Aviation Investigation Final Report

Location:	Marion, Illinois	**Accident Number:**	CEN16FA214
Date & Time:	June 10, 2016, 16:34 Local	**Registration:**	N508AJ
Aircraft:	CIRRUS DESIGN CORP SR22	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

After performing six touch-and-go maneuvers without incident, the pilot receiving instruction and flight instructor contacted air traffic control and requested a climb to 3,000 ft to perform a simulated engine failure and landing maneuver. The air traffic controller cleared the pilots for the maneuver and requested that they report the base-to-final turn to the runway, and the pilot acknowledged the instructions. The controller reported that, about 4 minutes later, he observed the airplane in a descending left turn. As the airplane approached the runway, he observed the right wing lift, and the airplane appeared to stall and roll to the right before it impacted terrain. Another witness reported that she could see the entire top of the airplane with the wings pointed up and down, and that she saw one wing strike the terrain shortly thereafter. The flight instructor had no recollection of the accident.

Examination of the wreckage revealed no evidence of preimpact mechanical malfunctions or failures that would have precluded normal operation. A review of the flight and engine data from the accident flight revealed that the airplane climbed to about 3,000 ft, and then circled while remaining in the airport traffic pattern area. The airplane then descended, and the airspeed gradually decreased from about 110 to about 87 kts. During the final 3 seconds of the recording, vertical, lateral, and longitudinal accelerations increased to recorded peaks of 1.4 g, -0.2 g, and 0.4 g, respectively. During the final second of the recording, the airplane was at 646 ft when it entered a descending left turn; the roll value increased from 36 degrees to 45 degrees left, and the pitch value ranged from -0.5 degrees to 2.4 degrees.

The witness statements and flight data are consistent with a the pilots failing to maintain adequate airspeed and exceeding the wing's critical angle of attack, which resulted in a subsequent aerodynamic stall and loss of control. The airplane's parachute system was found deployed, which likely occurred during the impact sequence. Given the low altitude at which the aerodynamic stall occurred (about 646 ft), it is unlikely that preimpact deployment of the system would have positively affected the outcome of the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilots' failure to maintain adequate airspeed while executing a simulated engine failure and landing maneuver, which resulted in the wing's critical angle of attack being exceeded and a subsequent aerodynamic stall and loss of control.

Findings

Aircraft	Airspeed - Not attained/maintained
Aircraft	Angle of attack - Not attained/maintained
Personnel issues	Aircraft control - Flight crew

Factual Information

History of Flight

Emergency descent	Loss of control in flight (Defining event)
Emergency descent	Aerodynamic stall/spin
Emergency descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On June 10, 2016, about 1634 central daylight time, a Cirrus Design Corporation SR22 airplane, N508AJ, impacted terrain following a loss of control during a simulated engine failure and landing maneuver at the Williamson County Regional Airport (MWA), Marion, Illinois. The private pilot, who was receiving instruction, sustained fatal injuries, the flight instructor sustained serious injuries, and the airplane was destroyed. The airplane was registered to and being operated by AJ Air, Inc, Carbondale, Illinois, as a 14 *Code of Federal Regulations* Part 91 instructional flight. Visual meteorological conditions existed at the airport at the time of the accident and a flight plan was not filed. The local flight departed MWA at 1627.

According to a tower controller and air traffic control transcripts provided by the Federal Aviation Administration (FAA), the pilot and flight instructor were performing touch and go maneuvers, then requested a climb to 3,000 feet to perform a simulated engine failure descent to land maneuver. The controller cleared the pilots for the maneuver and requested that they report the base to final turn to runway 20, and the pilot acknowledged the instructions. The controller reported that about 4 minutes later, he observed the airplane in a descending left turn. He added that as the airplane approached the runway, he observed "the right wing to go up as if the [right] aileron and [left] rudder were selected" and that the airplane then appeared to stall, and roll to the right. The airplane impacted terrain short of the runway threshold and west of the runway approach lights.

A witness reported to local authorities that she was driving in her vehicle adjacent to the airport when she observed an airplane low in the sky. She stated that the airplane was at an odd angle because she could see the entire top side of the airplane with the wings pointed up and down. She observed one wing strike the ground followed by the entire airplane.

The flight instructor reported to the National Transportation Safety Board (NTSB) investigator-in-charge that he had no recollection of the accident.

PERSONNEL INFORMATION

Pilot/Owner

The pilot/owner held a private pilot certificate with airplane single-engine land, and instrument airplane ratings. His most recent FAA medical certificate was issued August 3, 2015, as a special issuance third-

class medical certificate with the following limitations: Must wear corrective lenses. Not valid for any class after 08/31/2016. The pilot reported using the medications amlodipine and metoprolol on his medical application.

According to the pilot's logbook at the time of the accident, he had accumulated about 626 total flight hours, about 540 hours of which were in the accident airplane. The pilot's most recent flight review was satisfactorily completed on June 23, 2015, with the flight instructor who was involved in the accident. The last flight recorded in the pilot's logbook was dated November 15, 2015.

On his most recent airman medical application, the pilot reported a total of 750 flight hours, and 25 hours in the previous 6 months.

Flight Instructor

The flight instructor held a commercial pilot certificate with airplane single-engine land, airplane multi-engine land, and instrument airplane ratings. He also held a flight instructor certificate and a ground instructor certificate. The flight instructor's most recent FAA second-class medical certificate was issued on October 27, 2015, with the limitation: Must have available glasses for near vision.

The flight instructor reported to the NTSB that, at the time of the accident, he had accumulated 3,477 total flight hours, 2,406 total flight instructor hours, and 255 hours in Cirrus airplanes.

The flight instructor reported that he and pilot had accumulated 16 total flight hours together, from September 2012 to the date of the accident. Most of the flight hours were accumulated during flight reviews and recurrent instrument flight training.

The flight instructor met the course requirements and was recognized as a Cirrus Standardized Instructor Pilot (CSIP) on June 30, 2011. The flight instructor reported that his CSIP status was terminated in March 2013 because he did not renew it due to the total cost of the program.

AIRCRAFT INFORMATION

The Cirrus SR22 is a single-engine, low-wing airplane with four seats, fixed tricycle landing gear, and dual-side yoke controls. The accident airplane, serial number 1160, was manufactured in 2004. It was equipped with a 310-horsepower Teledyne Continental Motors IO-550-N six-cylinder, air-cooled, fuel-injected, horizontally opposed reciprocating engine. The three-blade, constant speed propeller was a Hartzell Model PHC-J3YF-1RF. The accident airplane was equipped with a Cirrus Airplane Parachute System designed to recover the airplane from catastrophic emergencies in which normal emergency procedures are ineffective. The airplane was also equipped with an electro-pneumatic stall warning system that provided audible warning of an approach to an aerodynamic stall.

The airplane was registered to the pilot/owner on November 30, 2004. A review of the airplane records showed that the most recent annual inspection had been completed on December 10, 2015, at a total time of 712.6 hours. A review of the airplane's maintenance records revealed that all applicable service bulletins and airworthiness directives had been accomplished.

METEOROLOGICAL INFORMATION

At 1657, the MWA automated weather observing system, reported the wind from 170 degrees at 7 knots, visibility 20 statute miles, sky clear, temperature 32 degrees C, dew point 19 degrees C, and an altimeter setting of 30.02 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

Examination of the accident site revealed an initial impact point that contained fractured portions of the green navigation light lens, consistent with the right wing. The debris field was about 242 feet long and on a magnetic heading of about 250 degrees from the initial impact to the main wreckage. The debris field contained fragmented sections of the right wing, propeller assembly, and forward fuselage structure. The main wreckage consisted of the fuselage, left wing, engine, and a portion of the right wing, and came to rest upright about 555 ft from the edge of the runway. The airframe parachute was found deployed and lying next to the main wreckage. The parachute deployment was consistent with impact damage activation.

The right wing flap and right aileron remained partially attached, the right main landing gear was separated, and the fuel cap was secure.

The left wing main spar was fractured near the mid-span of the wing. The left flap and left aileron remained partially attached, the left main landing gear remained attached, and the left wing tip was separated.

The empennage remained intact and was separated from the aft fuselage. The elevators and rudder remained attached to their respective fittings.

The engine was separated at the firewall and remained partially attached to the mount. The engine came to rest inverted adjacent to the fuselage. The propeller assembly was separated from the engine at the engine crankshaft propeller flange. Mechanical continuity was established throughout the engine, and thumb compression was noted on each cylinder.

The cockpit and cabin area was fragmented. The fuel selector was found positioned to the right fuel tank position. The Hobbs meter indicated 718.3 hours. The power and mixture control levers were in the full forward position.

Flight control continuity was established from the cockpit flight controls to all flight control surfaces. The flaps were found in the retracted position.

MEDICAL AND PATHOLOGICAL INFORMATION

The Williamson County Coroner's Office, Marion, Illinois, performed an autopsy on the pilot. The autopsy report stated that the cause of death was "multiple blunt impact trauma."

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed forensic toxicology on specimens from the pilot. The results were negative for carbon monoxide and ethanol. An unspecified amount of Amlodipine was detected in the blood and urine, and an unspecified amount of metoprolol was detected in the urine. Amlodipine and metoprolol are prescription medication used alone or in combination with other medications to treat high blood pressure and are not impairing.

TEST AND RESEARCH

On July 19, 2016, the engine was examined at AMF Aviation, Springfield, Tennessee. The examination revealed no anomalies that would have resulted in the engine not producing full power when needed.

Primary Flight Display (PFD) and Multifunction Display (MFD) Information

The airplane's PFD unit and MFD memory card were forwarded them to the NTSB's Vehicle Recorder Laboratory in Washington, D.C., for evaluation.

The Avidyne PFD unit includes a solid-state Air Data and Attitude Heading Reference System (ADAHRS), and displays aircraft parameter data including altitude, airspeed, attitude, vertical speed, and heading. The PFD unit has external pitot/static inputs for altitude, airspeed, and vertical speed information. The PFD contains two flash memory devices mounted on a riser card. The flash memory stores information the PFD unit uses to generate the various PFD displays. Additionally, the PFD has a data logging function, which is used by the manufacturer for maintenance and diagnostics. Maintenance and diagnostic information recording consists of system information, event data, and flight data.

The PFD samples and stores several data streams in a sequential fashion; when the recording limit of the PFD is reached, the oldest record is dropped and a new record is added. Data from the Attitude/Heading Reference System (AHRS) is recorded at a rate of 5 Hz. Air data information such as pressure altitude, indicated airspeed, and vertical speed are recorded at 1 Hz. Global Positioning System (GPS) and navigation display and setting data are recorded at a rate of 0.25 Hz, and information about pilot settings of heading, altitude, and vertical speed references are recorded when changes are made.

An examination of the PFD revealed that while it had been damaged by impact forces, the specialist was successful in extracting the data using NTSB surrogate hardware. The download revealed that the PFD contained about 25 hours of flight data, including the accident flight.

The MFD unit is able to display the pilot checklist, terrain/map information, approach chart information, and other aircraft/operational information depending on the specific configuration and options that are installed. One of the options available is a display of comprehensive engine monitoring and performance data.

Each MFD contains a compact flash (CF) memory card located in a slot on the side of the unit. This memory card contains all of the software that the MFD needs to operate. Additionally, this card contains all of the checklist, approach charts, and map information that the unit uses to generate the various cockpit displays.

The MFD generates new data files for each MFD power-on cycle. The oldest file is dropped and replaced by a new recording once the storage limit has been reached. MFD data are sampled every six seconds, and are recorded to memory once every minute. If an interruption of power occurs during the minute between MFD memory write cycles, data sampled during that portion of a minute are not recorded.

The accident MFD CF data card was in good condition and the data were downloaded using the manufacturer's procedure and NTSB surrogate hardware. The card contained 220 data files

corresponding to 110 flights. One data file was identified as recording during the accident flight. The data file was approximately 35 minutes in duration.

A review of the basic flight data and engine data from the accident flight revealed that prior to the accident, the airplane performed a total of six touch and go maneuvers using a left turning traffic pattern. For all but the last maneuver, the aircraft climbed to about 1,500 ft before descending back to the airport. Aircraft roll during the left turns typically reached between 30-40 degrees.

After the final touch and go maneuver, the airplane climbed to about 3,000 ft, and circled while remaining in the airport traffic pattern area. The airplane then descended, and the airspeed gradually decreased from about 110 kts to about 87 kts. In the final three seconds, vertical, lateral, and longitudinal accelerations all increased to recorded peaks of 1.4 g, -0.2 g, and 0.4 g, respectively. During the last second of the recording, the airplane was at 646 ft when it entered a tight descending left turn of nearly 360 degrees. During this time, the roll values increased from 36 degrees to 45 degrees left, and the pitch values ranged from -0.5 degrees to 2.4 degrees.

Engine parameters varied during the recording from values similar to those typically seen at takeoff to reduced power settings similar to those seen at engine idle during descent.

ADDITIONAL INFORMATION

Cirrus Standardized Instructor Pilot (CSIP) Qualifications

According to the Cirrus CSIP qualifications, the following criteria are used to establish initial and renewal of CSIP status.

Initial CSIP Qualifications:

- Current CFII (Instrument Flight Instructor)

- 500 total flight hours

- 250 total hours of instruction given

- Professional and moral character

Initial CSIP Training

According to Cirrus, CSIP training is a comprehensive course and requires dedicated pre-training to be prepared for the intensive flight training segment. Flight training occurs only with a Cirrus headquarters professional flight instructor with emphasis on developing abilities to fly and teach in a standardized fashion using Cirrus' proven syllabi. Closely mirroring the style of the customer Transition Training program, CSIP training goes one big step further as you will be required to demonstrate an instructor level of knowledge. By the end of the course, you will be expected to teach the last few lessons.

For most flight instructors, CSIP training is scheduled to occur over the course of 3 days with a mix of ground and flight lessons. The price is approximately $2,700 which includes 3 days of flight instruction, 1 hour in our flight training device (FTD), and a training kit. Aircraft rental/use, fuel, travel, and

accommodations are not included in the estimate. Since the course is completely proficiency based, the course may be longer or shorter depending on experience and aptitude. Cirrus requires that all CSIP applicants have sufficient knowledge of systems and operations before on-site training can take place. Failure to properly prepare for CSIP training will increase overall training time and expense.

CSIP Renewal

To retain status as an active and current CSIP, you must renew your status annually. To renew status, each CSIP must earn at least 10 credits during the past year of activity. Credits can be earned for overall experience, qualifications and ratings, flight activity, event attendance, and membership in professional organizations.

In addition to the credits required, there is a variable fee associated with the renewal, but commonly about $100.00.

FAA Advisory Circular AC-61-67C - Stall and Spin Awareness Training

According to FAA Advisory Circular AC-61-67C Stall and Spin Awareness Training:

"Power-off stalls (also known as approach-to-landing stalls) are practiced to simulate normal approach-to-landing conditions and configuration. Many stall/spin accidents have occurred in these power-off situations, such as crossed control turns from base leg to final approach (resulting in a skidding or slipping turn); attempting to recover from a high sink rate on final approach by using only an increased pitch attitude; and improper airspeed control on final approach or in other segments of the traffic pattern."

"Accelerated stalls can occur at higher-than-normal airspeeds due to abrupt and/or excessive control applications. These stalls may occur in steep turns, pullups, or other abrupt changes in flightpath. Accelerated stalls usually are more severe than unaccelerated stalls and are often unexpected because they occur at higher-than-normal airspeeds."

Pilot Information

Certificate:	Private	**Age:**	56,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:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Waiver time limited special	**Last FAA Medical Exam:**	August 3, 2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 23, 2015
Flight Time:	(Estimated) 626 hours (Total, all aircraft), 540 hours (Total, this make and model)		

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	64,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 27, 2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 2, 2015
Flight Time:	3477 hours (Total, all aircraft), 255 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP	**Registration:**	N508AJ
Model/Series:	SR22 NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	2004	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1160
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	December 10, 2015 Annual	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:	6 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	718.3 Hrs at time of accident	**Engine Manufacturer:**	CONT MOTOR
ELT:	C91 installed, not activated	**Engine Model/Series:**	IO-550-N
Registered Owner:	On file	**Rated Power:**	310 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:	MWA,471 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	16:57 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Clear	**Visibility**	20 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.02 inches Hg	**Temperature/Dew Point:**	32°C / 19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Marion, IL (MWA)	**Type of Flight Plan Filed:**	None
Destination:	Marion, IL (MWA)	**Type of Clearance:**	None
Departure Time:	16:27 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	Williamson County Regional MWA	**Runway Surface Type:**	Asphalt
Airport Elevation:	471 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	20	**IFR Approach:**	None
Runway Length/Width:	8012 ft / 150 ft	**VFR Approach/Landing:**	Simulated forced landing

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	37.77,-89.006942

Administrative Information

Investigator In Charge (IIC):	Sauer, Aaron
Additional Participating Persons:	Adama Allmond; Federal Aviation Administration; Springfield, MO Brannon Mayer; Cirrus Aircraft; Duluth, MN Chris Lang; Continental Motors, Inc; Mobile, AL
Original Publish Date:	June 26, 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=93358