between points, or manually anywhere by the pilot.

1.16.3 It also enables the pilot to fly and spray precise or accurate patterns using constant or variable rate flow control and spraying costs. During the investigation this device was retrieved from the wreckage and downloaded. The data showed multiple passes being flown above the first field and sprays being performed after which two successful landing were executed. After the third take off the aircraft proceeded or headed towards the second field where it performed the first pass and spray, and in an attempt to execute a 180 degree turn to the right the aircraft collided with the terrain. Just before the accident, the GPS data showed a sign of decrease in aircraft airspeed and abrupt changes in deviations on aircraft flight path most probably due to the pilot trying to recover the aircraft. GPS data is attached in the Appendices to the report. Picture of the GPS installed on the aircraft is shown below.

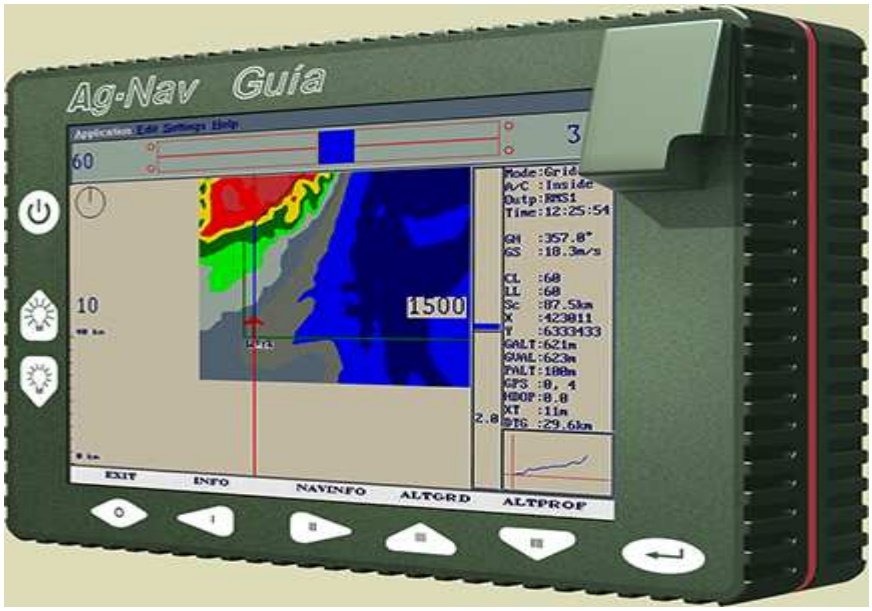

Figure 8: AG-NAV Guia GPS primarily used for aerial agricultural and forestry applications.

1.16.4 Further analysis and assessment of the accident site by the investigating team revealed mountain wave turbulence “forces of nature exerting a greater influence on aircrafts” from the mountain top, which is believed to have affected the aircraft airspeed and altitude on its flight path and to have rendered ground impact inevitable. *NOTE: Mountain waves are an atmospheric phenomenon in which an obstruction stimulates air currents into a standing wave pattern of up and down vertical flow. It can be visualised as waves downstream of a stone in water. The vertical rates of flow on mountain waves had been reported to reach 8.000 feet per minute, with rates of several thousand feet per minute being common. These rates greatly exceed the climb performance of light aircraft, particularly at the high elevations at which they are encountered. Typical aircraft climb performance in still air at these altitudes, is in the range of 300 to 500 feet per minute.

These aircraft are therefore incapable of climbing or even maintaining altitude while flying in a strong mountain wave (down flowing air). It can present a flight hazard to all aircraft, but the hazard is particularly severe for aircraft of limited performance, which includes almost all light aircraft. Below are pictures of the terrain at the accident site and effects of mountain wave turbulence on aircraft.

Figure 9: Terrain at the accident site.

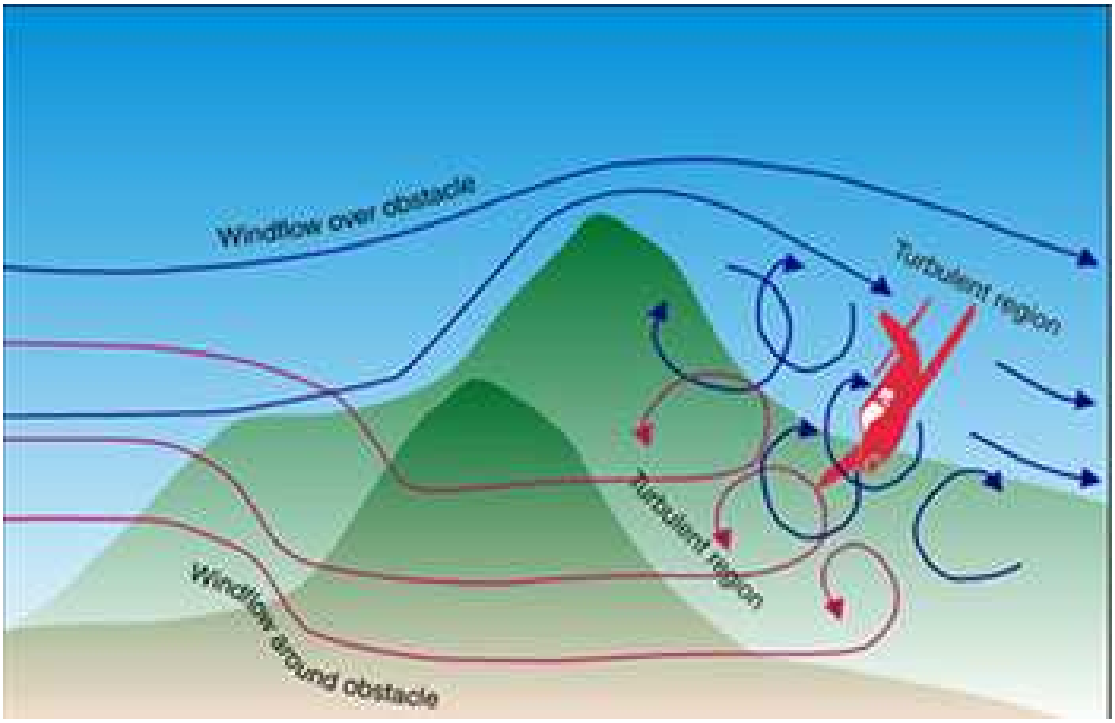

Figure 10: Effects of mountain wave turbulence on the aircraft.

1.17 Organisational and Management Information:

1.17.1 This was a commercial flight.

1.17.2 The aircraft was operated under the provisions of Part 137 of the South African Civil Aviation Regulations which caters for agricultural operations at the time of the occurrence.

1.17.3 The Aircraft Maintenance Organisation (AMO) that performed the last maintenance on the aircraft prior to the accident flight was in possession of a valid AMO approval certificate number 1148.

1.18 Additional Information:

1.18.1 None.

1.19 Useful or Effective Investigation Techniques:

1.19.1 Not necessary during this investigation.

2 ANALYSIS:

2.1 It is important to mention the role of human factor in this accident as it is believed that human error has contributed to many accidents recorded worldwide. Examination of the wreckage revealed no abnormalities with the aircraft and the aircraft documentation showed that the aircraft was maintained in accordance with approved procedures. The GPS data downloaded showed the aircraft executing quite a number of turns successfully next to the mountain during crop spraying. However during the last 180 degree turn the aircraft collided with the terrain. On site analysis of the accident site by the investigating team revealed mountain wave turbulence from the mountain top, which affected the aircraft airspeed and altitude and rendered ground impact inevitable.

2.2 Weather condition is therefore a very important consideration when flying in the mountains. An understanding of the airflow patterns is necessary for all pilots intending to fly at higher altitudes. Flying is a continuous process of decision making involving the pilot, the aircraft, the environment in which the flight is taking place and the operation itself. While in training, student pilots are constrained and their exposure to risk is controlled by lesson plans and the supervision of their instructors. Once they are licensed they are not as constrained and are likely to encounter more risks.

2.3 They will encounter weather they may have never seen before, fly more complex aircraft, and undertake more complex operations that require skill and over quite different terrain than what they encountered in training. In short, they will fly more and gain experience, but in their early stages they may not recognize some hazards, nor will they have reached a set of rule-based behavior patterns as more experienced pilots. Because of their lack of experience, they will not be able to make informed decisions and stay out of trouble.

2.4 In a nutshell, this accident could only be attributed to pilot failure to identify potential hazards associated with mountain flying which requires a high technical piloting level and a thorough knowledge of the mountainous environment.

3. CONCLUSION:

3.1 Findings:

3.1.1 The pilot had a valid commercial pilot licence and had the aircraft type endorsed on his pilot profile.

3.1.2 The pilot medical was valid with no restrictions.

3.1.3 The pilot did not have a rating to perform agricultural operations.

3.1.4 The aircraft was in possession of an invalid Certificate of Airworthiness (C of A).

3.1.5 The aircraft was within its allowable weight limit prior take off.

3.1.6 The Aircraft Maintenance Organisation (AMO) that performed the last maintenance inspection on the aircraft prior to the accident flight was in possession of a valid AMO Approval certificate No 1148.

3.1.7 Examination of the aircraft technical logbooks revealed no evidence of anomalies or deficiencies.

3.1.8 The accident was considered survivable.

3.2 Probable Cause/s:

3.2.1 Failure to maintain flying speed.

3.3 Contributing factor/s:

3.3.1 Poor airmanship.

4. SAFETY RECOMMENDATIONS:

4.1 None.

5. APPENDICES:

5.1 None.

5.2 *Tips on Mountain Flying* published by Transport Canada, Aviation Safety:

- Flight routing should be arranged to avoid topography that could prevent a safe landing.
- Flight routing should be along populated areas and well-known mountain passes.
- Sufficient altitude should be maintained at all time so as to enable a power off glide to a safe landing area.
- VFR Navigation Charts (VNC) should be used rather than World Aeronautical Charts (WAC) as they provide greater detail for air pilotage; the routing, including ground clearances, should be carefully studied before flight.
- When faced with a *sea of mountains*, believe your compass (bearing in mind compass irregularities) as it may be your only means of getting out of trouble.
- Do not fly when the winds are at or below mountain peak level, or at your intended cruise altitude, are above 30 KTS. Winds above 20 KTS should be avoided.
- In anticipation of possible down drafts, always cross a mountain ridge at a 45° angle so as to allow a turn away from the ridge.
- Know the wind direction at all times, and be on the lookout for changes in wind direction and velocity.
- Never fly in the vicinity of abrupt changes in the terrain, such as cliffs or ridges as they can be associated with severe turbulence.
- In anticipation of downdrafts and severe turbulence, Cross Mountain ridges at maximum altitude, and never with less than 1500' separation.

- Anticipate downdrafts on the leeward side of mountains, and updrafts on the windward side; anticipate downdrafts between 1500’ and 2000’ per minute.
- Do not panic if a downdraft is encountered; they usually cease with sufficient height above ground that will enable maneuvering safely away. Do not count on this, however, in extremely turbulent air or in canyon areas.
- If you encounter a severe downdraft, use full power and maintain the best rate of climb speed for the altitude at which you are operating; being cautious of the stall speed, attempt to fly to an updraft or smooth air.
- Remember that the actual horizon is near the base of distant mountains; improperly using the mountain peaks as the horizon will place the aircraft in a slow flight attitude unable to climb.
- Never fly up the middle of a canyon; instead, fly along one side or the other in case a 180-degree turn is required.
- If possible, fly up the right side of a canyon in anticipation of other aircraft flying in the opposite direction.
- Beware of flying up canyons, valleys, and passes where the rise in terrain could exceed an aircraft climb capability.
- Beware of flying below a cloud ceiling in mountain passes while the cloud base could be constant, the distance between the cloud base and the ground could decrease owing to rising terrain.

5.3 Data downloaded from the GPS.

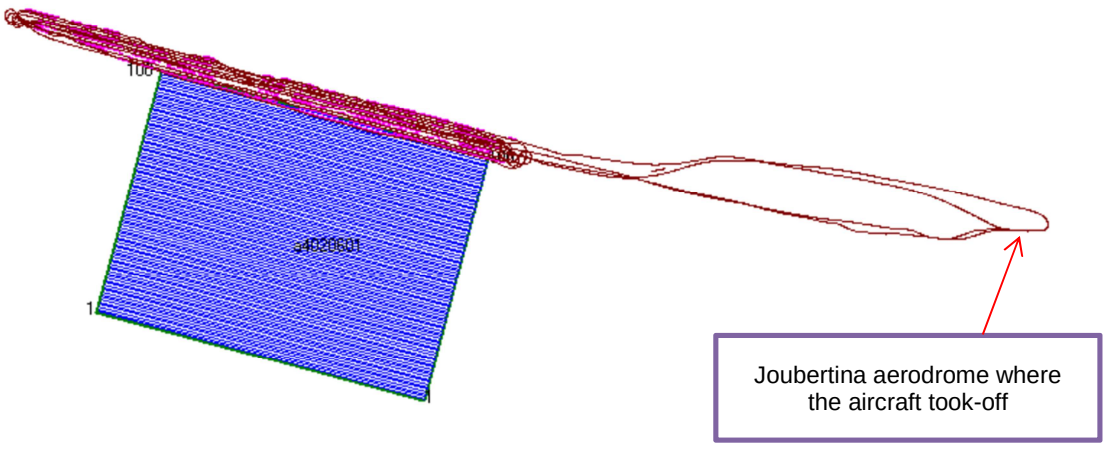

Figure 11: Aircraft flight path downloaded from the GPS.

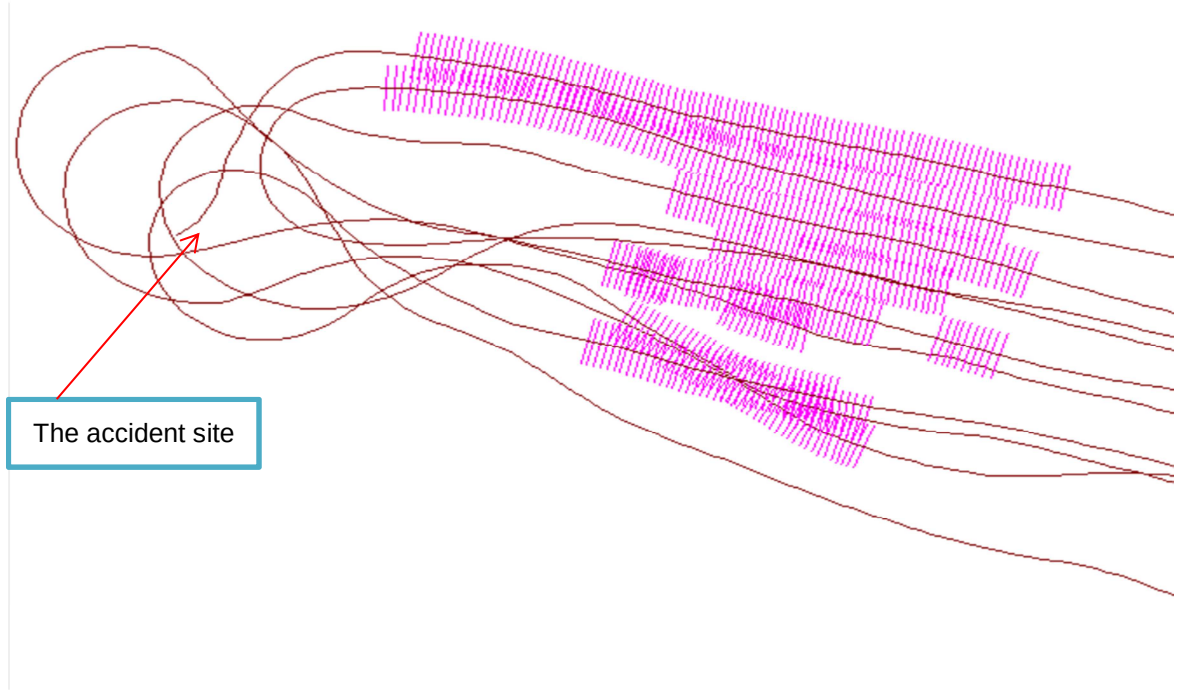

Figure 12: Expanded view of the flight passes and sprays performed by the aircraft and the accident site.