Aviation Investigation Final Report

Location:	Navasota, Texas	**Accident Number:**	CEN16FA111
Date & Time:	February 28, 2016, 08:59 Local	**Registration:**	N477TC
Aircraft:	CIRRUS DESIGN CORP SR20	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	4 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The flight instructor and the airplane owner, who did not hold a pilot certificate, were practicing takeoffs and landings in the airplane at an uncontrolled airport. Based on logbook records, this was most likely an instructional flight and the owner was most likely flying the airplane. Air traffic control radar and primary flight display data showed that they had performed two touch-and-go landings followed by two full stop landings before the accident. Shortly after taking off following the second full stop landing, while climbing through 550 ft mean sea level (msl) at an indicated airspeed of about 92 knots, the airplane entered a left bank and began to decelerate. The airplane began to descend, and the airspeed subsequently decreased below 75 knots before it began to increase. The airplane reached a 61° left-wing-down attitude at an airspeed of about 79 knots before entering a rapid roll to the right, through an inverted position. At about the same time, the airplane began a rapid pitch down, reaching a 69° nose-down attitude. The airplane briefly recovered to nearly wings level but again began to pitch down until the final recorded data point, which showed the airplane in a 65° nose-down and 45° right-wing-down attitude, at 268 ft msl, and 89 knots indicated airspeed. The airplane impacted terrain about 0.43 miles from the departure end of the runway.

Postaccident examination of the airplane did not reveal any mechanical malfunctions or failures that would have prevented normal operation. Calculations based on the airplane's weight at the time of the accident indicated that, at 1g with flaps up, the aerodynamic stall speed would have been 75 to 78 knots calibrated airspeed. The stall speed in a 60° turn (2 g) would have been 105 to 109 knots. Therefore, it is likely that the combination of a steep left bank and low airspeed resulted in an accelerated aerodynamic stall.

Probable Cause and Findings

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

The flight instructor's delayed remedial action to prevent a stall at an altitude that was too low to recover. Contributing to the accident was the owner/non-certificated pilot's failure to maintain control of the airplane, which resulted in an accelerated aerodynamic stall.

Findings

Personnel issues	Delayed action - Instructor/check pilot
Personnel issues	Aircraft control - Student/instructed pilot
Aircraft	Airspeed - Not attained/maintained
Aircraft	Lateral/bank control - Not attained/maintained

Factual Information

History of Flight

Approach-VFR pattern downwind	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On February 28, 2016, about 0859 central standard time, a Cirrus SR-20, N477TC, collided with terrain following a loss of control near the Navasota Municipal Airport (60R), Navasota, Texas. The flight instructor, the non-certificated pilot/owner who was receiving instruction, and the two passengers were fatally injured. The airplane was substantially damaged. The airplane was registered to Air Akhtar Heating & Air Conditioning LLC and was operated by the pilot/owner under the provisions of 14 *Code of Federal Regulations* Part 91 as a personal flight. Visual meteorological conditions prevailed, and no flight plan was filed. The instructional flight originated from the David Wayne Hook Airport (DWH), Spring, Texas, at 0818.

Radar data indicated that after departing DWH, the airplane turned northwest toward 60R. The last DWH air traffic control communication with the airplane was at 0821. Radar data indicated that the airplane subsequently entered a left downwind to runway 17 at 60R about 0836. The airplane turned onto base leg, turned onto final approach, and descended below radar coverage; at 0837:51, the airplane was on final approach to runway 17.

At 0839:37, radar data indicated a target about 0.75 nautical mile (nm) south of runway 17 at an altitude of 800 ft mean sea level (msl) that was consistent with the airplane having executed a touch-and-go landing on runway 17. The radar data indicated that the airplane then conducted a second touch-and-go landing before conducting a full stop landing about 0844:46. A still photo from a security camera at 60R, an uncontrolled airport, showed the airplane taxiing north on the taxiway at 0847:26.

At 0850:58 the airplane departed 60R, entered a left downwind for runway 17, and executed a second full stop landing. By 0858:51, the airplane had departed runway 17 and was climbing on a south heading.

Data recovered from the airplane's primary flight display (PFD) showed the same flight path as the radar data. In addition to GPS position and altitude, the PFD also recorded other parameters including airspeed, pitch, and roll attitudes. The PFD data indicated that, at 0859:02, while the airplane was climbing through 550 ft msl and about 92 knots indicated airspeed, it began to roll to the left and decelerate. Starting at 0859:06, the airplane started to pitch down and descend. At 0859:10, the airspeed decreased below 75 knots. At 0859:13, the airspeed had increased to about 79 knots, and the airplane had reached 61° left-wing-down before starting a rapid roll to the right, through an inverted position. At about the same time, the airplane began a rapid pitch down, reaching a 69° nose-down attitude.

Radar contact was lost at 0859:15 when the airplane was about .43 nm southeast of the departure end of runway 17 and about 0.16 nm from the accident site. The PFD data continued, and it showed that the

airplane briefly recovered to nearly wings level at 0859:18, but then it began to pitch down again. The final data point recorded by the PFD was at 0859:19, and it showed the airplane in a 65° nose-down and 45° right-wing-down attitude at 268 ft msl and 89 knots indicated airspeed. There were no known witnesses to the accident.

At 0904:14, radar data indicated that another airplane departed runway 17 at 60R and completed one complete circle around the accident location descending from 1,300 ft msl to 600 ft msl before climbing and resuming a downwind entry to runway 17. The pilot of this airplane reported that he was practicing touch-and-go landings when he spotted the wreckage southeast of the airport. He subsequently reported the accident to local authorities. The pilot stated that he did not hear or see the accident airplane in the area before seeing the wreckage.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	67,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:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	January 15, 2016
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	6550 hours (Total, all aircraft)		

Student pilot Information

Certificate:	None	**Age:**	53,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	106 hours (Total, all aircraft), 57 hours (Total, this make and model), 0 hours (Pilot In Command, all aircraft), 32.2 hours (Last 90 days, all aircraft), 32.2 hours (Last 30 days, all aircraft)		

The flight instructor's logbook(s) were not located during the investigation. On the application for his last Federal Aviation Administration (FAA) medical dated January 15, 2016, he reported having a total of 6,550 hours of flight time; 120 of those hours were flown within the previous 6 months. It is unknown how much experience he had in SR-20 airplanes before flying with the airplane owner.

The airplane owner, who was receiving flight instruction, did not hold a student pilot or medical certificate. He had taken a FAA medical examination on October 20, 2015. Due to the pilot's history of arrests, the aviation medical examiner deferred issuing a medical certificate. The FAA requested additional information, which the owner did not supply. On January 20, 2016, the FAA sent a letter to the owner notifying him that they could not determine his eligibility for a medical certificate.

According to the owner's pilot logbook, he had a total of 106 hours of flight time of which 57.1 hours were in SR-20 airplanes. The owner had previously flown with the flight instructor on 11 dual instructional flights, which totaled 25.7 hours.

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N477TC
Model/Series:	SR20	**Aircraft Category:**	Airplane
Year of Manufacture:	2003	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1378
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	January 12, 2016 Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	56 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	487.2 Hrs at time of accident	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-360-ES6B
Registered Owner:	On file	**Rated Power:**	210 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The airplane, serial number 1378, was a four-place, low-wing, single-engine airplane with fixed landing gear. The airplane was manufactured in 2003 and equipped with a Cirrus Airframe Parachute System (CAPS). The owner purchased the airplane on January 12, 2016.

Maintenance records indicated that the last annual inspection on the airframe was completed on January 12, 2016, at a total airplane and Hobbs meter time of 431.5 hours. The Hobbs meter at the time of the accident indicated 487.2 hours.

The airplane was equipped with a 210-horsepower, Continental Motors IO-360-ES6B engine, serial number 357628. The last annual inspection of the engine was completed on January 12, 2016, at an airframe total time of 431.5 hours. The last maintenance entry in the engine logbook was an oil and oil filter change on February 26, 2016, at an airframe total time of 481.6 hours.

There were no entries in the engine logbook showing that the engine had been overhauled or torn down; however, during the postaccident engine examination it was discovered that the crankshaft and bearings were not the original parts installed when the engine was manufactured in 2003. The owner of the

maintenance facility that performed the most recent annual inspections stated that the engine had been removed for a teardown inspection for metal contamination in April 2015. Records of the teardown inspection provided by the maintenance facility and the engine overhaul facility that performed the teardown inspection indicated that the engine overhaul facility completed the teardown inspection on August 17, 2015. A copy of the logbook entry prepared by the engine overhaul facility stated, in part, that the engine was "disassembled for metal contamination due to #6 piston burnt, replace cracked crankshaft with customer supplied New VAR crankshaft, repair 6ea.cylinders as necessary." The owner of the maintenance facility stated that the facility provided the previous airplane owner with the information and records for the engine logbook.

The airplane was fueled twice the day before the accident. The time on the fuel receipt indicated that the last fueling took place at 1655 when the airplane was fueled with 22.6 gallons of 100LL aviation fuel. According to the operator who fueled the airplane, the fuel added had topped-off the fuel tanks. It is not known if the airplane was flown between the last fueling and the accident flight.

Cirrus Aircraft performed stall speed calculations for the airplane. The calculations showed that, at gross weights of 2,904 pounds (full fuel) and 2,688 pounds (20 gallons of fuel), the flaps up stall speeds at 1g would have been 78 knots calibrated airspeed (KCAS) and 75 KCAS, respectively.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	CLL,320 ft msl	**Distance from Accident Site:**	29 Nautical Miles
Observation Time:	14:53 Local	**Direction from Accident Site:**	305°
Lowest Cloud Condition:	Scattered / 3000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Overcast / 6000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots / None	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	180°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.1 inches Hg	**Temperature/Dew Point:**	14°C / 12°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Navasota, TX (60R)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	08:50 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	Navasota Municipal Airport 60R	**Runway Surface Type:**	Asphalt
Airport Elevation:	229 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	17	**IFR Approach:**	None
Runway Length/Width:	5003 ft / 75 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	3 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 Fatal	**Latitude, Longitude:**	30.356388,-96.106666

The accident site was located about 0.43 mile southeast of the departure end of runway 17 at 60R in a lightly wooded area that was surrounded by open pasture. The airplane came to rest in the middle of a field that was bordered by three large trees spaced about 60 ft apart forming a triangular shape around the wreckage. The terrain at the accident site was wet and muddy. The main wreckage consisted of the entire airplane with a minor amount of airplane debris scattered in the immediate surrounding area. The airplane came to rest upright on a magnetic heading of 60°.

Although it sustained impact damage, the empennage was relatively intact. The elevator remained attached to the horizontal stabilizer, which remained attached to the empennage. The rudder remained attached to the vertical stabilizer, which remained attached to the empennage. A 6 to 8-inch-deep ground scar was located under the tail tie down and rudder. The bottom of the rudder was crushed upward. Both elevator and rudder control continuity were verified. The elevator trim motor was positioned to slightly nose down trim.

The spar cover, wing spar, and wings were angled downward, and the floor under the cabin seats exhibited impact damage. There was a ground impact scar correlating to the leading edge of both wings.

The entire leading edge of the left wing was crushed rearward. A 45° tear was present midspan in the top skin of the wing. The left aileron sustained impact damage, and it remained attached to the wing by its inboard hinge. The position of the roll trim motor was between neutral and full left trim. The left flap remained attached to the wing and was fully retracted.

The leading edge of the right wing was crushed aft. The outboard section of the upper wing skin was mostly separated from the torque box structure, and spar damage was observed. The right aileron and flap both exhibited impact damage; however, they remained attached to the wing. The right flap was fully retracted.

The right aileron cable was separated about 2 ft away from the cross-over turnbuckle. The separated ends of the cable showed signatures consistent with an overload separation. Aileron control continuity for the rest of the cable circuit was verified. The flap actuator was extended about 4 inches, which correlated to a fully retracted flap position.

Both wing fuel tanks were compromised, and there was no fuel present in the tanks. However, first responders reported there was a strong odor of fuel near the wreckage.

The four seats remained attached to their respective seat tracks and floor mounts. Both the left rear seat and the right front seat showed deformation to the left. All seat belt inertial reels functioned except for the left front seat. The left front seatbelt could be pulled out, but did not retract due to damage.

The CAPS activation handle was observed in its handle holder. The activation handle holder mounting bracket was bent downward and aft with an S-shaped bend. The rocket motor was expended and found on the ground near the airplane. The partially packed parachute bag was on the ground near the wreckage. The harnesses, risers, and a portion of the suspension lines had deployed. The three-ring release mechanism remained loosely interlocked. The break-away cover for the parachute enclosure was located on the ground near the rudder, indicating that the system had deployed during the ground impact.

An external examination of the engine was conducted at the accident site. The engine remained attached to the engine mounts, which remained attached to the firewall. The forward portion of the engine was buried at an angle of about 25° with only the top of the propeller spinner remaining above ground level. The firewall had impacted the rear of the engine with some of the engine accessories making an imprint on the firewall.

All engine cylinders displayed varying degrees of impact damage and remained attached to the crankcase. The crankcase sustained impact damage but was intact. The oil cooler remained attached to the engine. The oil filter and filter adapter had separated from the engine.

Both magnetos had separated from the engine. Both magneto impulse coupling engaged when the magneto drives were turned by hand. The ignition harness sustained impact damage. The top spark plugs were in place and undamaged. The bottom spark plugs were not removed during the on scene examination.

The fuel pump sustained impact damage. The fuel line going to the pump inlet remained secured at both the pump and the fuel bowl. The fuel line was removed from the fuel bowl, and no fuel was present in the line; however, there was fuel present in the fuel bowl. The throttle and fuel metering assembly remained attached to the engine. The throttle control arm remained secured to the shaft, and the throttle cable rod end remained secured to the throttle arm. The throttle position was observed at idle. The fuel manifold valve was intact, and it remained attached to the engine. All of the fuel nozzles were intact.

The exhaust system sustained impact damage with bent exhaust risers and flattened exhaust outflow pipes. The induction system sustained impact damage.

The propeller remained attached to the propeller flange. Both propeller blades remained intact within the propeller hub. One blade displayed forward bending, and the other propeller blade was bent aft.

During the on scene examination, there were no anomalies identified with the airframe, engine, or propeller that would have precluded normal operation of the airplane.

Medical and Pathological Information

The Central Texas Autopsy LLC, Lockhart, Texas, completed autopsy examinations for both the flight instructor and the airplane owner. The autopsy report for both listed the cause of death as multiple blunt force injuries.

The FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, conducted toxicological testing for both the flight instructor and the airplane owner. The tests conducted on the instructor were negative for alcohol and tested drugs.

Toxicology testing for the airplane owner detected diphenhydramine in cavity blood at 69 ng/ml and in urine. Naproxen was detected only in urine. Diphenhydramine is a sedating antihistamine used to treat allergy symptoms and as a sleep aid. It is available over the counter under the trade names Benadryl and Unisom and carries the following FDA warning: "may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery)." Naproxen is an anti-inflammatory analgesic available over the counter and by prescription with the names Aleve and Naprosyn, respectively.

Tests and Research

Primary Flight Display (PFD)
The PFD was removed from the instrument panel and sent to the NTSB Recorder Laboratory for download. Impact damage to the PFD disabled the ability to read the data directly from the unit, so an extraction of the interior memory module was performed. See the History of Flight section of this report for a discussion of the data recovered from the unit.

Multifunction Display (MFD)
The compact flash card from the MFD was removed and sent to the NTSB Recorder Laboratory. The laboratory verified that there was no recorded data on the card, which was expected since the airplane was not equipped with the exhaust gas temperature and cylinder head temperature probes required for engine monitoring.

Engine Teardown Examination
The engine was shipped to the Continental Motors, Inc., factory in Mobile, Alabama, for a teardown examination. The engine was disassembled, and the internal engine components including the crankshaft, camshaft, cylinders, pistons, bearings, and connecting rods appeared to be capable of normal operation. The crankshaft main journals, connecting rod journals, and main bearings displayed normal operating and lubrication signatures. The crankshaft to camshaft timing was verified to be correct. The piston pins for all cylinders were able to be pushed out by hand. There was no carbon build-up observed on the piston pins.

Both magnetos were bench tested with a slave ignition harness. Both magnetos produced a spark on all posts when bench tested. All spark plugs were removed and appeared to be in good condition with normal operation signatures.

The fuel pump, fuel manifold assembly, and throttle/fuel metering assembly were tested to

manufacturer's production standards. The fuel pump was placed on a production test bench, and it was noted that there was a significant leak at the fuel pump relief valve diaphragm, which was consistent with impact damage to the fuel pump. The throttle body and fuel pump tested slightly out of tolerance at some of the test points; however, the fuel flows noted would not have prevented normal operation of the engine. The fuel manifold assembly tested within specifications.

The oil pump was removed from the engine and disassembled. The pump gears were intact. The oil screen and oil filter were free of debris.

As previously discussed in the Aircraft Information section of this report, the postaccident teardown revealed indications that the engine had been disassembled at some point since it was manufactured. There were no anomalies noted during the postaccident teardown that would have prevented normal operation of the engine or production of rated horsepower.

Administrative Information

Investigator In Charge (IIC):	Sullivan, Pamela
Additional Participating Persons:	Casey Storm; FAA; Houston, TX Justin Kelly; FAA; Houston, TX Glen Longnion; FAA; Houston, TX Brad Miller; Cirrus; Duluth, MN Kurt Gibson; Continental Motors; Mobile, AL
Original Publish Date:	December 12, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=92774