AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9635		
Aircraft registration	**ZS-JDN**	**Date of accident**	3 September 2017		**Time of accident**	0930Z	
Type of aircraft	Cessna 172M (Aeroplane)		**Type of operation**		Private (Part 91)		
Pilot-in-command licence type		Commercial	**Age**	23	**Licence valid**	Yes	
Pilot-in-command flying experience		Total flying hours	291.0		Hours on type	215.1	
Last point of departure	Wonderboom Aerodrome (FAWB), Gauteng province						
Next point of intended landing	Wonderboom Aerodrome (FAWB), Gauteng province						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Magaliesberg Mountain Range (GPS position: 25°51'13.30" South 027°32'03.06" East) elevation of 5501 ft							
Meteorological information	Surface wind: 010º/3kt, Temp: 20°C, Dew point: 6°C, Visibility: CAVOK						
Number of people on board	1 + 1	**No. of people injured**	0	**No. of people killed**	2		
Synopsis							

On Sunday 3 September 2017, at 0908Z, ZS-JDN, a Cessna 172M, departed from Wonderboom Aerodrome (FAWB) for a private flight with the intention of returning to FAWB.

The intention of the flight was to route to the Hartbeespoort Dam and surrounds as a private flight operating under Part 91.

At 0940Z, a local farmer noticed smoke rising from the mountainside on his property. On further investigation, the farmer found the wreckage of the aircraft. This was immediately reported to the local police and fire departments.

The aircraft was destroyed in the post-impact fire and both occupants on board had sustained fatal injuries.

The investigation determined that the most probable cause is that the aircraft experienced a loss of airspeed while attempting to climb out of the valley. This led to a stall condition, which caused the aircraft to impact terrain due to insufficient altitude for recovery.

Probable cause

The most probable cause is that the aircraft experienced a loss of airspeed while attempting to climb out of the valley. This led to a stall condition, which caused the aircraft to impact terrain due to insufficient altitude for recovery.

SRP date	13 November 2018	Release date	06 December 2018

AIRCRAFT ACCIDENT REPORT

Name of Owner	**:** TR Eagle Air (Pty) Ltd
Name of Operator	**:** Private (Part 91)
Manufacturer	**:** Cessna Aircraft Company
Model	**:** 172M
Nationality	**:** South African
Registration markings	**:** ZS-JDN
Place	**:** Magaliesberg Mountain Range
Date	**:** 3 September 2017
Time	**:** 0930Z

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) the purpose of investigation of an aircraft accident or incident is to determine, in terms of the provisions of this Part, the facts of an accident or incident in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents, and ***not to apportion blame or liability****.*

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 Sunday 3 September 2017, at 0908Z, ZS-JDN, a Cessna 172M, departed from Wonderboom Aerodrome (FAWB) for a private flight with the intention of returning to FAWB.

1.1.2 On board the aircraft were two occupants. The pilot in command (PIC), occupied the left front seat, and one passenger, who was a holder of a private pilot licence (PPL), occupying the right front seat. The PIC was the holder of a commercial pilot license (CPL) and held the required rating to operate the aircraft.

1.1.3 Initial radio contact from the aircraft was made on the Wonderboom ground frequency and was transmitted by the passenger of the aircraft. The passenger requested taxi instructions from where the aircraft was parked on the aerodrome and indicated that there were two crew members on board the aircraft, with a three-hour endurance, for a flight to the Hartbeespoort Dam area. The aircraft was cleared to taxi to the active runway, which was runway 29. The local QNH at the time of taxiing was 1028 mb.

1.1.4 All further radio communication from this point was carried out by the PIC. The after-departure clearance required the PIC to report abeam Rosslyn, maintaining 6 000 ft. The PIC reported this position at 0911Z, at which point the FAWB Tower instructed the PIC to broadcast further intentions on the Johannesburg Special Rules Frequency (125.80 MHz).

1.1.5 The aircraft routed towards the Hartbeespoort Dam area by remaining south of the Magaliesberg Mountain range. In order to remain outside the Lanseria International Aerodrome (FALA) airspace, the aircraft routed to the north of FALA while en route to the Magaliesberg Flight Training Area (FAD 70-E).

1.1.6 At approximately 0940Z, a farm owner noticed smoke rising from the slope of the mountain. On further inspection, the farmer found the wreckage of the aircraft and notified the local police and Krugersdorp fire department.

1.1.7 The aircraft was destroyed due to the ensuing fire as well as the impact with the terrain. Both occupants sustained fatal injuries.

1.1.8 The flight time was approximately 32 minutes. It was conducted in daylight hours with Visual Meteorological Conditions (VMC) prevailing.

1.1.9 A bird sanctuary for the Cape Griffon species and high-tension cables were present near the accident site.

1.1.9 The accident occurred during daylight conditions at a geographical position that was determined to be 25°51’13.30” South 027°32’03.06” East, at an elevation of 5 501 feet above mean sea level (AMSL). The accident site was approximately 4.7 nm to the north-east of Hekpoort town.

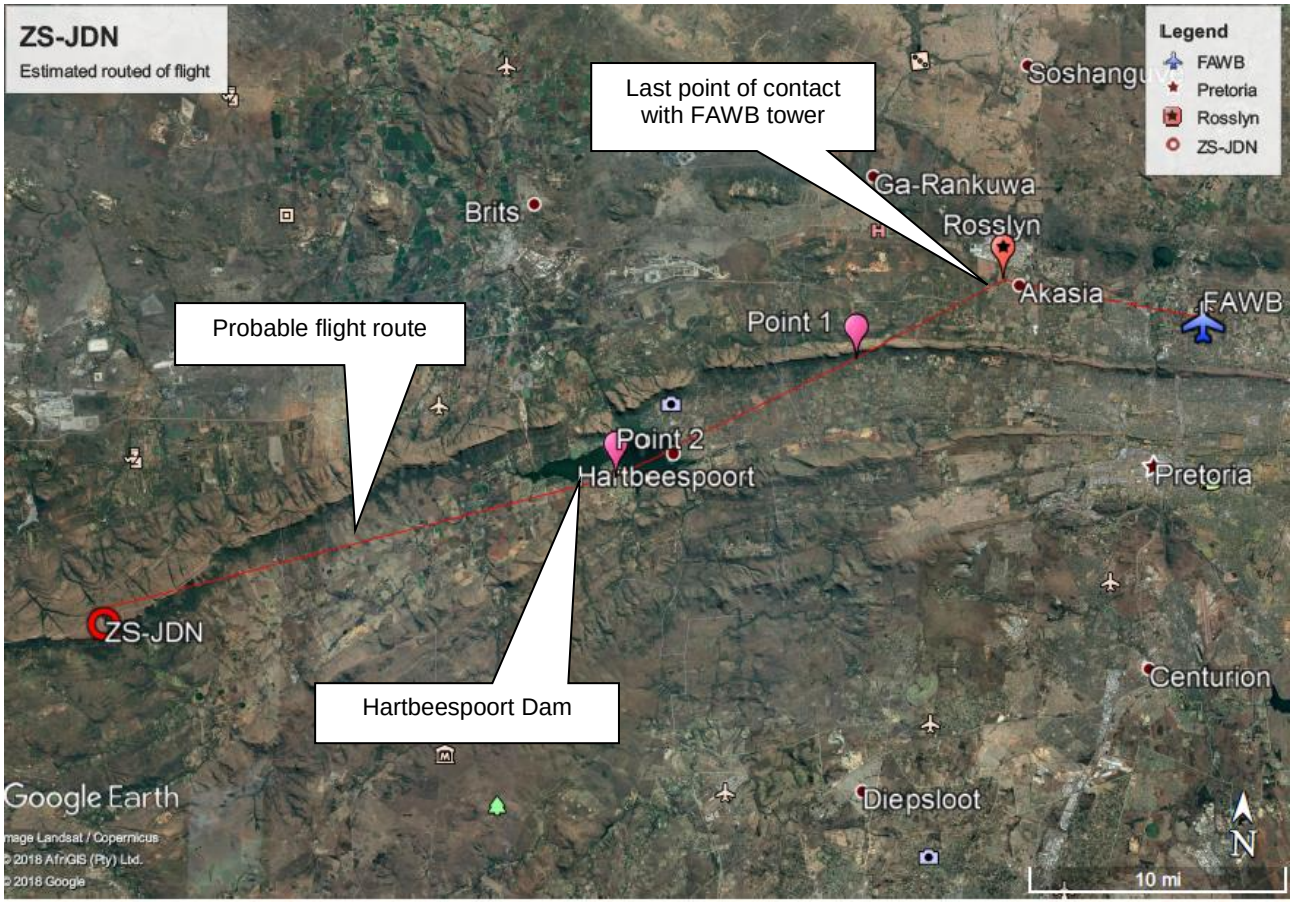


Figure 1: The most probable aircraft routing from FAWB to the point of impact

1.2 Injuries to persons

1.2.1 Both occupants were South African Citizens

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

1.3 Damage to aircraft

1.3.1 The aircraft was largely consumed by the post-impact fire. The fuel in the tanks leaking out and igniting may have caused the fire. The empennage area and a portion of the right wing sustained impact damage but no fire damage. The aircraft was destroyed due to the impact and ensuing post-impact fire.

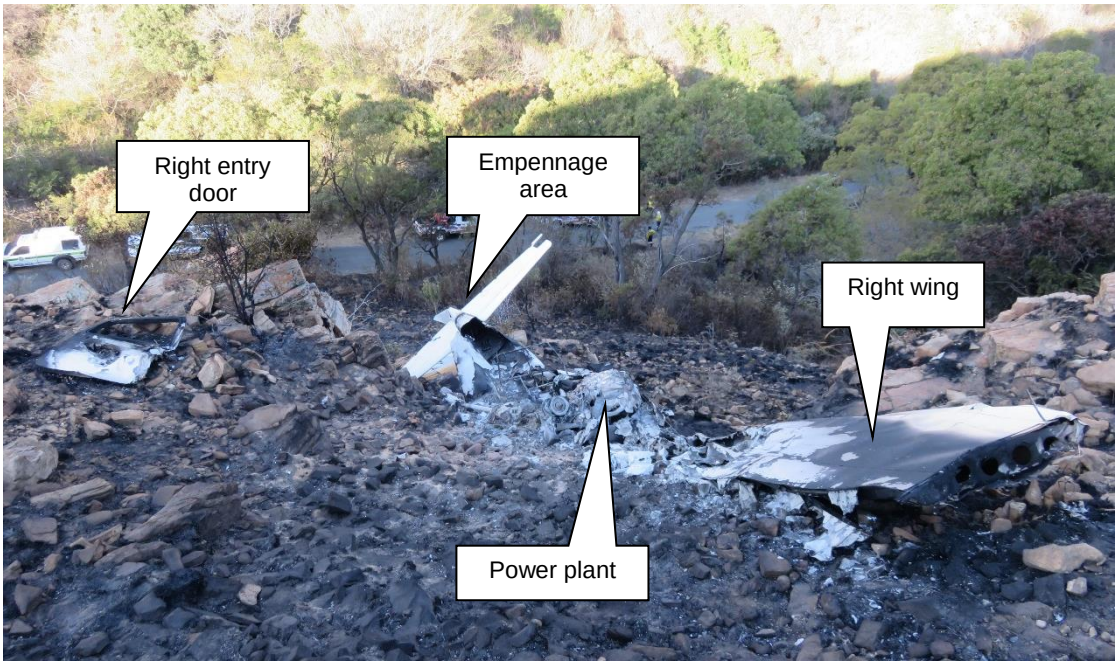


Figure 2: The aircraft as it came to rest on the side of the mountain

1.4 Other damage

1.4.1 A large section of vegetation was destroyed by the post-impact fire that set the dry savannah-type vegetation alight. Fire and rescue services wee informed of the fire. They responded from Krugersdorp and the fire was extinguished several hours later. No other damage was reported due to the accident.

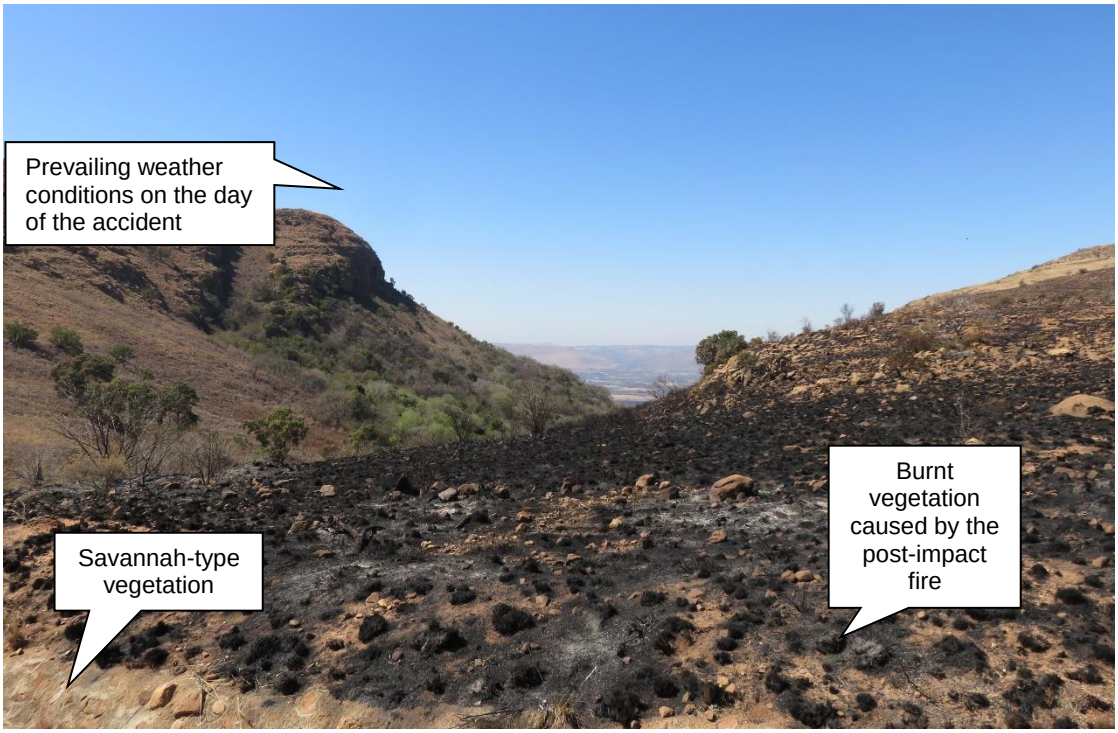


Figure 3: Burnt vegetation caused by the post-impact fire

1.5 Personnel Information

Note: The investigation was unable to determine who was flying the aircraft at the time of the accident

1.5.1 Pilot-in-command (PIC)

Nationality	South African	Gender	Female	Age	23
Licence number	027 244 6717	Licence type	Commercial		
Licence valid	Yes	Type endorsed	Yes		
Ratings	Instrument, Instructor (Grade 3)				
Medical expiry date	31 January 2018				
Restrictions	None				
Previous accidents	None				

Flying experience:

Total hours	291.0
Total past 90 days	30.9
Total on type past 90 days	10.7
Total on type	215.1

1.5.2 Passenger (Private pilot). Note: the passengers pilot license had elapsed 4 days prior to the accident. The passenger had recently converted to the Aermacchi MB-326 (Impala) jet aircraft. The passenger was also rated on the Cirrus SR-22 and the Atlas Angel turbine powered aircraft.

Nationality	South African	Gender	Male	Age	24
Licence number	027 239 1525	Licence type	Private		
Licence valid	No	Type endorsed	No		
Ratings	Night rating, Turbine				
Medical expiry date	31 July 2019				
Restrictions	None				
Previous accidents	None				

Flying experience:

Total hours	125.6
Total past 90 days	13.7
Total on type past 90 days	N/A
Total on type	N/A

1.6 Aircraft information

1.6.1 ZS-JDN was a Cessna (Textron Aviation) C172 M model. The serial number of the aircraft was 172-65365. The aircraft was manufactured in 1975 and first registered in South Africa on the 16th of June 1975.

1.6.2 The Certificate of Registration and the Certificate of Airworthiness were both valid at the time of the accident. The aircraft was allowed to operate under the standard Part 135 category (air transport operations) but was restricted to Part 141 operations (aviation training organisations).

1.6.3 The owner of the aircraft was TR Eagle Air (Pty) Ltd. The company took ownership of the aircraft on 26th of May 2015. The operator of the aircraft at the time of the accident was the PIC. The aircraft was hired from the owner and operated in a private capacity.

Figure 4: The aircraft prior to the accident (Eagle Air)

Airframe:

Type	Cessna 172M	
Serial number	172-65364	
Manufacturer	Cessna Aircraft Company	
Year of manufacture	1975	
Total airframe hours (at time of accident)	*13 689.4	
Last MPI (hours & date)	13 644.9	18 August 2017
Hours since last MPI	*44.5	
C of A (issue date)	4 January 2009	
C of A (expiry date)	3 January 2018	
C of R (issue date) (present owner)	26 May 2015	
Operating categories	Part 135 Restricted to Part 141	

*NOTE: The aircraft hours at the time of the accident could not be determined with accuracy as the Hobbs meter and tachometer, as well as the flight folio, were destroyed by the post-impact fire. The hours entered in the table above were obtained from the ATO, as they had a record on the aircraft, which included the hours when it last flew. A period of 30 minutes was added for the accident flight. This was an estimated flying time as the actual time of the flight could not be determined with accuracy.

Engine:

Type	Lycoming O-320-E2A
Serial number	L-29440-27AC
Hours since new	1 238.3
Hours since overhaul	598.2

Propeller:

Type	McCauley 1C160-CTM-7553
Serial number	733352
Hours since new	1 738.1
Hours since overhaul	1098

1.6.4 The aircraft fuel type used, as approved by the manufacturer, was AVGAS 100 low lead (LL). The last recorded fuel uplift was carried out on the 2nd of September 2017. The total uplift was 86 L. According to the weight and balance report carried out by the PIC before the flight, the fuel mass is listed as 181,7 L (48 gallons). Prior to taxi, the fuel endurance was reported to be 3 hours. This equates to approximately 100 L of fuel on board.

1.6.5 Prior to departure, no technical defects were reported.

1.6.6 The weight and balance of the aircraft as reported during the pre-flight were as follows:

ZS-JDN	Weight (lbs)	Arm (inches)	Moment (lb-in)
Aircraft empty weight	1488.5	39.62	58968
Front seat 1 and 2	276	37	10212
Baggage	5	37	185
Zero fuel mass	1769.5	39.20	69365
Fuel 48 gallons	288	47.8	13770
Ramp weight	**2057.5**	**40.40**	**83135**
Taxi fuel 2 gallons	12	47.8	573.6
Take-off mass	**2045.5**	**40.36**	**82561.4**

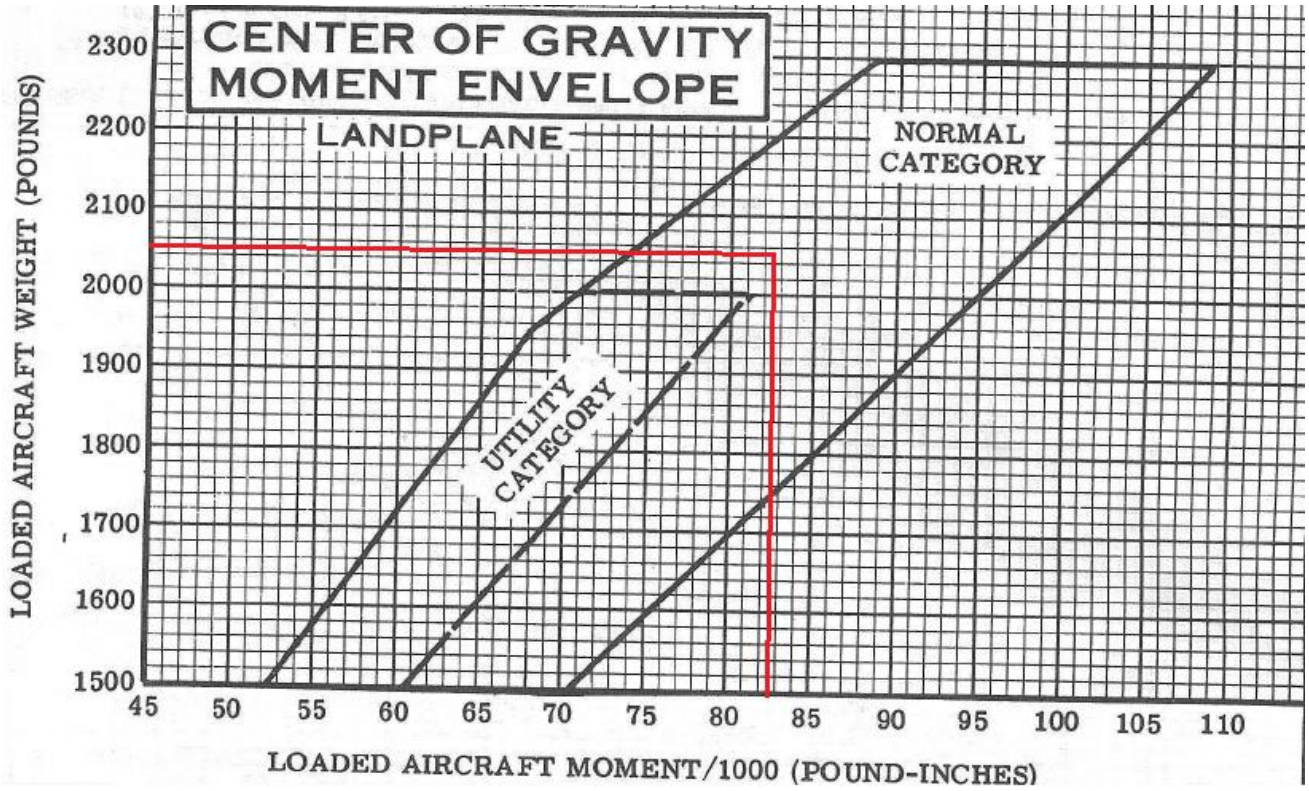


Figure 5: Weight and balance chart (C172M POH)

Note: According to the Cessna 172M Pilot's operating handbook (POH), the maximum take-off weight for this aircraft was 2300 lbs. The aircraft was therefore within its weight limitations for the flight.

1.7 Meteorological information

1.7.1 The aircraft departed from FAWB. This aerodrome has METAR information available to pilots operating from the aerodrome. The METAR is available from the control tower on request.

1.7.2 An official weather report was obtained from the South African Weather Services (SAWS).

1.7.3 The two closest weather-reporting stations to the accident site were Lanseria International Airport (FALA, 25 nm East South East) and Rustenburg Aerodrome (FARG, 19 nm North West).

FALA 030900Z VRB03KT CAVOK 19/02 Q1030 NOSIG=

Wind direction	VRB	Wind speed	3 kts	Visibility	9999 m
Temperature	19°C	Cloud cover	N/A	Cloud base	N/A
Dew point	2°C				

FARG 030900Z AUTO 01003KT 20/06 Q1028

Wind direction	030°	Wind speed	3 kts	Visibility	9999 m
Temperature	20°C	Cloud cover	N/A	Cloud base	N/A
Dew point	6°C				

Figure 6: Closest aerodromes to the accident site (Google Earth)

1.7.4 The weather at the time of the accident was fine with no clouds and a very light wind blowing in a variable direction. The conditions were VMC and the accident happened during daylight hours.

Figure 7: Location of the sun (northerly) (SunCal)

1.8 Aids to navigation

1.8.1 The aircraft was equipped with standard navigational aids as approved by the regulator.

1.9 Communication

1.9.1 The first contact made by the aircraft on the morning of the accident was on the Wonderboom ground frequency (120.60 MHz). The passenger, who was a private pilot, initially communicated with the ground controller. The passenger requested taxi instructions from where the aircraft was parked on the aerodrome and indicated that there were two crew members on board the aircraft, with a three-hour endurance, for a flight to the Hartbeespoort Dam area. The aircraft was cleared to taxi to the active runway, which was runway 29. The local QNH at the time of taxi was 1028 mb.

1.9.2 After the taxi clearance was issued, the PIC took over all radio communication. Once fully ready, the aircraft was cleared for take-off, using runway 29. The after-departure instructions were to climb to 6 000 ft and to report abeam Rosslyn. The aircraft began the take-off roll at 0908Z.

1.9.3 At 0911Z the PIC called FAWB tower, reporting overhead Rosslyn at 6 000 ft, whereupon ATC advised the PIC to broadcast further intentions on radio frequency to 125.80 MHz (Special Rules West).

1.9.4 Once the aircraft entered the Magaliesberg Flight Training Area (FAD 70E), it would have been required of the PIC to broadcast any intentions on 124.8 MHz. The investigation was unable to determine if this change of frequency had occurred.

1.9.5 No distress call was received on any radio frequency prior to the accident.

1.10 Aerodrome information

1.10.1 The accident did not occur at an 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 it required by the regulations for these to be fitted to this type of aircraft.

1.12 Wreckage and impact information

1.12.1 The area of impact was a rocky mountainous area, covered by savannah type shrubbery.

1.12.2 The aircraft came to rest in an inverted position.

1.12.3 The configuration of the aircraft was unable to be determined due to the extensive fire damage.

1.12.4 There is no wreckage trail and the entire aircraft is located within a 5 m radius.

1.12.5 The aircraft may have impacted the terrain with a high vertical speed and a low forward airspeed.

1.12.6 A post-impact, fuel-fed fire erupted after the accident. This destroyed a large portion of the aircraft.

1.12.7 Due to the post-accident fire, the investigation is unable to determine if any components malfunctioned in flight.

Figure 8: Aerial photograph of the accident site indicating the location of the wreckage

1.13 Medical and pathological information

1.13.1 The medico-legal post-mortems/autopsies were performed on both occupants on Thursday, 7 September 2017, at a facility in Roodepoort. The cause of death were due to: *"Multiple blunt force injuries are a possibility, carbon monoxide poisoning is probable*."

1.14 Fire

1.14.1 Most of the aircraft structure was destroyed by the fuel-fed, post-impact fire that erupted. The post-impact fire did not consume the empennage and a portion of the right wing.

1.14.2 The post-impact fire set the savannah type vegetation alight. The assistance of the Krugersdorp fire and rescue services was obtained and they were dispatched to the scene and contained the fire, which had consumed a large part of vegetation.

1.15 Survival aspects

1.15.1 No eyewitnesses saw the accident occurring. The initial response was by a local farmer who noticed the smoke from the post-impact fire. Once the farmer arrived on scene, the police and fire services were notified.

1.15.2 No emergency locator transmitter (ELT) signals were transmitted by the aircraft.

1.15.3 The PIC was seated in the left seat and the passenger in the right seat. Due to the substantial fire damage, the investigation is unable to determine the effectiveness of the safety equipment fitted to the aircraft.

1.15.4 It cannot be determined with certainty if the initial impact may have been survivable, due to the extensive fire damage.

1.16 Tests and research

1.16.1 No new techniques were used in the investigation.

1.17 Organisational and management information

1.17.1 This was a private flight (hire and fly) from an ATO based at FAWB.

1.18 Additional information

1.18.1 What is an aerodynamic stall?

1.18.1.1 An aerodynamic stall is defined by Skybrary as follows: “as a sudden reduction in the lift generated by an aerofoil when the critical angle of attack is reached or exceeded.”

1.18.1.2 At a low angle of attack (a small angle between the chord line and the relative airflow), the airflow over the wing is laminar and smooth. As the angle of attack increases, the smooth airflow over the wing starts to become turbulent. When the angle of attack reaches it’s critical angle, the airflow over the wing breaks away and all lift is lost. This angle is referred to as the stall angle.

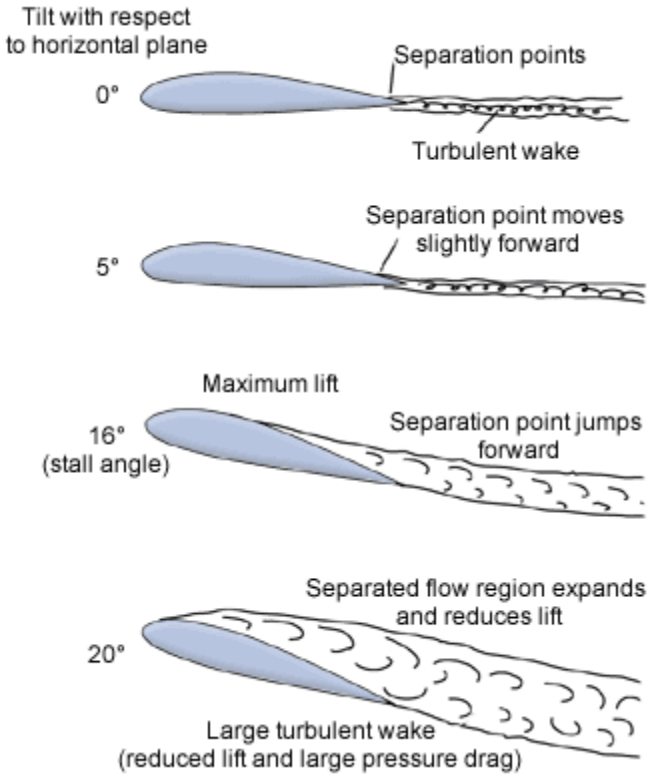


Figure 9: The angle of attack in relation to airflow over the wing (Lapeeraviation.com)

1.18.2 What are the signs of an impending stall?

1.18.2.1 Prior to the stall occurring the aircraft may experience one or more of the

following symptoms:

- High nose angle
- low airspeed
- Buffeting controls
- Ineffective roll controls
- Stall warning sound or light

1.18.3 What happens to an aircraft after a stall occurs?

1.18.3.1 The aircraft will experience a nose down pitching tendency. An aileron input may cause the aircraft to enter into a spin.

1.19 Useful or effective investigation techniques

1.19.1 No new methods were applied.

2. ANALYSIS

2.1 Both occupants on the board the aircraft were pilots. The passenger had recently converted to the Aermacchi MB-326 (Impala) jet aircraft. The passenger was also rated on the Cirrus SR-22 and the Atlas Angel turbine powered aircraft.

2.2 The investigation could not accurately determine who was in control of the aircraft at the time of the accident.

2.3 It is probable, that if the passenger had been flying the aircraft at the time of the accident, the expectation of additional power (having last flown a jet aircraft) available to climb out of the valley may have played a role.

2.4 Apart from the PIC holding a CPL and an instructor's rating, the passenger held a jet rating, which could be regarded, in high esteem.

2.5 The weather on the day was fine with no risk of inadvertent IMC conditions.

2.6 With high-tension cables in close vicinity to the flight path, it is probable that the

pilot flying rapidly increased the angle of attack of the aircraft in an attempt to avoid the cables. This may have contributed to the loss of lift. The passenger in the aircraft had just completed a high-performance jet aircraft rating. This may have led the passenger to believe that the aircraft possessed sufficient power to exit the valley.

2.7 The investigation determined that the most probable cause is that the aircraft experienced a loss of airspeed while attempting to climb out of the valley. This led to a stall condition, which caused the aircraft to impact terrain due to insufficient altitude for recovery.

3. CONCLUSION

3.1 Findings

Occupants

3.1.1 The PIC of the aircraft held a valid CPL and an instructors rating and was adequately rated to operate the aircraft. The PIC's aviation medical certificate was valid.

3.1.2 The passenger held a PPL, which expired 4 days prior to the accident. The passenger's aviation medical certificate was valid. The passenger had experience on high-performance turbine-powered aircraft.

3.1.3 The C172 is a single pilot-operated aircraft with dual controls. Therefore, whether or not the passenger's PPL had expired does not affect the operations of the aircraft in any way. The PIC met all the requirements to carry out the flight.

Aircraft

3.1.4 The aircraft was in possession of a valid certificate of release to service and a valid certificate of airworthiness.

3.1.5 The endurance of the aircraft as stated in the request to taxi was 3 hours.

3.1.6 No prior technical issues were reported relating to the aircraft and all systems were in working order.

3.2 Probable cause

3.2.1 The most probable cause is that the aircraft experienced a loss of airspeed while attempting to climb out of the valley. This led to a stall condition, which caused the aircraft to impact terrain due to insufficient altitude for recovery.

3.3 Contributing factors

3.3.1 With high-tension cables in close vicinity to the flight path, it is probable that the pilot flying rapidly increased the angle of attack of the aircraft in an attempt to avoid the cables. This may have contributed to the loss of lift.

3.3.2 The passenger in the aircraft had just completed a high-performance jet aircraft rating. This may have led the passenger to believe that the aircraft possessed sufficient power to exit the valley.

3.3.3 AIC 20-1 (see Appendix A) warns pilots of Cape Griffon birds near the accident area. The pilot may have taken evasive action to avoid impacting a bird.

4. SAFETY RECOMMENDATIONS

4.1 None.

5. APPENDICES

5.1 Annexure A (AIC 20-1, dated 01-12-15)
5.2 Annexure B (Airspace of accident site)
5.3 Annexure C (National Transportation Safety Board: Preventing stalls at low altitude)

ANNEXURE A

	REPUBLIC OF SOUTH AFRICA *CIVIL AVIATION AUTHORITY*	*CAA* *Private Bag X08* *Waterkloof* *0145*
Tel: (012) 346 5566 *Fax: (012) 346 6059* *E-Mail: mail@caa.co.za*	***AERONAUTICAL INFORMATION CIRCULAR***	***AIC*** *20·1* *01-12-15*

OPERATION OF AIRCRAFT

GENERAL

AVIATION DISTURBANCE OF CAPE GRIFFONS IN THE MAGALIESBERG

Λ *Indicates changes.*

Λ *This AIC replaces AIC 20·1 dated 93-11-15.*

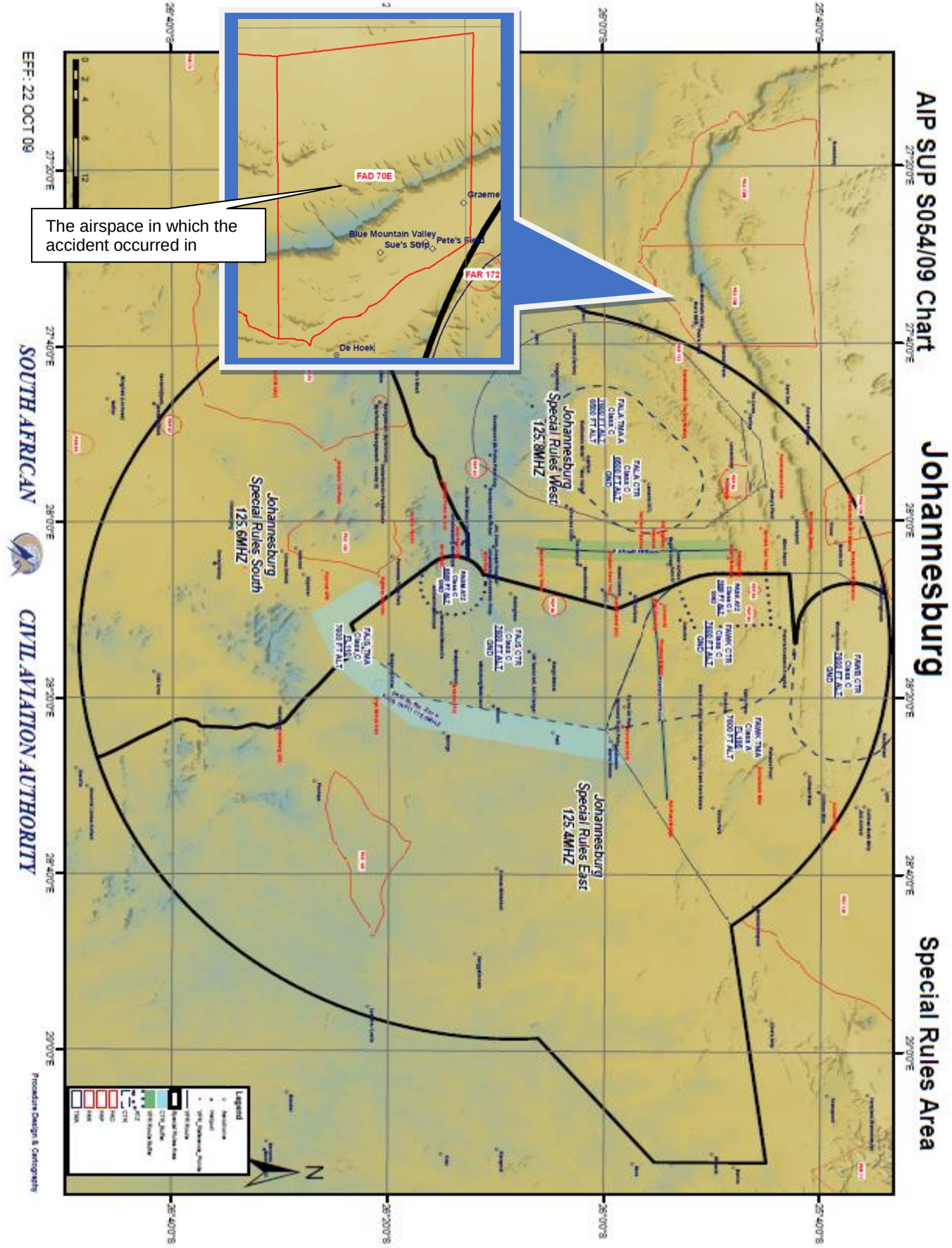
Λ1. *Cape Griffons are found in three localities in the Magaliesberg. Scheerpoort, which is situated above the Magalies River inflow to Hartebeespoort Dam, houses the largest colony numbering about 500 Cape Griffons, the Roberts' Farm colony at Olifantspoort near Rustenburg has more than 120 birds. At the Nooitgedacht colony, which lies between Scheerpoort and Roberts' Farm, there are now more than 200 mature Cape Griffons and the number is increasing at a steady rate. Cape Griffons are among those species in South Africa that are regarded as vulnerable, and this means that any negative influence on the species could give a serious blow to the total population and endanger the survival of the species. The birds are sensitive to disturbance at the nests and sleeping places and will often, after serious human disturbance, not use the nests again. This means that vultures that abandon their nests must contend for other nesting places in the colony and this creates stress within the colony. Factors that cause disturbance are, among others, direct human disturbance, heavy calibre rifle fire, explosions, nearby air traffic, stone throwing by people passing near the colony, vehicle noises in the valley below the colonies, and so on.*

Λ2. *The Vulture-study Group (VSG) has for years been working on the preservation and monitoring of the Cape Griffons in the Magaliesberg and are running a specialist project, namely the SASOL Vulture-monitoring project (VMP), in the Magaliesberg and surrounding areas. Monitoring the numbers and the food supply of the vultures, limiting disturbances, studying the influence of human activities on the birds, communicating with landowners and the public, and being engaged in various other activities, make up the functions of the VMP.*

Λ3. *The VSG believes that most of the disturbances by aircraft at colonies are caused unknowingly by the pilots and make an appeal to pilots to avoid the areas. The specific grid reference of each colony is given at the end of this document. The VSG also requests pilots not to approach and attempt to follow vultures in flight with aircraft of any kind. Observations by members of the SASOL VMP indicate that vultures clearly exhibit fear of aircraft, except gliders, and that this leads to perturbation and stress. It is actually astonishing that no great air disaster has as yet occurred in the Magaliesberg, considering that pilots often risk coming dangerously close to vultures in flight. Microlight aircraft, together with a few helicopters, are at present the main source of disturbance at the colonies.*

4. *The VSG would be happy to provide any information and advice concerning the vultures to pilots and hopes and foresees that they will wish to co-operate in this regard. Pilots are invited to pass on to the VSG any observations on vultures, especially about flying heights, flying speeds and localities where they spotted vultures. Such information is not only interesting, but also very valuable scientifically.*

ANNEXURE B


AIP SUP S054/09 Chart
Johannesburg
Special Rules Area
SOUTH AFRICAN CIVIL AVIATION AUTHORITY
EFF: 22 OCT 09
The airspace in which the accident occurred in
FAD 70E
FAR 172
Graeme
Blue Mountain Valley
Sue's Strip
Pete's Field
De Hoek
Johannesburg Special Rules West 125.8MHZ
Johannesburg Special Rules South 125.6MHZ
Johannesburg Special Rules East 125.4MHZ
Legend
N

NTSB

SAFETY ALERT

National Transportation Safety Board

★ Prevent Aerodynamic Stalls at Low Altitude ★

Avoid this often deadly scenario through timely recognition and appropriate responses

The problem

- While maneuvering an airplane at low altitude in visual meteorological conditions (VMC), many pilots fail to:
  - avoid conditions that lead to an aerodynamic stall,
  - recognize the warning signs of a stall onset, and
  - apply appropriate recovery techniques.
- Many stall accidents that occur in VMC result when a pilot is momentarily distracted from the primary task of flying, such as while maneuvering in the airport traffic pattern, during an emergency, or when fixating on ground objects.[1]
- Aerodynamic stall accidents fall into the "loss of control in flight" category, which is the most common defining event for fatal accidents in the personal flying sector of general aviation (GA).[2]

Related accidents

Sadly, the circumstances of each new accident are often remarkably similar to those of previous accidents. This suggests that some pilots are not taking advantage of the lessons learned from such tragedies that could help them avoid making the same mistakes. The following accident summaries[3] illustrate some common—and preventable—accident scenarios related to aerodynamic stalls:

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[1] See FAA Advisory Circular 61-67C, "Stall and Spin Awareness Training," the links to which are provided in the "Interested in More Information?" section of this safety alert.

[2] Each year, the NTSB investigates about 1,500 GA accidents in which about 475 people are killed. See the NTSB data for GA fatalities for calendar years 2007 – 2011. The defining events information is derived from the NTSB's Review of U.S. Civil Aviation Accidents, 2007-2009. Both data sources are available from the NTSB's Aviation Statistics web page at www.ntsb.gov/data/aviation_stats_2012.html.

[3] The accident reports for each accident referenced in this safety alert are accessible by NTSB accident number from the NTSB's Accident Database & Synopses web page at www.ntsb.gov/aviationquery/index.aspx. (The NTSB accident numbers are CEN12FA271, ANC11FA065, and CEN12CA294, respectively.) Each accident's public docket is accessible from the NTSB's Docket Management System web page at www.ntsb.gov/investigations/dms.html.

- A commercial pilot and a flight instructor were killed after executing a very steep, left, base-to-final turn in the airport traffic pattern in a Beech S35 airplane. The airplane subsequently descended to the ground in a manner consistent with a stall. Evidence indicates that the pilot likely overshot the extended runway centerline when turning to the final approach leg then applied excessive bank angle to correct the course.

- A commercial pilot was killed after his Piper PA-12 airplane lost engine power during takeoff. When the airplane was about 200 to 300 feet above the ground, it turned to the left as if the pilot were attempting to return to the airstrip, then it pitched down abruptly and descended in a steep, nose-down attitude, consistent with a stall. The accident site was adjacent to a road and about 300 yards from a clear field, both of which were suitable potential landing areas.

- The pilot of an RV-6 experimental airplane was flying over a beach area while a friend watched from the ground. The pilot was on his third low-altitude pass when he initiated a "tight left turn" then felt what he described as a "bump/drop" as if the airplane's "left wing lost lift." The left wing dropped, and the airplane descended to the water below, consistent with a stall. The pilot, who sustained serious injuries, had about 15 hours total time in RV-6 airplanes.

What can pilots do?

- Be honest with yourself about your knowledge of stalls and your preparedness to recognize and handle a stall situation in your airplane. Seek training to ensure that you fully understand the stall phenomenon, including angle-of attack (AOA) concepts and how elements such as weight, center of gravity, turbulence, maneuvering loads, and other factors affect an airplane's stall characteristics.

- Remember that an aerodynamic stall can occur at any airspeed, at any attitude, and with any engine power setting.

- Remember that the stall airspeeds marked on the airspeed indicator (for example, the bottom of the green arc and the bottom of the white arc) typically represent *steady flight speeds at 1G* at the airplane's maximum gross weight in the specified configuration. Maneuvering loads and other factors can increase the airspeed at which the airplane will stall. For example, increasing bank angle can increase stall speed exponentially. Check your airplane's handbook for information.

- Reducing AOA by lowering the airplane's nose at the first indication of a stall is the most important immediate response for stall avoidance and stall recovery.

- Manage distractions when maneuvering at low altitude so that they do not interfere with the primary task of flying.

- Resist the temptation to perform maneuvers in an effort to impress people, including passengers, other pilots, persons on the ground, or others via an onboard camera. "Showing off" can be a deadly distraction because it diverts your attention away from the primary task of safe flying.

- Understand that the stall characteristics of an unfamiliar airplane may differ substantially from those of airplanes with which you have more flight experience.

Interested in more information?

Education and training are essential to improving GA safety. The Federal Aviation Administration (FAA) Safety Team (FAASTeam) provides access to online training courses, seminars, and webinars as part of the FAA's "WINGS—Pilot Proficiency Program." The program includes targeted flight training designed to help pilots develop the knowledge and skills (including flight by reference to instruments) needed to achieve flight proficiency and to assess and mitigate the risks associated with the most common causes of accidents. The courses listed below and others (many of which were developed by the Aircraft Owners and Pilots Association [AOPA] Air Safety Institute, a division of AOPA Foundation), as well as seminar and webinar information, can be accessed from the FAASTeam website at www.faasafety.gov. (Course access requires login through an existing or creation of a free FAASTeam account.)

- Essential Aerodynamics: Stalls, Spins, and Safety
- Avoiding Loss of Control
- Maneuvering: Approach and Landing
- Positive Aircraft Control

Other resources:

- The AOPA Air Safety Institute offers several interactive courses, presentations, publications, and other safety resources that can be accessed from its website at www.aopa.org/asf/. (Course access requires creation of a free account.)

- "Airplane Flying Handbook" (FAA-H-8083-3A) provides guidance about stalls and spins (including accelerated maneuver stalls) in chapter 4 and discusses stalls in the airport traffic pattern in chapter 8. The handbook can be accessed from the FAA's website at www.faa.gov.

- "Stall and Spin Awareness Training" (FAA Advisory Circular [AC] 61-67C) and "Airmen Transition to Experimental or Unfamiliar Airplanes" (FAA AC 90-109) can be accessed from the FAA's Regulatory and Guidance Library web page at rgl.faa.gov.

- "Pilot's Handbook of Aeronautical Knowledge" (FAA-H-8083-25A) discusses aeronautical decision making and risk management in chapter 17. It provides basic risk management tools (including the "IMSAFE" health checklist, the "DECIDE" process for aeronautical decision making, the "PAVE" risk assessment checklist, and other tools). The handbook can be accessed from the FAA's website at www.faa.gov.

- A Personal Minimums Checklist can be accessed from the FAA's Guidance and Documents website at www.faa.gov/training_testing/training/fits/guidance/.

This NTSB safety alert and others can be accessed from the NTSB's Safety Alerts web page at www.ntsb.gov/safety/safety_alerts.html.