AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9199		
Aircraft Registration	ZS-CAP	**Date of Accident**	18 July 2013		**Time of Accident**	0730Z	
Type of Aircraft	Cirrus SR20		**Type of Operation**	Training (Check flight)			
Pilot-in-command Licence Type	Commercial Pilot		**Age**	24	**Licence Valid**	Yes	
Pilot-in-command Flying Experience	**Total Flying Hours**	1 637,5			**Hours on Type**	777,3	
Private Licence Type	Private Pilot		**Age**	19	**Licence Valid**	Yes	
Private Pilot Flying Experience	**Total Flying Hours**	55,6			**Hours on Type**	50,8	
Last point of departure	Lanseria International Airport (FALA), Gauteng Province						
Next point of intended landing	Lanseria International Airport (FALA), Gauteng Province						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
On the private farm Bultfontein in the Muldersdrift area and approximately 500 m from the north eastern boundary of Lanseria International Airport (GPS coordinates: S 25°55,986, E 027°56,628 at 4 327 feet elevation)							
Meteorological Information	Temperature: 13 ºC; Dew Point: 7 ℃; Wind 040º/07 k t; Visibility: 9 000 m; Cloud Cover: FEW at 1 500 ft; QNH: 1 034 hPa						
Number of people on board	2 + 0	**No. of people injured**	0	**No. of people killed**	2		

Synopsis

A private pilot accompanied by a Grade 2 flight instructor departed from Lanseria International Airport with the intention to complete a proficiency check flight in the Lanseria circuit. The pilots of ZS-CAP completed two uneventful circuits and during final approach for the second circuit whilst communicating with FALA air traffic control (ATC), the aircraft was cleared for a touch and go where after the private pilot requested an early right hand turn. FALA ATC approved the request provided the aircraft was safe and able to complete the manoeuvre.

After the touch and go the aircraft was seen turning right onto the crosswind leg on the third circuit, where after it was seen diving towards the ground. The fitted ballistic parachute was seen by witnesses in the transition phase of deployment. During the impact sequence both occupants on board sustained fatal injuries. The aircraft was destroyed in the crash.

The investigation revealed that the accident aircraft had had a full flap setting which was not normal for an aircraft in a take-off configuration as stipulated in the Pilot's Operating Handbook (POH).

Probable Cause

The aircraft entered a stall at low altitude from which the pilots were unable to recover.

Contributory Factor/s:

1. The pilots omitted to reconfigure the aircraft flaps for take-off as per the POH take-off settings following the touch and go landing.
2. The aircraft's ballistic parachute was deployed and was in transition at a low altitude, which further lowered the nose attitude of the aircraft.

IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : CDC Aviation (PTY) LTD
Manufacturer : Cirrus
Model : SR20
Nationality : South Africa
Registration Marks : ZS-CAP
Place : Farm Bultfontein, Muldersdrift
(Approximately 500 m outside the boundary of FALA)
Date : 18 July 2013
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 the morning of 18 July 2013, a Cirrus SR20-rated pilot and a flight instructor conducted a proficiency check flight at Lanseria International Airport (FALA). The proficiency check flight was conducted because the private pilot had not recently flown the aircraft type. The operator's policy required pilots to complete a proficiency check flight if they had not flown at the flight school within the past 30 days. The check flight normally consists of three circuits and is intended to enable an instructor to evaluate the pilot's proficiency. Following the proficiency check flight, the private pilot intended to hire the aircraft (Hire and Fly) in order to accumulate flying hours towards his commercial pilot licence.

1.1.2 At 0651Z the private pilot completed the operator's electronic authorisation sheet, which included the weight and balance calculation for the flight. He and the flight instructor then signed it. After the pre-flight inspection, the aircraft was taxied to Runway 06L at FALA for take-off.

1.1.3 After completing the first circuit, the pilot continued with a second circuit. Whilst on final approach for runway 06L, the aircraft was cleared for a touch and go where after the pilot requested an early right hand turn. FALA ATC approved the requests provided the aircraft was safe and able to complete the manoeuvre.

1.1.4 A witness, also a pilot, who was seated in the cockpit of an aircraft parked outside a

hangar at FALA, saw the aircraft perform a touch and go on Runway 06L. The aircraft banked sharply to the right onto the crosswind leg, with the top of the aircraft visible to the witness. He saw the aircraft rolling level and then diving sharply towards the ground, followed by the deployment of the ballistic parachute.

1.1.5 Another witness, who was walking on the farm Bultfontein where the accident occurred, saw the aircraft at approximately 50 feet above ground level (AGL) when its nose pitched down, followed by the deployment of the ballistic parachute. The aircraft impacted the ground on the private farm Bultfontein at approximately 0730Z. Bultfontein borders on the eastern boundary of FALA, and the accident occurred approximately 500 m from its north-eastern boundary at GPS coordinates S 25°55,986, E 027°56,628 at 4 327 feet elevation. The accident occurred during daylight conditions.

1.1.6 FALA ATC saw the red parachute in the air and after confirming that communication with the aircraft was lost, requested assistance from a helicopter flying in the vicinity to locate the accident site. Lanseria International Aerodrome Rescue and Fire Fighting (ARFF) personnel immediately responded to the accident following the activation of the crash alarm by ATC. Both occupants on board the aircraft sustained fatal injuries during the accident sequence.

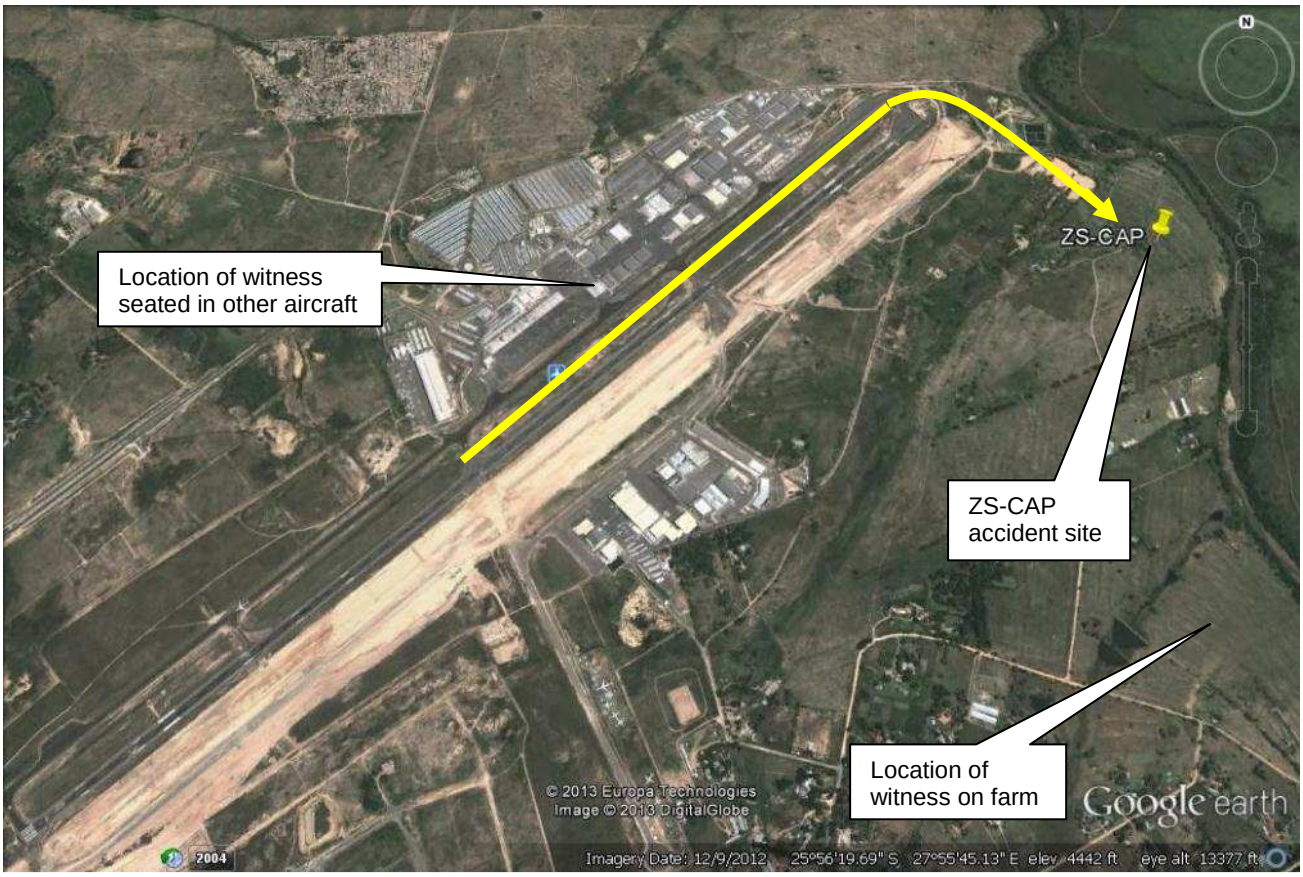

Figure 1: Google Earth view of the area and flight path

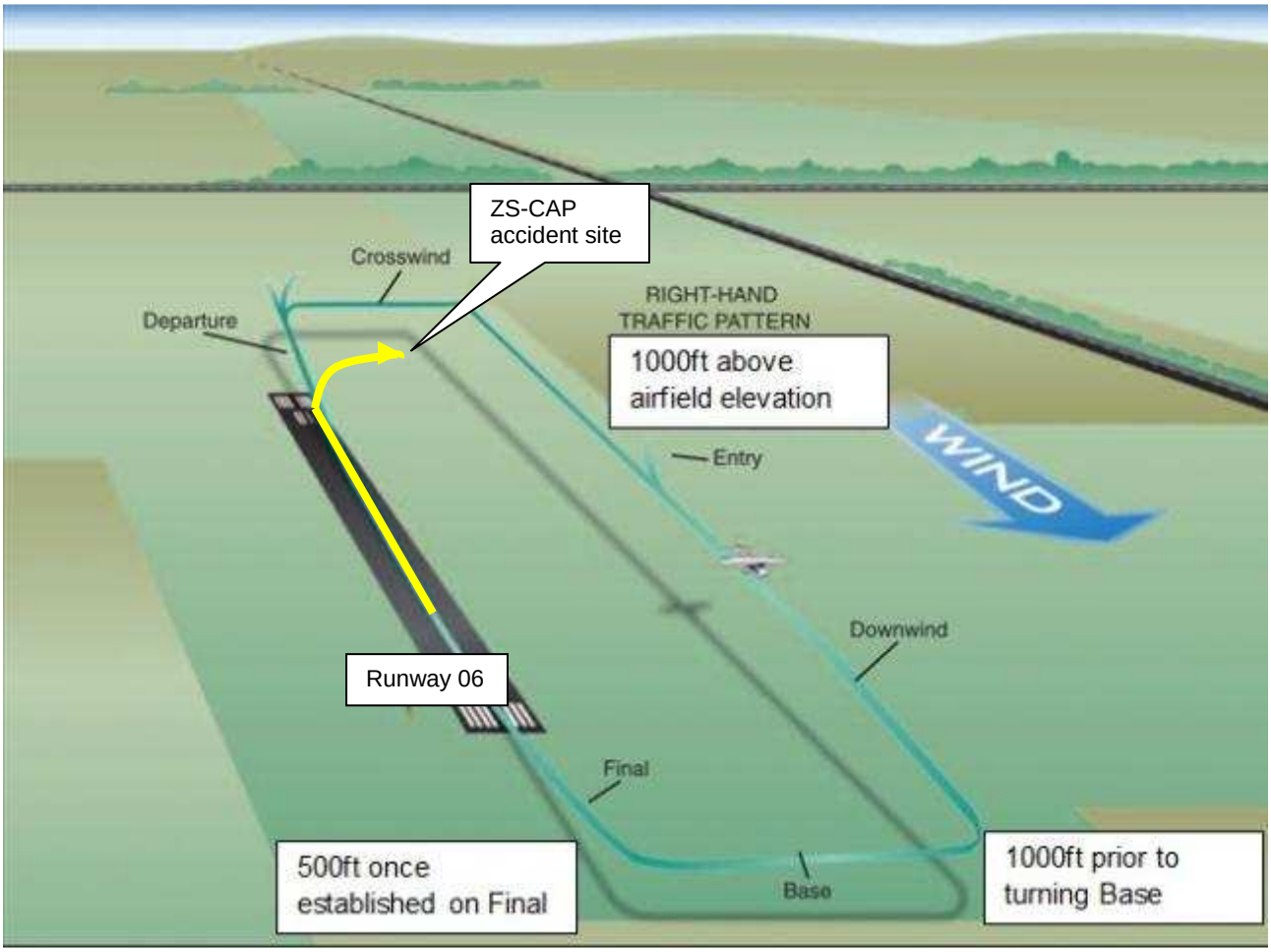

Figure 2: Illustration of the flight path

1.2 Injuries to Pilots

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

1.3 Damage to Aircraft

1.3.1 The aircraft was destroyed during the impact sequence.

Figure 3: View of aircraft wreckage

Figure 4: View of aircraft wreckage

1.4 Other Damage

1.4.1 No other damage was caused.

1.5 Personnel Information

1.5.1 Pilot-in-command (Instructor)

Nationality	South African	Gender	Female	Age	24
Licence Number	0272237587	Licence Type	Commercial		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Instrument, Night, Instructor Grade 2, Multi-engine Piston				
Medical Expiry Date	28 February 2014				
Restrictions	None				
Previous Accidents	None				

Flying Experience

Total Hours	1 637,5 (1 223,2 hours as instructor)
Total Past 90 Days	196,1
Total on Type Past 90 Days	192,1
Total on Type	777,3 (475,8 hours as instructor)

Note: 1. The pilot's logbook was last updated on 26 April 2013. The pilot's flying hours with the operator until the accident flight were obtained and her total hours calculated.
2. The pilot's last annual flight renewal test was done on 26 April 2013.

1.5.2 Private Pilot (Pilot Flying)

Nationality	South African	Gender	Male	Age	19
Licence Number	0272442112	Licence Type	Private Pilot		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	31 January 2015				
Restrictions	None				
Previous Accidents	None				

Flying Experience:

Total Hours	55,6
Total Past 90 Days	2,1
Total on Type Past 90 Days	0
Total on Type	50,8

Note: 1. The private pilot started his training on 10 January 2013 and was licensed on 18 April 2013.
2. The pilot's last annual flight renewal test was done on 14 April 2013.

1.6 Aircraft Information

1.6.1 Cirrus SR20

General Description

The SR20 monocoque fuselage is constructed primarily of composite materials and is designed to be aerodynamically efficient with seating for four adults. A composite

roll cage within the fuselage structure provides roll protection for the cabin occupants.

Engine and Propeller

The SR20 is powered by a Teledyne Continental IO-360-ES, six cylinder, normally aspirated, fuel-injected engine de-rated to 200 hp at 2 700 RPM. The engine has a 2000-hour time between overhaul (TBO). Dual conventional magnetos provide ignition.

The airplane is equipped with a constant-speed, aluminium-alloy three-blade propeller with a governor. The propeller governor automatically adjusts propeller pitch to regulate propeller and engine RPM. Any change in airspeed or load on the propeller results in a change in propeller pitch.

Wings

The wing structure is constructed of composite materials while each wing provides an attach structure for the main landing gear and contains a 30,25 gallon fuel tank. The wing spar is manufactured in one piece and is continuous from wingtip to wingtip.

Flight Controls

The SR20 uses conventional flight controls for ailerons, elevator and rudder. The control surfaces are pilot-controlled through either of two single-handed side control yokes mounted beneath the instrument panel. Roll trim and pitch trim are available through an electric button on the top of each control yoke. The electric roll trim is also used by the autopilot to position the ailerons. It is possible to easily override full trim or autopilot inputs by using normal control inputs.

Figure 5: A typical Cirrus SR20 aircraft

1.6.2 Airframe

Type	Cirrus SR20	
Serial Number	1122	
Manufacturer	Cirrus Design Corporation	
Date of Manufacture	2001	
Total Airframe Hours (at time of accident)	1 804,3	
Last MPI (Hours & Date)	1 715,1	7 June 2013
Hours since Last MPI	89,2	
Certificate of Airworthiness (Issue Date)	1 March 2013	
C of R (Issue Date) (present owner)	20 July 2012	
Operating Categories	Standard Part 135	
Previous Incidents	Hard landing on 13 December 2012	

1.6.3 Engine

Type	Continental IO-360-ES6B
Serial Number	357296
Hours since New	1 804,3
Hours since Overhaul	TBO not reached

1.6.4 Propeller

Type	Hartzell PHC-J3YF-1MF
Serial Number	FP8112B
Hours since New	293,9
Hours since Overhaul	TBO not reached

Note: On 13 December 2012 the aircraft was involved in a hard landing incident. The propeller sustained damage and was replaced with a new propeller. The engine was also shock loaded.

1.6.5 Fuel

The right and left wing tanks ruptured on impact with the ground. The first responders to the accident, the Lanseria International Aerodrome Rescue and Fire Fighting (ARFF) services verified the presence of fuel at the wreckage. During recovery fuel was also present in the aircraft fuel lines.

According to documented evidence, 63 litres of Avgas 100LL was uplifted prior to the accident flight, which filled the tanks to capacity. It was calculated that ZS-CAP thus had approximately 211 litres of fuel in its tanks for the flight.

1.6.6 Weight and Balance

a) The total weight of the aircraft was within limits for the flight and was determined to be 221 lbs below the maximum take-off weight limit and 121 lbs below the maximum landing weight limit of the aircraft. See the column below.

Basic Empty Mass	2146 lbs
Private Pilot	154 lbs
Instructor Pilot	132 lbs
Fuel	336 lbs
Cargo	11 lbs
Total Weight	**2779** lbs
Maximum Take-off Weight	3000 lbs
Below Maximum Take-off Weight	**221 lbs**
Maximum Landing Weight	2900 lbs
Below Maximum Landing Weight	**121 lbs**

b) The centre of gravity of the aircraft was also within limits as seen in Figure 6.

	Station Mass (lb)	**Arm (in)**	**Moment (in.lb)**
Basic Empty Mass	2146	139,50	299367
Private Pilot	154	140,00	21560
Instructor Pilot	132	140,00	18480
Fuel	336	153,80	51676
Cargo	11	208,00	2288
Ramp Weight	**2779**	**141,55**	**393371**

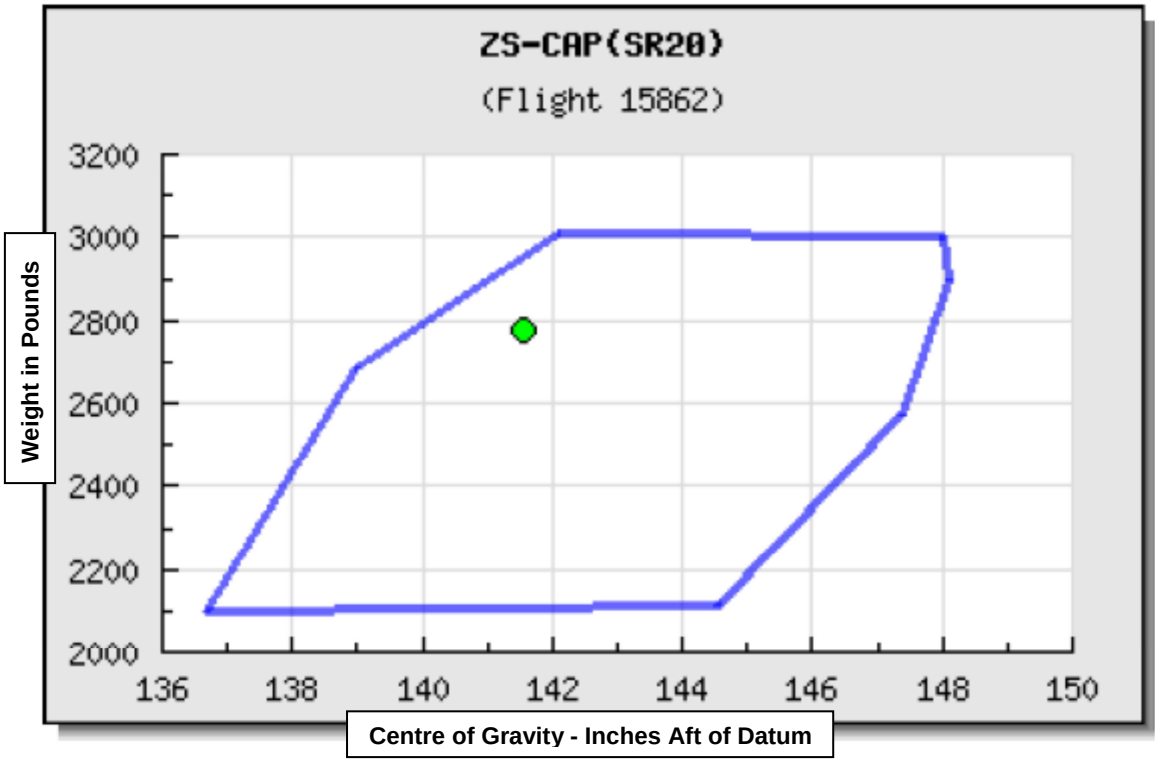

Figure 6: Centre of gravity calculation of the aircraft, represented by the green dot

1.7 Meteorological Information

1.7.1 The following information was obtained from the official report by the South African Weather Services (SAWS):

Summary and Conclusion
The observations at Lanseria airport (FALA) indicate a few clouds (1–2 oktas), a visibility of at least 9 km, and light wind of 05–10 kt. The weather was under the influence of a high-pressure system, and therefore stable.

Satellite image

i. The satellite image in Figure 7 shows patches of low cloud over the accident area (see the marked area on the satellite image). FALA, which is the closest weather station to the accident area, was reporting few clouds (1-2 oktas) at 1 500 ft AGL and visibility >= 9 km closest to the time of accident (see METARs provided).

ii. Surface data
FALA is the closest reporting weather station (see METARs). The 0800Z METAR closest to the time of accident contains the following weather variables:

Wind direction	040	Wind speed	07 knots	Visibility	9 000 m
Temperature	13℃	Cloud cover	FEW	Cloud base	1 500 feet
Dew point	7℃	QNH	1 034 hPa		

METARs
FALA 180700Z 08006KT 050V110 9000 FEW015 11/06 Q1034 NOSIG=
FALA 180800Z 04007KT 360V070 9999 FEW015 13/07 Q1034 NOSIG=

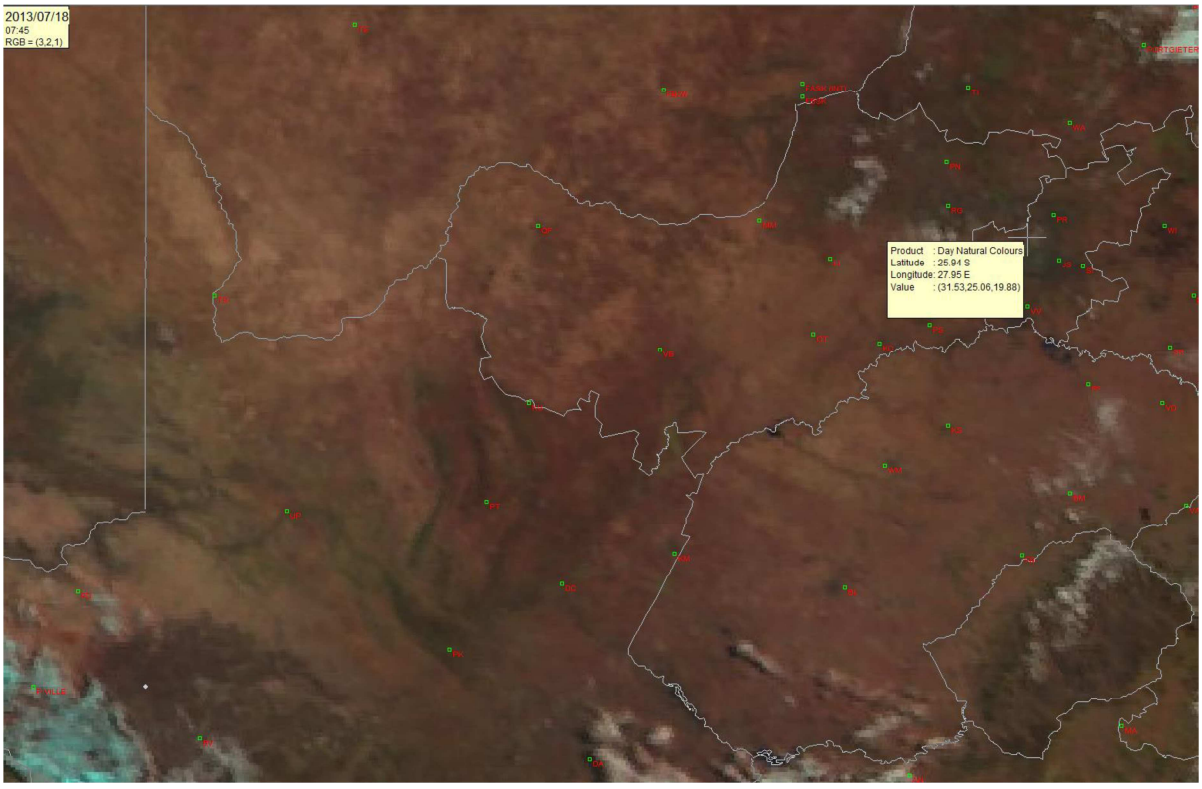

Figure 7: Satellite image of the weather in the area

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with approved navigational aids. No defects to the navigational equipment were reported or recorded prior to the accident flight.

1.8.2 The aircraft was also equipped with an optional S-TEC System Thirty autopilot.

1.9 Communications

1.9.1 The aircraft was equipped with the approved communications equipment. No defects to the communication equipment were reported or recorded prior to the accident flight.

1.9.2 The pilots maintained radio communication with FALA ATC on the VHF frequency 124,0 MHz during the flight. During the second circuit on final approach for Runway 06L the pilot in ZS-CAP requested an early turn to the right. FALA ATC approved the request provided the aircraft was “safe and able to complete the manoeuvre”. The above phraseology was defined by the manager of FALA ATC as cautionary advice to prevent early low level turns over the hangars.

1.10 Aerodrome Information

1.10.1 The aircraft accident occurred approximately 500 m outside the boundaries of FALA on the private farm Bultfontein. The GPS coordinates of the accident site position are S 25°55,986, E 027°56,628.

1.10.2 The accident occurred after the aircraft performed the second touch and go on Runway 06L at FALA.

Aerodrome Location	Lanseria International Airport (FALA)	
Aerodrome Co-ordinates	S 25°56,23 E 27°55,28	
Aerodrome Elevation	4 517 ft	
Runway Designations	06L/24R	06R/24L
Runway Dimensions	2 910 x 30 m	1 760 x 23 m
Runway Used	Runway 06L	
Runway Surface	Asphalt	
Aerodrome Status	Licensed	
Approach Facilities	ILS; NDB; VOR; UHF; DME; ILS GP	

1.11 Flight Recorders

1.11.1 The aircraft was not fitted with a cockpit voice recorder (CVR) or a flight data recorder (FDR), nor was this required by regulations.

1.12 Wreckage and Impact Information

1.12.1 The aircraft was observed banking sharply to the right onto the crosswind leg and rolling level. The aircraft was then seen diving sharply towards the ground followed by the deployment of the ballistic parachute.

1.12.2 The wreckage indicated that the aircraft impacted the ground in a nose-down and slight left wing low attitude. The propeller dug into the ground and the aircraft nosed-over with the fuselage breaking at the engine section. The aircraft wreckage pattern was confined to the impact point with the ballistic parachute deployed and still attached to the aircraft wreckage. The aircraft was destroyed during the impact sequence.

The following damage was found:

- The damage sustained to the propeller indicated that the engine was at a high power setting at the time of the impact sequence.
- Both wings of the aircraft were destroyed during the impact sequence.
- The left wing broke midway; however, the wing spar was still intact.
- Both wing tanks ruptured during the crash.
- The cockpit area and forward part of the cabin was completely destroyed.
- Both front seats broke from their attachments.
- The nose landing gear broke from the fuselage and the main landing gear was still intact.
- The right flap was found in the full down (100%) position with the right flap attachments broken on impact.
- The flap linear actuator was found in the full down (100%) position.
- The flap control switch and flap indicator lights mounted on the centre console that identify flap position was completely destroyed during the accident sequence.

The rudder, horizontal stabiliser, vertical stabiliser and elevators sustained no damage.

Figure 8 & 9: Damage to the aircraft

1.12.3 The ballistic parachute of ZS-CAP was found on the ground in the deployed position. The ballistic parachute T-handle was found in the slack position indicating that it was pulled by the crew and the ballistic parachute canopy was still attached with the canopy suspension lines and harness to the fuselage structure. The ballistic parachute rocket canister, fuselage parachute composite cover and deployment bag was found approximately 37m from the wreckage.

Figure 10: The activation T-handle in the slack position

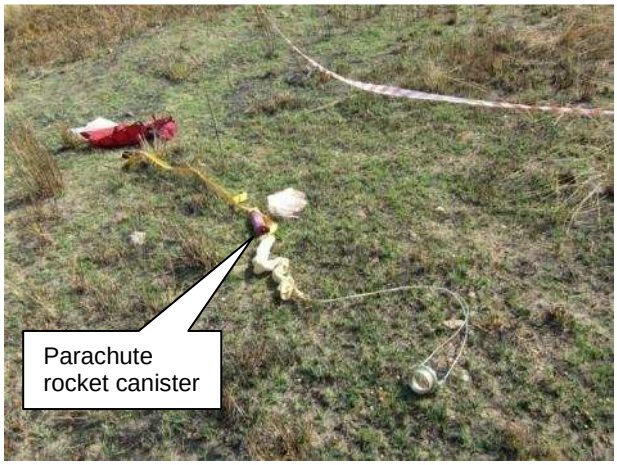

Figure 11: The rocket canister that was found 37m away

1.12.4 There was no evidence of an in-flight structural failure. All extremities and control surfaces were accounted for at the site. Although flight control cable runs were disrupted by the impact forces, pre-accident control integrity was established.

1.12.5 After the engine was lifted off the ground, the three-bladed propeller was found to have dug into the ground during the impact sequence. The propeller broke at the attachment to the crankshaft during the impact with the ground. Propeller blade damage and twist was consistent with the engine producing power at impact.

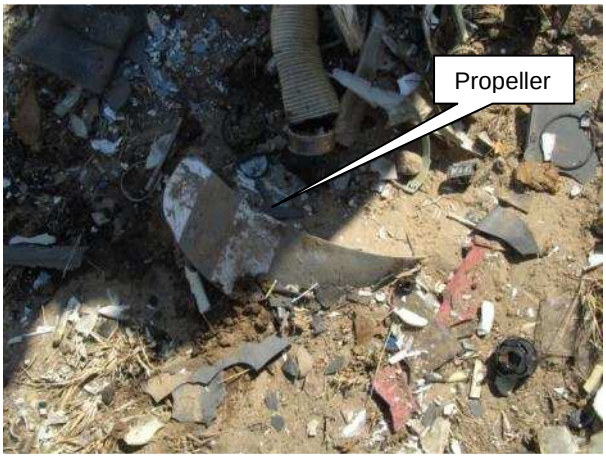

Figure 12 & 13: Recovery of the propeller

Figure 14: Propeller of ZS-CAP

1.13 Medical and Pathological Information

1.13.1 Instructor Pilot

According to the post-mortem autopsy report, the cause of death of the instructor pilot was determined to be multiple blunt force injuries. The results of the toxicology tests for the instructor pilot were not available at the time this report was compiled. Should any of the toxicology results indicate that medical aspects may have affected the performance of the instructor pilot, this will be considered as new evidence and the investigation will be reopened.

1.13.2 Private Pilot

The post-mortem autopsy report and toxicology tests for the private pilot were not available at the time this report was compiled. Should any of the results indicate that medical aspects might have affected the performance of the private pilot, this will be considered as new evidence and the investigation will be reopened.

1.14 Fire

1.14.1 There was no evidence of pre- or post-impact fire.

1.15 Survival Aspects

1.15.1 The accident was not considered survivable due to the magnitude of the deceleration forces experienced when the aircraft impacted the ground surface.

1.15.2 Integrated seat belt and shoulder harness assemblies with inertia reels are provided for the pilot and each passenger. The forward seat belts are attached to the seat frame and the shoulder harnesses are attached to inertia reels mounted in the seat back for the front seats. Each harness is attached to the seat belt. Both shoulder harnesses secured the occupants without failure. However, the front seats broke out of their attachments during the impact sequence.

1.16 Tests and Research

1.16.1 Engine Investigation

The engine was recovered to an approved aircraft maintenance organisation (AMO) and stripped with a designated representative from the agent present, for further investigation purposes.

The following findings were made:

- The engine exhaust, magnetos, starter and alternator sustained substantial impact damage.
- The cylinders were individually removed, and visually inspected for condition and operation. All six cylinders appeared to be operating normally.
- The crankcase halves were separated and no mechanical failure of the crankshaft, camshaft or rear gear train was found.
- On inspection of the crankshaft fracture that was caused on impact, it was noted that the fractures were running at about 45 degrees to the centre line of the crankshaft, in the direction of rotation of the crankshaft. This would indicate that the engine was rotating at the time of impact.

1.16.2 Flap System Investigation

a) During the investigation of the wreckage the right flap was found in the full down (100%) position and the linear actuator fully extended (full down flap position). The left flap attachments were broken on impact. The flap control switch and flap indicator lights mounted on the centre console in the cockpit, that identify flap position was completed destroyed during the accident sequence.

b) Flap Description

The electrically controlled, single-slotted flaps provide low-speed lift enhancement. Each flap is manufactured of aluminium and connected to the wing structure at three hinge points. The flaps are selectively set to three positions: 0%, 50% (16°) and 100% (32°) by operating the flap control switch. The flap control switch positions the flaps through a motorised linear actuator mechanically connected to both flaps by a torque tube.

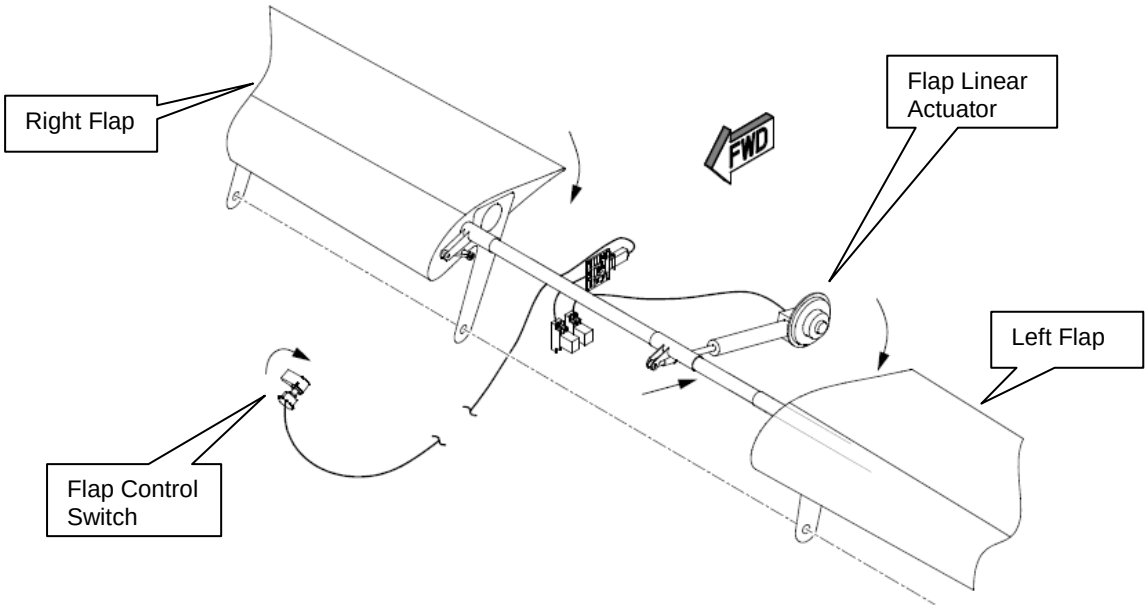

Figure 15: Illustration of the flap system

c) Flap Linear Actuator on ZS-CAP

The flap linear actuator was found in the extended position and removed for further investigation.

The following findings were made:

- The flap linear actuator operated normally with no impact damage.
- Impact could not have caused the flap linear actuator to move to the full down position as the flap linear actuator works on rotary movement.
- The flaps were in the full down (100%) position when the accident occurred.

It was concluded that the flaps were in the full down (100%) position prior to impact.

d) Flap Limitations

The following information was obtained from the Cirrus SR20 POH:

i. Flap Limitations

Serials 1005 through 1204 before accomplishment of Service Bulletin SB 20-27-05: Simultaneous Flap operation and communication transmission is prohibited.

Approved Takeoff Settings.....UP (0%) or 50%
Approved Landing Settings .....Up (0%), 50%, or 100%

Note: ZS-CAP – serial no. 1122

ii. Balked Landing/Go-Around

In a balked landing (go-around) climb, disengage autopilot, apply full power, then reduce the flap setting to 50%. If obstacles must be cleared during the go-around, climb at the best angle of climb with 50% flaps. After clearing any obstacles, retract the flaps and accelerate to the normal flaps-up climb speed.

1. *Autopilot .....DISENGAGE*
2. *Power Lever .....FULL FORWARD*
3. *Flaps 50%*
4. *Airspeed.....BEST ANGLE OF CLIMB (81 – 83 KIAS)*
   After clear of obstacles:
5. *Flaps .....UP*

e) After consultation with the manufacturer regarding the flight characteristics of the aircraft during a turn with 100% flaps, the following was received:

> *Flight characteristics are typically benign during a go around with full flaps. It is possible for the wing to drop if the aircraft is stalled during uncoordinated flight; there is nothing in my experience to explain a sharp pull up other than pilot action. An aggressive pull up at low speed in uncoordinated flight could result in a stall and roll tendency, however relaxation of the pitch control will normally result in immediate return to controlled flight although if performed at low altitude, recovery may not be possible prior to encountering the ground.*

1.16.3 Stalls

a) Description

A stall occurs when the smooth airflow over the airplane's wing is disrupted, and the lift degenerates rapidly. This is caused when the wing exceeds its critical angle of attack. This can occur at any airspeed, in any attitude, with any power setting. Though it depends on the degree to which the stall has progressed, most stalls require some loss of altitude during recovery. The longer it takes to recognize the approaching stall, the more complete the stall is likely to become, and the greater the loss of altitude to be expected.

The Cirrus SR20 POH states the following:

> *SR20 stall characteristics are conventional. Power-on stalls are marked by a high sink rate at full aft stick. When practicing stalls at altitude, as the airspeed is slowly reduced, you will notice a slight airframe buffet and hear the stall speed warning horn sound between 5 and 10 knots before the stall. Normally, the stall is marked by a gentle nose drop and the wings can easily be held level or in the bank with coordinated use of the ailerons and rudder. Upon stall warning in flight, recovery is accomplished by immediately reducing back pressure to maintain safe airspeed, adding power if necessary and rolling wings level with coordinated use of the controls.*
>
> *WARNING: Extreme care must be taken to avoid uncoordinated, accelerated or abused control inputs when close to the stall, especially when close to the ground.*

b) Stalling in a turn

The following information describe the recovery of stalling in a turn.

Reference: Air Pilot's Manual
Flying Training – Volume 1

> *Back pressure on the control column increases the angle of attack and*

may cause a stall. Since the load factor is increased in a turn, the stall will occur at a higher speed than in straight and level flight – by how much depends on the g-loading. Stalls at higher speed than normal are called accelerated stalls.

Follow the standard recovery of moving the control column centrally forward (relaxing the back pressure may be sufficient), and when the wings are unstalled, use coordinated rudder and ailerons to roll the wings level. Apply power as required and resume the desired flight path.

c) <u>The stall during the accident</u>

After the second touch and go on Runway 06L the aircraft was seen banking sharply to the right onto the crosswind leg, with the top of the aircraft visible to the witness. The aircraft was seen rolling level and then diving sharply towards the ground, followed by the deployment of the ballistic parachute.

From witness information it was determined that the aircraft was at a bank angle of 45° during the right turn while the aircraft had 10 0% flap configuration. The Cirrus SR20 POH states that the approved take-off setting for the flaps are 50% or 0% (UP). In a balked landing/go-around the flap setting should be reduced to 50% flaps. With flaps fully down (100%) it was calculated that the stall speed of ZS-CAP during the right turn was 67 knots. (See figure 16 as taken from the Cirrus SR20 POH)

The eyewitness reported a manoeuvre that was performed by ZS-CAP which has the characteristics of an aggressive pull-up climbing turn in which the pilot uses the inertia of the aircraft to achieve a rapid gain in height.

Weight	Bank Angle	STALL SPEEDS					
		Flaps 0%Full Up		Flaps 50%		Flaps 100%Full Down	
LB	Deg	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3000 Most FWD C.G.	0	65	67	61	63	56	59
	15	66	68	62	64	57	60
	30	70	72	65	68	61	63
	45	78	80	72	75	67	70
	60	92	95	86	89	80	83
3000 Most AFT C.G.	0	64	66	59	62	54	57
	15	65	67	60	63	55	58
	30	69	71	64	66	58	61
	45	76	78	71	73	64	68
	60	90	93	84	87	76	81

Figure 16: The stall speed of the aircraft as taken from the POH

d) Stall Warning System

Description:

The airplane uses an electro-pneumatic stall warning system. As the angle of attack increases and the airplane approaches an aerodynamic stall, low pressure passes over the stall warning port located on the leading edge of the right wing. Negative pressure is sensed by a pressure switch which activates the stall warning horn in the cockpit.

Stall warning of ZS-CAP

Although the stall warning system of ZS-CAP was completely destroyed during to the crash, the system was considered to have been serviceable prior to the accident as an operational test is performed as part of the pre-flight inspection.

1.17 Organisational and Management Information

1.17.1 The aircraft was approved to be utilised by the aviation training organisation (ATO). The ATO, no. CAA/0006, was in possession of a valid ATO certificate with expiry date 17 October 2013.

1.17.2 The last mandatory periodic inspection (MPI) was carried out by an approved AMO no. 1099 on 6 June 2013.

1.18 Additional Information

1.18.1 Cirrus Airplane Parachute System

The SR20 is equipped with a Cirrus Airplane Parachute System (CAPS) designed to bring the aircraft and its occupants to the ground in the event of a life-threatening emergency. The parachute system does not require electrical power for activation and can be activated at any time.

CAPS is initiated by pulling the CAPS activation T-handle installed in the cabin ceiling to activate the rocket. When the rocket launches, the parachute assembly is extracted outward due to rocket thrust and rearward due to relative wind. In approximately two seconds the parachute will begin to inflate and when air begins to fill the canopy, the forward motion of the airplane will be slowed dramatically. During this deceleration a slight nose-up may be experienced, particularly at high speed. The nose will then gradually drop until the aircraft is hanging nose-low beneath the canopy. Eight seconds after deployment the aircraft tail will drop down into its final approximately level attitude.

The CAPS is designed to work in a variety of aircraft attitudes, including spins. However, deployment in an attitude other than level flight may yield deployment characteristics other than those described above.

Figure 17: View of CAPS deployed

1.18.2 Cirrus Airplane Parachute System

Deployment Altitude

No minimum altitude for deployment has been set because the actual altitude loss during a particular deployment depends upon the airplane's airspeed, altitude and attitude at deployment as well as other environmental factors. As a guideline, the demonstrated altitude loss from entry into a one-turn spin until under a stabilized parachute is 920 feet. Altitude loss from level flight deployments has been demonstrated at less than 400 feet.

Deployment Attitude

The CAPS has been tested in all flap configurations at speeds ranging from V_{SO} to V_A and most CAPS testing were accomplished from a level attitude. From these tests it can be assumed that the CAPS should be activated from a wings-level, upright attitude, if at all possible, to minimize the chances of parachute entanglement and reduce aircraft oscillations under the parachute.

Note: V_{SO}

Stalling Speed is the minimum steady flight speed at which the aircraft is controllable in the landing configuration (100% flaps) at the most unfavourable weight and balance.

V_A

Design Manoeuvring Speed is the speed above which it is unwise to make full application of any single flight control (or "pull to the stops") as it may generate a force greater than the structural limitations.

1.19 Useful or Effective Investigation Techniques

1.19.1 Not required.

2. ANALYSIS

2.1 The flight was intended as a check (dual) flight with the instructor evaluating the private pilot's proficiency in order for the private pilot to be able to hire the aircraft for accumulation of flying hours towards a commercial pilot license. The check ride consists of three touch and go landings.

2.2 After completing an uneventful first circuit, the aircraft continued with a second circuit. Whilst on final approach for runway 06L, ZS-CAP was cleared for a touch and go where after the pilot of ZS-CAP requested an early right hand turn. FALA ATC approved the request provided the aircraft was safe and able to complete the manoeuvre.

2.3 After the second touch and go landing, ZS-CAP was seen by a witness banking sharply to the right onto the crosswind leg with the top of the aircraft visible to the witness. During the sharp climbing turn manoeuvre the flaps were in the full down (100%) position which was confirmed by the fully extended position of flap linear actuator recovered from the wreckage. The aircraft then entered into a stall at approximately 67 knots as calculated with the flaps fully down. The aircraft was then seen by a witness to roll level at approximately 50 feet AGL where after it dived to the ground. This indicates a stall recovery was initiated. As the aircraft's height above ground was not sufficient for successful stall recovery and as ground impact was inevitable the pilot opted to deploy the ballistic parachute

2.4 The non-standard departure requested by the pilot suggests that the sharp climbing turn manoeuvre was intentional and not as a result of any control malfunction. The manoeuvre was done with the flaps at 100% down which a greater than usual decay in speed resulted in a stall. A series of events following rotation i.e. 100% flap configuration and 45° angle of bank lead to the air craft reaching its stall speed sooner subsequently stalling at a low altitude from which the pilots were unable to recover timeously. The deployment of the ballistic parachute then also contributed to a further nose down attitude of the aircraft.

2.5 The investigation eliminated the possibility of structural failure to the aircraft, including flight controls, an engine failure or an airframe defect. The damage sustained to the propeller indicated that the engine was at a high power setting at the time of the impact sequence. There was also no evidence of pilot incapacitation and the weather conditions at the time of the accident were not considered to have contributed to the accident.

2.6 During the impact sequence with the ground the occupants on board suffered fatal injuries and the aircraft was destroyed.

3. CONCLUSION

3.1 Findings

3.1.1 The instructor pilot was the holder of a valid commercial pilot licence and had the aircraft type endorsed on her licence. She accumulated a total of 1 637,5 flying hours which included 777,3 on type.

3.1.2 The instructor pilot was the holder of a valid aviation medical certificate issued by an approved medical examiner.

3.1.3 The private pilot was the holder of a valid private pilot licence and had the aircraft type endorsed on his licence. He had accumulated a total of 55,6 flying hours which included 50,8 on type.

3.1.4 The private pilot was the holder of a valid aviation medical certificate issued by an approved medical examiner.

3.1.5 The aircraft was in possession of a valid Certificate of Airworthiness.

3.1.6 There was sufficient fuel on board the aircraft at the time of the accident.

3.1.7 The weight and balance of the aircraft were below the maximum allowable limits for the aircraft.

3.1.8 All control surfaces were accounted for, and all damage to the aircraft was attributable to the severe impact forces.

3.1.9 There was no evidence of any defect or malfunction in the aircraft that could have contributed to the accident.

3.1.10 Propeller blade damage and twist was consistent with the engine producing power at impact.

3.1.11 The second touch and go was performed with 100% (full) flaps configuration which was the incorrect configuration as prescribed by the POH. The approved take off settings are 0% or 50%.

3.1.12 The flaps at the wreckage were found in the 100% (full) flaps configuration.

3.1.13 The aircraft, with the instructor and private pilot on board, was seen by a witness banking sharply to the right, levelling out and then entering a dive. During the climbing turn the aircraft stalled.

3.1.14 The pilot attempted stall recovery but due to the low altitude the aircraft impacted the ground. Both occupants were fatally injured in the crash.

3.1.15 The aircraft ballistic parachute was deployed but did not have time to fully deploy before impact due to the low altitude.

3.1.16 Fine weather conditions prevailed, which were not considered to have had any bearing on the accident.

3.2 Probable Cause/s

3.2.1 The aircraft entered a stall at low altitude from which the pilot was unable to recover.

3.3 Contributory Factor/s

3.3.1 The pilots omitted to reconfigure the aircraft flaps for take-off as per the POH take-off settings following the touch and go landing.

3.3.2 The aircraft's ballistic parachute was deployed and was in transition at a low altitude, which further lowered the nose attitude of the aircraft.

4. SAFETY RECOMMENDATIONS

4.1 None

5. APPENDICES

5.1 None.