Aviation Investigation Final Report

Location:	Truckee, California	**Accident Number:**	WPR21FA228
Date & Time:	June 15, 2021, 10:45 Local	**Registration:**	N89423
Aircraft:	CIRRUS DESIGN CORP SR20	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The student pilot recalled that, during takeoff on an instructional flight, the airplane's stall warning indicator activated and that the flight instructor deployed the Cirrus airframe parachute system. The student pilot did not remember any other events during the accident flight but stated that he likely conducted the takeoff given his experience during previous training flights.

A pilot-rated witness observed the accident airplane's departure and stated that the airplane appeared to make shallow right turns, consistent with right crosswind and downwind turns. The witness stated that he expected the wings to level; however, the airplane abruptly banked to the right 90°, and the nose pitched down. The parachute deployed from the airplane, which was followed by the airplane descending below the tree line and out of the witness' view. The witness stated that he heard the sound of the airplane impacting the terrain.

Postaccident examination of the airframe and engine revealed no evidence of a mechanical failure or malfunction that would have precluded normal operation. A review of recoverable data module data showed that, throughout the flight, the airplane's flaps were at the 50% position. During the takeoff climb, the airplane's indicated airspeed continued to increase gradually, reaching a maximum of 89 knots. The airspeed then began to decrease, and the airplane entered a climbing right turn to a maximum GPS altitude of 6,391 ft, about 500 ft above ground level. Before the parachute was activated, the stall warning was recorded three times, including when the bank angle was 81°, and the electronic stability and protection system's roll mode was active for 2 seconds.

The airplane's *Pilot Operating Handbook* showed that, at the airplane's maximum gross weight and with a forward center of gravity, 50% flap position, and 60° bank angle, the airplane's stall

speed is 89 knots indicated airspeed. With the same data except for an aft center of gravity, the stall speed is 85 knots indicated airspeed.

The student pilot likely exceeded the airplane's critical angle of attack during a turn, which resulted in an aerodynamic stall, a low-altitude parachute deployment, and an impact with terrain. The flight instructor was likely delayed in his attempted remedial action before deploying the airplane's parachute system.

Postaccident examination of the airframe and engine revealed no evidence of a mechanical failure or malfunction that would have precluded normal operation.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The student pilot's exceedance of the airplane's critical angle of attack during a turn and the flight instructor's delayed remedial action, resulting in an aerodynamic stall and a subsequent impact with terrain.

Findings

Aircraft	Angle of attack - Not attained/maintained
Personnel issues	Aircraft control - Student/instructed pilot
Personnel issues	Delayed action - Instructor/check pilot

Factual Information

History of Flight

Initial climb	Loss of control in flight (Defining event)
Initial climb	Off-field or emergency landing

On June 15, 2021, about 1045 Pacific daylight time, a Cirrus Design Corporation SR20 airplane, N89423, was substantially damaged when it was involved in an accident at Truckee-Tahoe Airport (TRK), Truckee, California. The flight instructor sustained fatal injuries, and the student pilot sustained serious injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

Review of the recorded communication between the air traffic controller and accident pilots revealed that the controller had issued taxi instructions to runway 20. Shortly thereafter, the pilots transmitted that they were ready for takeoff from runway 20 and requested a closed traffic pattern. The controller advised the pilots of the wind conditions, acknowledged a right closed traffic pattern, and cleared the flight for takeoff. No further radio communications between the controller and the pilots were recorded.

The student pilot recalled few details of circumstances surrounding the accident. He did recall that the stall warning indicator activated during takeoff and that the flight instructor deployed the Cirrus airframe parachute system (CAPS). The student pilot stated that he likely performed the takeoff given that he "had been taking off for at least a few weeks."

The airplane was equipped with a recoverable data module (RDM) that recorded flight, engine, and autopilot data in 1-second intervals. A review of the data showed that the airplane began its takeoff roll about 1042:37 and that the airplane pitched up to rotate about 1043:01. The airplane's airspeed continued to increase gradually during the next 15 seconds, reaching a maximum indicated airspeed of 89 knots. As the airplane's airspeed decreased, the airplane continued to climb to a maximum GPS altitude of 6,391 ft, about 500 ft above ground level.

A pilot rated witness reported that, while standing on the airport ramp of TRK, he observed the accident airplane depart from runway 20. The airplane appeared to make a shallow right turn, consistent with a right crosswind and downwind turns. About the time the witness expected the wings to level, the airplane abruptly banked about 90° to the right and pitched down in a nose low attitude. The witness stated that the parachute simultaneously deployed as the airplane, descended below the tree line out of visual sight. The witness heard the sound of the airplane as it impacted the terrain. The witness added that at the time of departure, they observed an airport sign that indicated a density altitude of 7,100 ft.

Recorded automatic dependent surveillance-broadcast (ADS-B) data provided by the Federal Aviation Administration (FAA) showed that the airplane departed at 1042:49 and that, at 1044:05, it had climbed to an altitude of 6,325 ft and was flying along a southwesterly heading. At 1044:14, the airplane was at an altitude of 6,300 ft and on a northerly heading. The airplane remained on a northerly heading and continued to descend. The last ADS-B data point, at 1044:21, indicated that the airplane was at an altitude of 6,050 ft and was about 116 ft south of the accident site. Figure 1 shows the airplane's flight track.

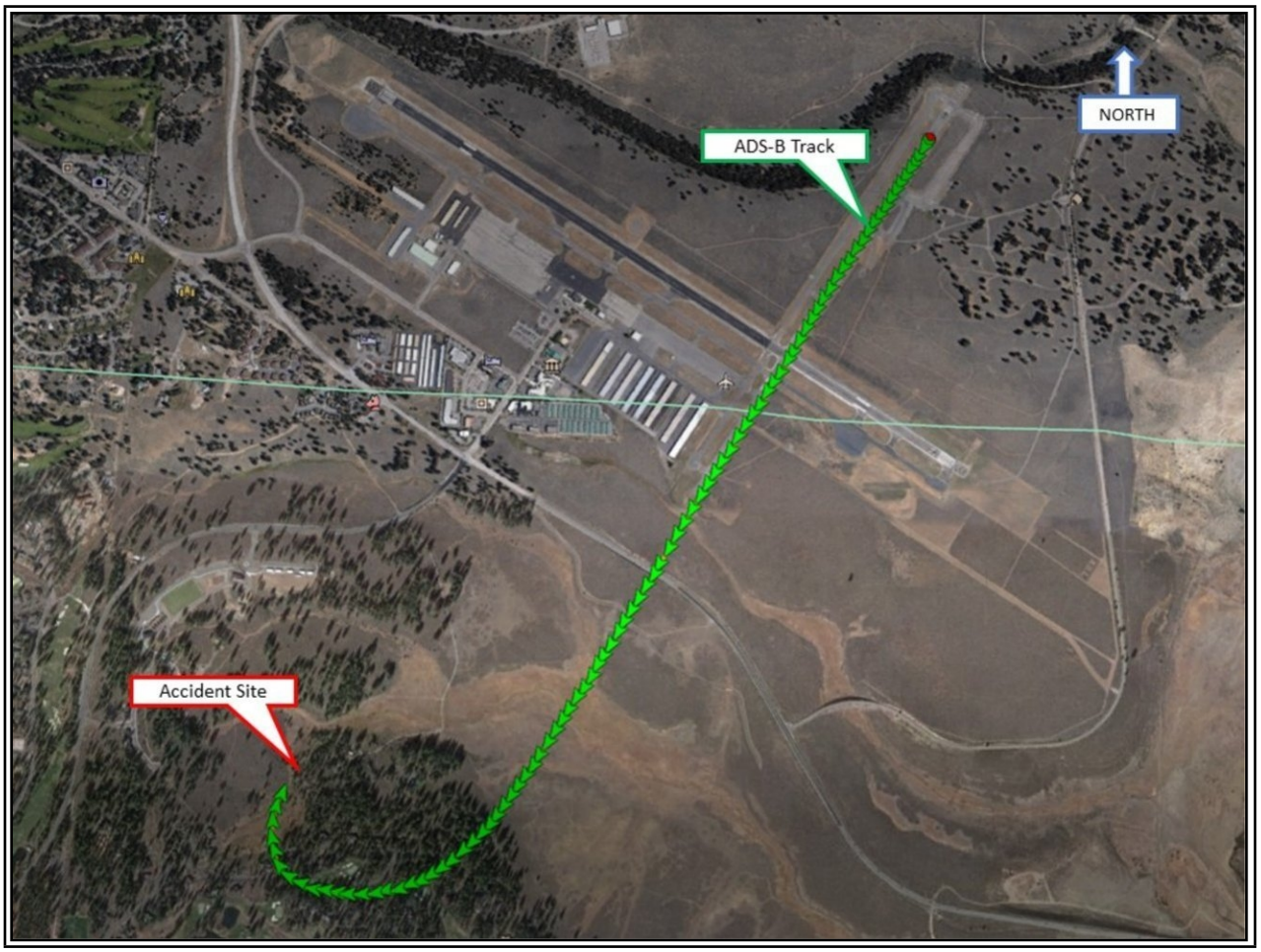

Figure 1. Airplane flight track based on ADS-B data.

A pilot-rated witness reported that he observed the accident airplane's departure, stating that the airplane appeared to make shallow right turns, consistent with a right crosswind and downwind turns. About the time that the witness expected the wings to level, the airplane abruptly banked about 90° to the right and pitched down in a nose-low attitude. The witness stated that the airplane's parachute deployed as the airplane descended below the tree line and out of his view. The witness heard the sound of the airplane's impact with terrain. The witness added that, at the time of departure, an airport sign indicated that the density altitude was 7,100 ft.

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	24,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	November 6, 2021
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	January 6, 2020
Flight Time:	(Estimated) 661.3 hours (Total, all aircraft), 112 hours (Total, this make and model), 592.8 hours (Pilot In Command, all aircraft)		

Student pilot Information

Certificate:	Student	**Age:**	47,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	January 29, 2021
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 23 hours (Total, all aircraft), 23 hours (Total, this make and model)		

The flight instructor completed about 12 flight hours of dual instruction with another flight instructor in the accident airplane about 3 months before the accident flight.

The student pilot's 24 hours of total flight experience included dual instruction in the accident airplane make and model with a flight instructor.

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N89423
Model/Series:	SR20	**Aircraft Category:**	Airplane
Year of Manufacture:	2014	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	2255
Landing Gear Type:	Tricycle	**Seats:**	5
Date/Type of Last Inspection:	June 2, 2021 Annual	**Certified Max Gross Wt.:**	3020 lbs
Time Since Last Inspection:	16 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2699.8 Hrs as of last inspection	**Engine Manufacturer:**	Continental
ELT:	C126 installed, activated	**Engine Model/Series:**	IO-360-ES (26)
Registered Owner:	SIERRA SKYPORT LTD	**Rated Power:**	210 Horsepower
Operator:	Mountain Lion Aviation	**Operating Certificate(s) Held:**	None

The airplane was manufactured with the standard CAPS installed. The airplane's *Pilot Operating Handbook* showed no minimum altitude for deployment. During the manufacturer's test flight program, the CAPS had a demonstrated deployment altitude of less than 400 ft and a recommended maximum indicated airspeed of 133 knots.

The airplane was equipped with a Garmin electronic stability and protection (ESP) system, which was designed to provide automatic control inputs to preclude airplane operation outside the normal flight envelope. The system works to maintain the desired pitch, roll, and airspeed by automatically engaging one or more servos when the airplane is near a defined pitch, roll, or airspeed operating limit. The servos engage when the ESP system exceeds one or more of the conditions beyond the normal flight parameters. Servo engagement is perceived by the pilot as resistance to flight control movement in the undesired direction when the airplane approaches a steep attitude or high airspeed. Roll limit indicators are displayed on the roll scale at 45° right and left. If an airplane's roll attitude exceeds 45° in either direction, the ESP system would engage, and the left or right roll limit indicator would move to 30°. The system would disengage as roll attitude decreases.

The airplane's RDM showed that, throughout the flight, the flap switch was at the 50% position. The RDM also showed that the stall warning activated three times: at 1044:09 with an indicated airspeed of 69 knots, a 12° pitch attitude, and an 11° bank; at 1044:13 with an indicated airspeed of 78 knots, a 4° pitch attitude, and a 36° bank; and at 1044:16 with an indicated airspeed of 71 knots, a -16° pitch attitude, and an 81° bank. The ESP system activated in roll mode at 1044:14 and 1044:15 as the airplane entered a steep right roll. The

CAPS activated shortly thereafter, and the recording ended at 1044:21. Figure 2 shows the RDM data overlaid on an image of the area surrounding the accident site.

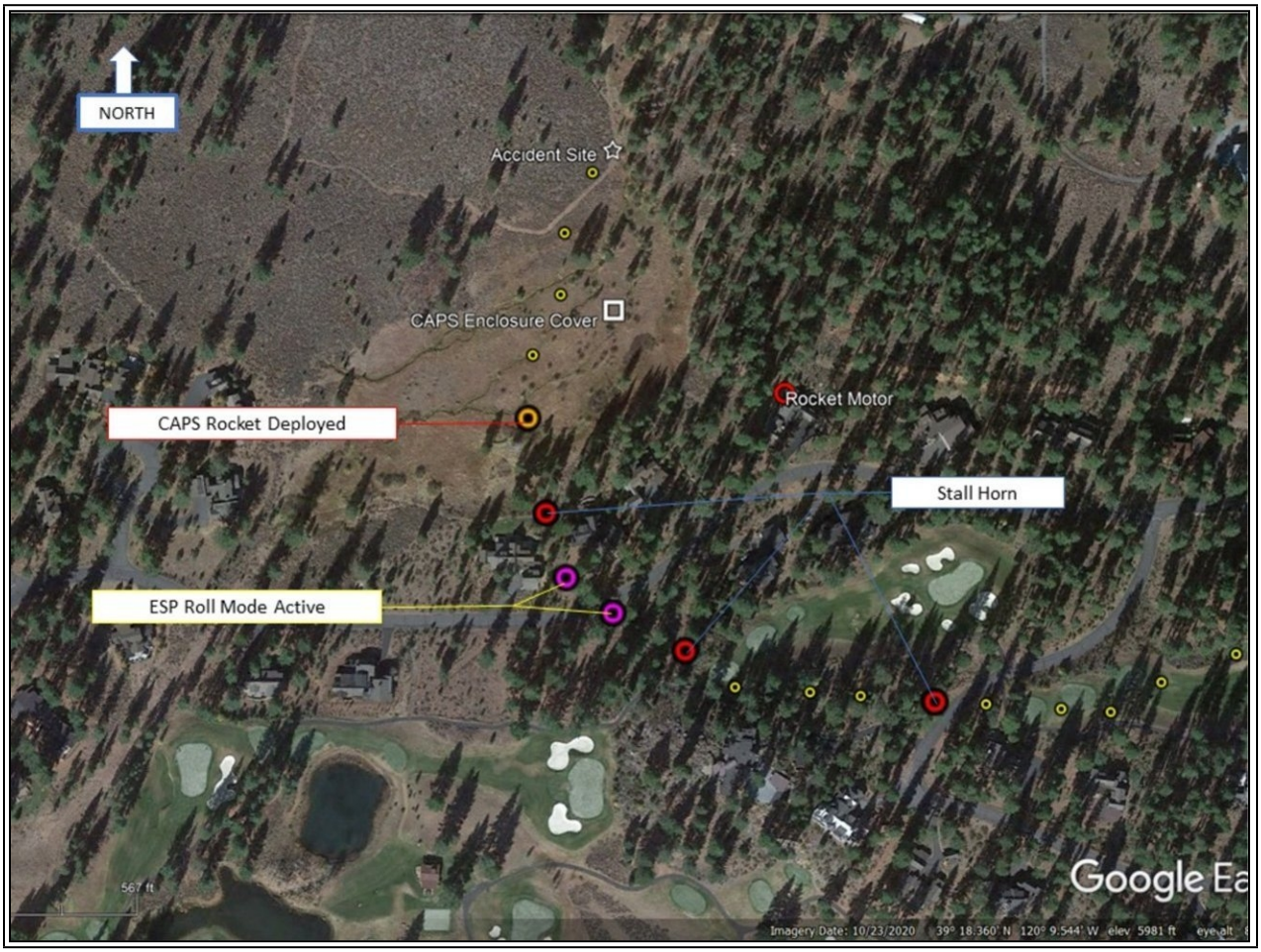

Figure 2. Airplane's flightpath along with RDM-recorded events.

According to the airplane's *Pilot Operating Handbook* (section 5, Performance Data, Stall Speeds), with an airplane weight of 3,050 pounds the maximum gross weight) and a "Most FWD C.G." with the flaps at 50% and a 60° bank angle (the largest bank angle presented in the data), the stall speed is 89 knots indicated airspeed. With an airplane weight of 3,050 pounds and a "Most AFT C.G." with flaps at 50% and a 60° bank angle, the stall speed is 85 knots indicated airspeed as seen in figure 3.

Weight	Bank Angle	STALL SPEEDS					
		Flaps 0% Full Up		Flaps 50%		Flaps 100%Full Down	
LB	Deg	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3050 Most FWD C.G.	0	69	67	66	63	61	59
	15	70	68	67	65	62	60
	30	74	72	70	68	64	63
	45	81	80	76	75	70	70
	60	95	95	89	90	83	83
3050 Most AFT C.G.	0	69	67	63	60	59	56
	15	75	68	64	61	60	57
	30	77	72	66	64	62	60
	45	83	79	72	71	68	67
	60	99	94	85	85	79	79

Figure 3: View of POH stall speeds

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KTRK,5900 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	11:45 Local	**Direction from Accident Site:**	39°
Lowest Cloud Condition:	Scattered	**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	13 knots / 20 knots	**Turbulence Type Forecast/Actual:**	Terrain-Induced / Unknown
Wind Direction:	230°	**Turbulence Severity Forecast/Actual:**	Unknown / Unknown
Altimeter Setting:	30.27 inches Hg	**Temperature/Dew Point:**	22°C / -2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Truckee, CA	**Type of Flight Plan Filed:**	None
Destination:	Truckee, CA	**Type of Clearance:**	VFR
Departure Time:		**Type of Airspace:**	Class D

Airport Information

Airport:	TRUCKEE-TAHOE TRK	**Runway Surface Type:**	Asphalt
Airport Elevation:	5904 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	20	**IFR Approach:**	None
Runway Length/Width:	4654 ft / 75 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	39.305568,-120.15393

The airplane impacted terrain about 1 mile southwest of the departure end of runway 20 with the parachute deployed but still attached to the airframe. The airplane came to rest upright in a nose- low attitude of about 15°, on a magnetic heading of about 335°, and at an elevation of 5,905 ft. No visible ground scars were observed around the wreckage. The parachute rocket motor was located about 450 ft southeast of the wreckage, and the parachute cover was located about 250 ft south of the wreckage. The fuselage and wings were mostly intact, and the forward portion of the fuselage exhibited impact damage. Flight control continuity was established from all primary flight control surfaces to the left and right cockpit controls. Both flight control sticks exhibited impact damage. No separations in the flight control cables were observed.

Examination of the airframe and engine revealed no evidence of a mechanical anomaly that would have precluded normal operation.

Examination of the flap actuator and electronic flap relay by the airplane manufacturer found no evidence indicating that either part was faulty or nonfunctional. Examination of the propeller governor by an FAA repair station found no evidence indicating oil contamination or a failure of the governor.

Examination of the recovered airframe and engine did not reveal evidence of any mechanical anomalies that would have precluded normal operation.

Medical and Pathological Information

An autopsy of the flight instructor was performed by the Placer County Sheriff-Coroner's Office in Roseville, California. His cause of death was multiple blunt force injuries.

Toxicology testing performed on the flight instructor's specimens at the FAA Forensic Sciences Laboratory produced negative results.

Additional Information

The FAA's *Pilot's Handbook of Aeronautical Knowledge* (H-8083-25A), stated that an aerodynamic stall results from a rapid decrease in lift caused by the separation of airflow from the wing's surface brought on by exceeding the critical angle of attack. The handbook defined angle of attack as the acute angle between the chord line of an airfoil and the direction of the relative wind. The handbook further stated that an aerodynamic stall can occur when an airplane flies too slowly or when higher wing loads are imposed due to maneuvers such as pull-ups or banked flight.

Preventing Similar Accidents

Prevent Aerodynamic Stalls at Low Altitude (SA-019)

The Problem

While maneuvering an airplane at low altitude in visual meteorological conditions, 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 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.

What can you 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.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-019.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Gutierrez, Eric
Additional Participating Persons:	Ryan Branch; FAA; Reno, NV Brad Miller; Cirrus Design Corp; Duluth, MN
Original Publish Date:	December 7, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=103268