Aviation Investigation Final Report

Location:	SCHELLVILLE, California	**Accident Number:**	WPR17FA150
Date & Time:	July 13, 2017, 12:45 Local	**Registration:**	N821SG
Aircraft:	CIRRUS DESIGN CORP SR22T	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of engine power (total)	**Injuries:**	2 Fatal, 1 Serious, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot and three passengers departed on a personal cross-county flight. Several witnesses located at or near the airport reported that, while the airplane was climbing, they heard the engine "sputter" or "pop" a few times as the airplane flew over their position. Subsequently, they heard a louder sound and, shortly afterward, observed the deployment of the airplane's parachute system. Most of the witnesses observed the airplane descending just before they lost sight of it at tree-top level, which was just before the airplane impacted the ground.

A review of the airplane's flight data revealed that, shortly after takeoff, the airplane's engine lost power. At that time, the airplane's airspeed decreased and approached the stall speed; the stall warning system activated twice. From the first stall warning to the end of the data, the airplane's airspeed was between 71 and 75 knots and the airplane was in a bank of about 27°; the airplane's stall speed is 76 knots at a bank angle of 30°. The airplane's parachute system was deployed when the airplane's altitude was about 130 ft mean sea level.

When engine power was lost, the pilot failed to maintain an adequate airspeed and did not follow the emergency procedures for a low-altitude engine failure in the *Cirrus SR22T Pilot's Operating Handbook* (POH), which were to lower the nose, establish an appropriate glide airspeed, and accomplish a landing straight ahead, turning only to avoid obstructions.

Postaccident examination of the airframe and engine revealed no anomalies that would have precluded normal operation. However, examination of the top spark plugs in the ignition system revealed that their insulators were dark in color, consistent with a rich fuel/air mixture.

The POH stated that the electric fuel pump switch must be set to the "Boost" position for takeoff and climbout. However, the flight data indicated an excessively high fuel flow to the engine that was consistent with the electric fuel pump switch selected to the "High Boost/Prime" position (which is used for priming the fuel pump before engine start) at the time of the loss of engine power. The flight data indicated that the fuel flow increased and peaked at a level that was about 6.5% higher than the average climbout fuel flow just before the power loss. The National Transportation Safety Board's investigation of an accident involving another Cirrus SR22T airplane found that the airplane experienced an engine power loss following that pilot's inadvertent activation of the High Boost/Prime switch, and flight data from that airplane revealed a similar increase in the fuel flow before the loss of engine power.

For this accident, both the fuel flow and manifold pressure exceeded the manufacturer's parameters in the POH, peaking about the time of the engine power loss. Further, given that the engine's speed exceeded the manufacturer's upper warning range just before the loss of engine power, the engine components and the fuel system were likely operating effectively before the loss of power. Thus, it is likely that the accident pilot improperly selected the High Boost/Prime position during the climbout, which resulted in the excessive fuel flow to the engine and the subsequent loss of engine power.

Probable Cause and Findings

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

The pilot's failure to maintain adequate airspeed after a loss of engine power, which resulted in an aerodynamic stall at a low altitude from which the pilot was unable to recover. The loss of engine power resulted from the pilot's improper selection for the electric fuel pump setting during climbout, which caused an excessively high fuel flow to the engine. Contributing to the accident was the pilot's failure to follow the airplane manufacturer's emergency procedures for a low-altitude loss of engine power.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	Airspeed - Not attained/maintained
Aircraft	Angle of attack - Not attained/maintained
Personnel issues	Use of equip/system - Pilot
Aircraft	Fuel pump - Incorrect use/operation
Personnel issues	Use of checklist - Pilot

Factual Information

History of Flight

Initial climb	Loss of engine power (total) (Defining event)
Initial climb	Aerodynamic stall/spin
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On July 13, 2017, about 1245 Pacific daylight time, a Cirrus Design Corporation SR22T airplane, N821SG, was destroyed when it impacted terrain in Schellville, California, about 1/2 mile west of Sonoma Skypark Airport (0Q9), Sonoma, California. The private pilot and a passenger were fatally injured, one passenger was seriously injured, and one passenger received minor injuries. The airplane was owned by DDLV LLC and operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions prevailed for the time of the accident, and no flight plan had been filed for the cross-country flight. The flight originated from 0Q9 and was destined for Reid-Hillview Airport of Santa Clara County, San Jose, California.

According to data from the airplane's recoverable data module, at 1244:10, the engine power was increased for takeoff. At the start of the takeoff roll, the engine power was about 113%, the manifold pressure was about 37.5 inches of mercury (inHg). The fuel flow was about 43.5 gallons per hour (gph), and the engine speed just above 2,500 rpm.

At 1244:30, the time of the takeoff rotation, the airplane's indicated airspeed was about 73 knots. The data showed that the airplane then accelerated and climbed for the next 5 seconds at an airspeed of about 87 knots.

During the climb out, which was conducted at a pitch attitude of about 15° nose up, the manifold pressure was 36.5 inHg, the fuel flow was between 43.2 and 43.8 gph, and the engine speed was at or above 2,500 rpm.

At 1244:40, the engine speed reached a peak value of 2,563 rpm, and the manifold pressure reached its peak value of 37.8 inHg. Two seconds later, the fuel flow reached its peak value of 46.6 gph, and the engine speed decreased to 2,402 rpm during the next second.

At 1244:44, the engine speed and fuel flow parameters began to decrease, and the airplane's airspeed also began to decrease from 86 knots. At this time, the airplane leveled off at an altitude of about 209 ft mean sea level (msl). The airplane's pitch decreased, and then immediately increased, and the airspeed continued to decrease.

At 1244:45, the engine speed was 1,788 rpm, the fuel flow was 40.5 gph, and the airspeed decreased to 81 knots. Three seconds later, when the airspeed was 72 knots, the airplane reached its peak altitude of

227 ft msl, and then the airplane began to descend. At 1244:49, the stall warning system activated. One second later, the engine speed was 1,212 rpm, the altitude was 185 ft msl, the airspeed was 71 knots, and the vertical speed was -608 ft. At 1244:51, the stall warning activated again; at that time, the altitude was 157 ft msl, engine was 1,236 rpm, airspeed was 76 knots, and the vertical speed was -768 ft.

The airplane was equipped with a Cirrus Aircraft Parachute System (CAPS). At 1244:52, the system handle was pulled; at that time, the airplane was banked about 27° to the left, the altitude was about 130 ft msl, and the airspeed was 75 knots. The last recorded data at 1244:53, showed the airplane's altitude was about 90 ft msl, airspeed was about 75 knots, pitch was about 16° nose down, and bank was about 68° to the left and that the engine's speed was 1,174 rpm, and fuel flow was 30.4 gph.

Several witnesses located at or near 0Q9 reported that they heard the engine "sputter" or "pop" a few times as the airplane passed their position. Subsequently they heard a louder sound and shortly thereafter, observed the airplane's parachute system deploying. Most of the witnesses saw the airplane descending just before they lost sight of the airplane at treetop level, which was just before the airplane impacted the ground.

PERSONNEL INFORMATION

The pilot held a private pilot certificate with ratings for airplane single-engine land, and instrument airplane. The pilot was issued a third-class medical certificate on July 11, 2017, with no limitations. The pilot's application for his medical certificate indicated that he had accumulated 550 hours of total flight experience, 30 hours of which were accumulated in the previous 6 months.

A review of the pilot's logbook revealed that he had logged about 604 hours of total flight experience. The pilot logged about 390 hours in the Cirrus SR22; most of this time was logged in the accident airplane, which he began flying on August 1, 2011. In the previous 7 months, the pilot flew the accident airplane on nine flights (not including the accident flight) with a total flight time of about 19.8 hours.

AIRCRAFT INFORMATION

The low-wing, fixed-gear airplane, was manufactured in 2011. It was powered by a 315-horsepower Continental Motors TSIO-550-series reciprocating engine. The engine was equipped with a three-bladed, constant-speed composite propeller.

The airframe logbook was not located during the investigation. A recovered airplane document revealed that the airplane's most recent conditional inspection was completed on November 10, 2016, at an airframe total time of about 349 hours.

The Cirrus SR22T *Pilot's Operating Handbook* (POH), listed the upper warning range for the engine speed as greater than 2,550 rpm. The manifold pressure upper warning range was between 37.5 and 40.0 of inHg. The normal range for the fuel flow was between 10 and 45 gph. The POH stated that "for maximum power operations (Power lever full forward - 2,500 rpm, 36 inHg manifold pressure), fuel flow should be in the green arc"

The POH section titled *Takeoff Power Check* stated in part the following:

"Check full-throttle engine operation early in takeoff run. The engine should run smoothly and turn approximately 2,500 rpm. All engine parameters are not in caution or warning ranges. Discontinue takeoff at any sign of rough operation or sluggish acceleration…. Manifold pressure may temporarily increase to 36.0 - 37.0 in. Hg on first flight of the day due to cooler oil temperatures and associated higher oil pressures. This is acceptable under these conditions, but normal full throttle manifold pressure should be 36.0 in. Hg. The fuel flow will normally also increase in proportion to the increase in manifold pressure. If manifold pressure exceeds 37.0 in. Hg on takeoff or during full power climbs, reduce power to maintain no more than 37.0 in. Hg."

The POH also listed the stall speeds. At an airplane weight of 3,400 pounds (the maximum gross weight), and no bank angle, the stall speed is at 73 knots at the most forward center of gravity (CG) and at 72 knots at the most aft CG. At 30° of bank, the stall speed is 76 knots, at both the forward and aft CG limits. A warning in the POH stated "extreme care must be taken to avoid uncoordinated accelerated or abused control inputs when close to the stall, especially when close to the ground." Further, a note in the POH stated "altitude loss during a wings level stall may be 250 ft or more."

The POH emergency checklist for an engine failure duirng takeoff at low altitude stated the following:

"If the engine fails immediately after becoming airborne, abort on the runway if possible. If altitude precludes a runway stop but is not sufficient to restart the engine, lower the nose to maintain airspeed and establish a glide attitude. In most cases, the landing should be made straight ahead, turning only to avoid obstructions."

The best glide speed was listed as 88 knots, for all airplane weights.

The POH stated that no minimum altitude for CAPS deployment had been set but that "if circumstances permit, it is advisable to activate CAPS at or above 2,000 ft." The handbook also stated that "at any altitude, once the CAPS is determined to be the only alternative available for saving the aircraft occupants, deploy the system without delay."

The airplane's fuel system consists of an engine driven fuel pump and an electrically powered auxiliary fuel pump. The electric fuel pump is controlled by a three-position rocker switch located in the cockpit center console to the left of the power lever. The forward selection of the switch is the "Boost" position, which is used for takeoff, climb, landing, and switching fuel tanks; the center (neutral) selection is the "Off" position, and the aft selection is the "High Boost/Prime" position, which is used for priming the engine before it is started (and for suppressing vapor formation in flight above 18,000 ft). The engine control panel had a placard that indicated that the fuel pump must be selected to Boost for takeoff, climb, landing, and switching tanks.

The POH stated that the Boost position energizes the fuel pump in the low-speed mode regardless of engine speed or manifold pressure and delivers a continuous 4 to 6 psi boost to the fuel flow. For the High Boost/Prime position, a lockout relay controls the fuel pump operation and allows operation when the manifold pressure is greater than 24 inHg or when the engine speed is less than 500 rpm during engine starting. The High Boost/Prime position delivers a continuous high boost to the fuel flow. The pump is rated at 16 psi and 42 gph.

The manufacturer's airplane maintenance manual provided information about the fuel pump setup. The information stated in part the following: "Advance throttle to 2500 RPM (full power) and turn boost pump on to BOOST position. The recommended fuel flow at 36.5 inHg, at a range between 37.4-40.5 gph."

METEOROLOGICAL INFORMATION

The recorded weather conditions at Petaluma Municipal Airport, Petaluma, California, which was about 8 miles west of the accident site, at 1255, were wind variable at 6 knots, visibility 9 statute miles, sky clear, temperature 25°C, dew point 13°C, and an altimeter setting of 30.00 inHg.

AIRPORT INFORMATION

0Q9 is a privately owned, non-towered airport with a reported field elevation of 20 ft msl. The airport was equipped with an asphalt runway, 08/26 which was 2,480 ft long and 40 ft wide.

WRECKAGE AND IMPACT INFORMATION

The airplane impacted the ground and came to rest upright in the middle of a wheat field. The fuselage was found along a magnetic heading of about 006°. The right wing remained attached to the main fuselage and the left wing had separated. The empennage was separated from the fuselage aft of the avionics bay.

The engine came to rest inverted and about 45° from the fuselage heading. All of the engine mounts were separated. The engine remained attached to the airplane's main fuselage through the throttle control cable and electrical wiring. The three-bladed propeller remained attached to the crankshaft. Two of the blades were separated at the hub and located at the initial impact area. One of the separated blades exhibited leading edge and chordwise paint erosion. The other separated blade was relatively intact. The blade that remained attached to the propeller hub was damaged forward at the tip and displayed chordwise paint erosion at the tip. The propeller spinner was crushed aft around the hub and was slightly deformed toward one side.

A postaccident examination of the airframe and engine revealed that the crankshaft was able to be manually rotated using the propeller, and rotational continuity was established throughout the engine, accessory section, and valve train. During crankshaft rotation, thumb compression and suction were attained on all cylinders. A borescope inspection of the cylinders revealed evidence of normal operational conditions.

Fuel was observed in the line between the fuel metering unit and the fuel manifold valve and tested negative for water contamination. The fuel manifold and fuel injection nozzles were disassembled, and no anomalies were noted with the internal components. The engine-driven fuel pump was damaged by impact forces and was removed for examination. The examination revealed that fuel poured from the fittings, the fuel pump shear drive coupler was intact, and the drive shaft rotated freely when rotated manually. Disassembly of the pump found that the vanes were intact and that there were no signs of contamination. Most of the cabin instrumentation was substantially damaged by impact forces, including the electric fuel pump control switch, precluding a determination of the position of the switch.

Examination of the ignition system found that for the top sparkplugs that were intact, their insulators were dark in color, which was consistent with a rich fuel/air mixture. The left and right magnetos produced spark at each of their distribution towers. The ignition key was found in the "both" position.

The ignition switch was removed and examined, and no anomalies were observed. Additionally, the wiring from the ignition switch to the engine firewall was examined and no anomalies were observed.

Postaccident examination of the airframe and engine revealed no preimpact mechanical malfunctions or failures that would have precluded normal operation.

MEDICAL AND PATHOLOGICAL INFORMATION

Regional Pathology and Autopsy Services, San Leandro, California, conducted an autopsy of the pilot. The pilot's cause of death was "multiple blunt force injuries."

Toxicology testing performed at the FAA's Forensic Sciences Laboratory, identified fexofenadine in the pilot's blood and urine specimens and azacyclonol in the pilot's urine specimens but not his blood specimens. The testing was negative for carbon monoxide and ethanol.

Fexofenadine is a medication available by prescription and over the counter. It is a non-sedating antihistamine used to relieve allergy symptoms. Fexofenadine is generally acceptable for use by pilots while flying. Azacyclonol is a metabolite of fexofenadine.

TEST AND RESEARCH

The accident airplane's Heads Up Technologies recoverable data module, a crash-hardened storage unit installed in the tail of the airplane, was recovered at the accident site and sent to the National Transportation Safety Board's Vehicle Recorders Laboratory in Washington, DC, for download. A review of the data from seven previous flights revealed that during three of the flights, the fuel flow exceeded 41.0 gph during takeoff and the manifold pressure was greater than 36.5 inHg. The flight data was further analyzed to determine the peak fuel flow and manifold pressure during the 23 seconds after applying takeoff power, to compare the data with those (46.6 gph and 37.8 inHg respectively) for the same period during the accident flight. A flight on December 7, 2016, indicated a peak fuel flow of 42.4 gph and a peak manifold pressure of 37.3 inHg. A flight on January 6, 2017, indicated a peak fuel flow of 43.9 gph and a peak manifold pressure of 37.5 inHg. A flight on March 18, 2017, indicated a peak fuel flow of 41.6 gph, and manifold pressure of 37.1 inHg.

Further, for two of the previous flights, the fuel flow was between about 3.2 and 3.5 gph, when the engine speed was between 1,100 and 1,174 rpm. Before engine start for the accident flight, the fuel flow was 21.4 gph, which was consistent with activation of the High Boost/Prime switch. The electric fuel boost pump operation was not a recorded parameter. Before takeoff, the fuel flow was 3.5 gph, when the engine speed was 1,078 rpm.

ADDITIONAL INFORMATION

Related Cirrus SR22T Accident

On September 7, 2018, a Cirrus SR22T airplane experienced a complete loss of engine power shortly after takeoff from an airport in Kennett, Missouri. While trying to resolve an issue with his headset, the pilot inadvertently placed the electric fuel boost pump in the High Boost/Prime position shortly after takeoff. A review of the downloaded data from the accident flight revealed that, after the electric fuel pump switch was activated to the High Boost/Prime position during the climb out, the fuel flow increased about 2.55 gph to between about 41.0 and 42.9 gph. The fuel flow then slightly decreased during the next several seconds. The manifold pressure initially indicated about 35.2 inHg, and then decreased as the engine's speed decreased. After the engine power loss, the fuel flow remained stable between 38.3 and 39.6 gph for about 10 seconds.

Cirrus Service Advisory

On May 7, 2018, Cirrus issued Service Advisory SA 18-02, regarding the use of the electric fuel pump in the High Boost/Prime position. The advisory provided a reminder about the POH's intended use of the fuel pump's High Boost/Prime position, which was "priming prior to engine start, and suppressing vapor formation above 18,000 feet with hot fuel." The advisory also stated that "the fuel pump must be set to Boost – but not High Boost/Prime – for takeoff, climb, landing, and for switching fuel tanks," The advisory further stated that "the pilot should monitor fuel flow during takeoff. Fuel flow should never exceed 41 gallons per hour (GPH) and 36.5 inches of manifold pressure. Higher fuel flow rates may result in a rough running engine and/or loss of power."

Pilot Information

Certificate:	Private	**Age:**	38,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	July 11, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 550 hours (Total, all aircraft)		

Passenger Information

Certificate:		**Age:**	Female
Airplane Rating(s):		**Seat Occupied:**	Rear
Other Aircraft Rating(s):		**Restraint Used:**	Unknown
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Passenger Information

Certificate:		**Age:**	Female
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	Unknown
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Passenger Information

Certificate:		**Age:**	Male
Airplane Rating(s):		**Seat Occupied:**	Rear
Other Aircraft Rating(s):		**Restraint Used:**	Unknown
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N821SG
Model/Series:	SR22T NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	2011	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0185
Landing Gear Type:	Tricycle	**Seats:**	5
Date/Type of Last Inspection:	November 10, 2016 Condition	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	348.9 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	C126 installed, not activated	**Engine Model/Series:**	TSIO-550 SER
Registered Owner:	On file	**Rated Power:**	315 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KO69,89 ft msl	**Distance from Accident Site:**	8 Nautical Miles
Observation Time:	12:55 Local	**Direction from Accident Site:**	267°
Lowest Cloud Condition:	Clear	**Visibility**	9 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	25°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	SONOMA, CA (0Q9)	**Type of Flight Plan Filed:**	None
Destination:	SAN JOSE, CA (RHV)	**Type of Clearance:**	None
Departure Time:	12:44 Local	**Type of Airspace:**	

Airport Information

Airport:	SONOMA SKYPARK 0Q9	**Runway Surface Type:**	
Airport Elevation:	20 ft msl	**Runway Surface Condition:**	Dry;Vegetation
Runway Used:	26	**IFR Approach:**	None
Runway Length/Width:	2480 ft / 40 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal, 1 Serious, 1 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal, 1 Serious, 1 Minor	**Latitude, Longitude:**	38.257499,-122.434165(est)

Administrative Information

Investigator In Charge (IIC):	Nixon, Albert
Additional Participating Persons:	Bart Hauger; Federal Aviation Administration; Oakland, CA Laurie Parenteau; Federal Aviation Administration; Oakland, CA Nicole Charnon; Continental Motors Inc; Mobile, AL Brannon Meyer; Cirrus Aircraft; Duluth, MN Rick Beach; COPA Safety Chair; Napa, CA
Original Publish Date:	August 25, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=95566