Aviation Investigation Final Report

Location:	Phoenix, Arizona	**Accident Number:**	WPR12FA067
Date & Time:	December 15, 2011, 09:54 Local	**Registration:**	N7850P
Aircraft:	CIRRUS DESIGN CORP. SR22	**Aircraft Damage:**	Substantial
Defining Event:	Aircraft wake turb encounter	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation		

Analysis

A review of radar data revealed that the single-engine Cirrus airplane entered the left downwind leg of the traffic pattern for runway 3 as a Gulfstream twin-engine corporate jet was 5 miles to the west for landing. The tower controller instructed the Cirrus pilot to extend his downwind leg to follow the Gulfstream and then instructed him to report when he had the Gulfstream in sight. The Cirrus pilot made his base turn towards the final approach course before reporting the Gulfstream in sight, which resulted in the Cirrus being in very close proximity to the Gulfstream. The Cirrus pilot had the discretion to turn from the extended downwind to the base leg prior to the controller advising him to do so; however, when he made this decision it then became his responsibility to maintain safe separation from the Gulfstream.

After several traffic advisories from the controller to the accident pilot, the pilot finally reported the Gulfstream in sight, at which point the Gulfstream was about 0.11 nautical miles ahead of--and 200 to 300 feet higher than--the Cirrus on final to runway 3. The controller then radioed the Cirrus pilot to stand by for a possible go-around and the pilot replied that he was standing by. The controller instructed the Cirrus pilot to start a climb and go around. Three seconds later, an unidentified pilot radioed the controller that an airplane on final had just gone down; no further communications were received from the Cirrus pilot. About 7 seconds before the accident, the Cirrus was at an altitude of 1,400 feet above ground level. The Gulfstream had passed that location about 30 seconds earlier and 150 feet higher than the Cirrus. The upset and loss of control most likely occurred as a direct result of an encounter with the wake turbulence generated by the Gulfstream while the Cirrus was in trail and on final approach to the runway. An onboard recording device revealed that at 0954 the Cirrus experienced an upset, rolling rapidly from 35 degrees left-wing-down to over 77 degrees left-wing-down, before rapidly rolling to 25 degrees right-wing-down. At this time, the airplane's rate of descent was in excess of 3,000 feet per minute.

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 separation behind a corporate jet, which resulted in an encounter with wake turbulence and a subsequent loss of control.

Findings

Personnel issues	Incorrect action performance - Pilot
Environmental issues	Wake turbulence - Effect on equipment
Personnel issues	Aircraft control - Pilot
Environmental issues	Glare - Effect on personnel

Factual Information

History of Flight

Approach-VFR pattern final	Aircraft wake turb encounter (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On December 15, 2011, about 0954 mountain standard time, a Cirrus Design Corp. SR22, N7850P, experienced a loss of control and descended into a residential neighborhood about 0.75 nautical miles from the approach end of runway 3 at the Scottsdale Airport (SDL), Scottsdale, Arizona. The airplane was registered to Frank M. Smith & Associates, Inc., and it was operated by a company private pilot who was fatally injured. The passenger was seriously injured. The airplane was consumed by a post-impact fire. No one on the ground was injured during the impact sequence. The flight was performed under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan was filed. The flight originated from Show Low Regional Airport (SOW), Show Low, Arizona, about 0913, with SDL as its planned destination.

The surviving passenger reported in a post-accident interview with the NTSB investigator-in-charge (IIC), that the airplane was based at SOW, and that the pilot made routine flights to and from SDL. The passenger stated that prior to departure the pilot preflighted the airplane for about 30 minutes, and that nothing unusual occurred during the takeoff, climb, or during the en route phase of the flight, which was smooth.

The passenger revealed that while approaching SDL, he recalled the controller asking the pilot if he saw the Gulfstream, and that the pilot asked him, "Do you see the Gulfstream?" The passenger reported that he initially did not see the Gulfstream, but when he looked outside his right-side window he saw it very close to the Cirrus. He added that at the time, the pilot was still looking left for the Gulfstream, and that he did not initially see it. The passenger stated that about the time when this occurred, the pilot was turning left toward the airport and that he was startled by the sudden presence of a dark shadow over the Cirrus as the Gulfstream passed overhead. The passenger further stated that the Gulfstream appeared to "fly on top of us." The passenger also opined that he did not recall seeing the Gulfstream again, and it was about this time that the controller asked the pilot again if he saw the Gulfstream. The passenger reported that the pilot replied to the controller that the Gulfstream was "in my back seat." He further reported that the pilot was startled by the close proximity between his airplane and the Gulfstream, and that he did not believe that the pilot had observed the Gulfstream prior to the close encounter of the two airplanes. The passenger recalled that it seemed like only seconds after the close encounter that the Cirrus started rapidly descending. The passenger did not recall anything further, including the impact sequence or how he exited the airplane after it had crashed.

A review of radar data provided by Cirrus Aircraft Corporation, as well as communications between Federal Aviation Administration Air Traffic Control, N7850P (the accident airplane), and N534QS (the

Gulfstream), revealed that the Gulfstream first contacted the SDL control tower at 0950:25, six nautical miles west of the airport. The controller instructed N534QS to enter a left base for runway 3. At 0950:44, N534QS turned to a heading of 142 degrees magnetic for the left base leg to runway 3. While on the base leg, N534QS slowed from 185 knots to 142 knots. At 0950:46, the controller instructed N7850P to extend his left downwind leg and to follow the Gulfstream. The pilot of N7850P acknowledged extending his left downwind leg and that he would be number two. At 0951:47, the controller cleared N534QS to land on runway 3. At 0951:53, the controller instructed N7850P to report when he had the Gulfstream in sight, and that it had just passed right to left ahead of him on base leg; there was no reply from the accident pilot. At 0952:05, the controller advised the accident pilot that the Gulfstream was now ahead and to his left, eleven o'clock and 2 miles, left base to final. At 0952:12, the accident pilot replied (first part unintelligible), "…blue Gulfstream, sun's in my eyes." At 0952:43, the controller advised the accident pilot that the Gulfstream was off to his left and on final; the accident pilot responded, "Gulfstream on final." At 0953:09, the controller asked the accident pilot to confirm that he had the Gulfstream in sight; the pilot responded that the Gulfstream was in sight at 0953:12. At 0953:36, the controller advised the pilot of N7850P to standby for a possible go-around, to which the pilot confirmed. At 0954:06, the controller instructed the accident pilot to start a climb and go around. At 0954:06, an unidentified pilot radioed to the controller that there was an airplane on final that just went down. There were no further communications received from N7850P.

The following data reveals the horizontal and vertical separation between the two airplanes over the next 15 seconds:

0952:45 0.80nm 300 feet

0952:50 0.58nm 300 feet

0952:55 0.42nm 300 feet

0953:00 0.23nm 300 feet

This data revealed that the Gulfstream was always higher than the Cirrus on the approach.

The data further indicates that about 0953:06, N534QS passed over top of N7850P by approximately 300 feet. At this point the distance between the Gulfstream and Cirrus steadily increased. About 0953:12, the Gulfstream was about 0.11 nm ahead of and 200 to 300 feet higher than N7850P on final. N7850P was about 300 feet below the Gulfstream for most of the final approach to runway 3. The last radar return from N7850P at 0954:02, showed the airplane at an altitude of 1400 feet above ground level. The Gulfstream had passed that location approximately 30 seconds earlier and 150 feet higher than N7850P.

The IIC recorded comments from several witnesses to the accident. One witness reported that she observed an aircraft at an angle and that it fell flat to the ground. A second witness stated that an aircraft went approximately 100 feet over houses then started a turn and went down toward the houses; it was lower than normal. Another witness reported that he saw the Gulfstream go overhead, then looked back and observed [the accident airplane] very low, saw it bank left about 100 degrees from the original direction that it was heading, then lost sight of it as it went behind a building, and then heard it crash. He added that it was very close behind the Gulfstream. A fourth witness reported seeing an aircraft coming

from the southwest headed towards the school, very close to the ground, and it flipped on its side in the air. It then flipped back around and started to nose dive toward the ground.

The airplane was recovered from the front yard of the private residence and examined. Fire-damaged components (primary flight and multifunction electronic displays) that contained non-volatile memory were removed from the instrument panel. These components were sent to the National Transportation Safety Board's Vehicle Recorder Division in Washington, D.C., for examination.

PERSONNEL INFORMATION

The pilot, age 62, held a private pilot certificate, which was issued on October 6, 2004, with an airplane single-engine land rating. His most recent Federal Aviation Administration (FAA) first-class airman medical certificate was issued on March 31, 2010, at which time he reported a total flight time of 700 hours. The certificate revealed the limitation "holder shall possess glasses for near and intermediate vision."

A damaged pilot's logbook was recovered from the accident site. The logbook covered dates from November 14, 2009 to December 9, 2010. A further review of the logbook revealed that there were no totals forwarded from previous logbooks, and the times logged were exclusively for N7850P. It was observed that about 62 hours of logged flight time in the accident airplane had been recorded in the recovered logbook. It was also observed that the vast majority of those flights logged were flights been between SOW and SDL.

AIRCRAFT INFORMATION

The airplane, a Cirrus SR22-1351, received its standard airworthiness certificate on March 17, 2005. It was equipped with an S-TEC 55X autopilot, Avidyne Entegra Primary and Multifunction Flight Display (PFD, MFD), dual Garmin GNS 430s, GPS navigation transceivers, as well as an engine monitor, and XM satellite weather interface.

One of the pilot's logbook entries was labeled "Annual Service" and dated June 26, 2010, at a Hobbs time of 621.9. No maintenance records were obtained during the investigation.

METEOROLOGICAL INFORMATION

At 0953, the SDL weather reporting system, located about 1 nm from the accident site, reported wind 250 degrees at 4 knots, visibility 10 miles, temperature 8 degrees Celsius (C), dew point 4 degrees C, and an altimeter setting of 30.18 inches of mercury.

A senior NTSB meteorologist reported that astronomical data from the United States Naval Observatory located in Washington, D.C. revealed that on December 15, 2011, Sunrise was at 0724 MST. The meteorologist added that at 0954 MST, the Sun was 23.1 degrees above the horizon at an azimuth of 143 degrees true, or off of the right wing of the accident airplane, given his heading of 222 degrees magnetic, as reported by the IIC.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest about 0.75 miles from the threshold of runway 3 at SDL, and in the front yard of a residence at an elevation of 1,417 feet mean sea level. The debris field indicated that the energy path was oriented on a heading of about 275 degrees magnetic. The airplane came to rest on a measured magnetic heading of 232 degrees.

The main wreckage came to rest about 80 feet from the initial point of impact and consisted of the entire fuselage and carry-though wing, minus various smaller components found in the debris field. The initial point of impact was a 7-foot tall hedge located on the adjacent neighbor's property that was missing the top portion of its branches. The driveway the hedge abutted to had a steel gate that exhibited impact damage and white paint transfer marks. The gate was observed separated from its hinges and lying in the street. The right wingtip of the accident airplane came to rest in the driveway near the gate and white paint transfer marks were present across the cement driveway. One black transfer mark was noted on the edge of the driveway, and the hedge between the two properties was damaged.

A shallow trench was observed which contained the front nose landing gear strut, nose wheel assembly, and other small pieces of airplane debris leading away from the hedge on the side opposite the driveway leading towards the main wreckage for about 15 to 20 feet.

The engine and propeller remained attached to the firewall with portions of the upper and lower cowlings still attached to each other. Fire consumed most of the roof and right side of the fuselage. The cockpit area exhibited extensive fire damage from the fire wall aft to the bulkhead aft of the Cirrus Airframe Parachute System (CAPS) enclosure. The empennage remained attached to the fuselage and exhibited extensive thermal damage.

The right side of the wing from the cuff outboard was consumed by fire. The right flap and right aileron were mostly consumed by fire, and the identifiable portions of each had come to rest behind the wing.

The left wingtip was observed separated and was located under the right side of the horizontal stabilizer. The left side of the wing exhibited impact damage. The fuel cap was present and secure. A stick was inserted in the fuel tank. From the bottom lip of the filler cap to the bottom of the tank the stick measured roughly 18 centimeters; when the stick was extracted from the tank, 16 centimeters of the stick was observed to be wet. The wing lay relatively flat but slightly tipped forward. The left flap and aileron remained attached to the wing and exhibited impact damage.

Aileron control cable continuity was verified. The roll trim actuator was in between neutral and full left trim. The flap actuator shaft was extended approximately one half inch from the actuator housing, which was consistent with a flap setting of 100 percent, or fully extended.

The vertical stabilizer remained attached to the empennage and exhibited impact and fire damage. The rudder remained attached to the vertical stabilizer and exhibited impact damage. Rudder control cable continuity was verified.

The horizontal stabilizer remained attached to the empennage and exhibited impact and fire damage. The left and right elevators remained attached to the horizontal stabilizer. Elevator control cable continuity was verified. The pitch trim actuator was in an approximate neutral position.

The right crew door was separated from the fuselage and exhibited fire and impact damage. The left crew door remained attached to the fuselage at the lower hinge and exhibited fire and impact damage. The baggage door remained attached to the fuselage and exhibited fire and impact damage.

The nose landing gear assembly separated from the engine mount. The right main landing gear remained attached to the wing and exhibited impact and fire damage. The left main landing gear separated from the wing and was located about 25 feet aft of the main wreckage near the left wheel pant.

The Cirrus Aircraft Parachute System (CAPS) safety pin was located on the bolster switch panel below the ignition switch. A grommet with red material consistent with the Remove Before Flight tag was present on the key ring style retainer containing the safety pin. The CAPS activation handle, handle holder, and mounting bracket were not observed. The activation cable housing was mostly consumed by fire, with only the wire mesh having been left behind on the activation cable. The activation cable was present and attached at the igniter. The other end of the activation cable had a ball swage on it but no activation handle. The CAPS enclosure cover remained attached to the left fuselage half and exhibited fire damage.

The only anomaly noted during the engine examination was a reddish colored residue on the forward half of the piston head and around the forward half of the intake valve face on the #1 cylinder. The propeller remained attached to the engine and exhibited impact damage. The spinner had deformation on one side between two of the propeller blades. All three propeller blades were bent aft. Two of the propeller blades had scratches spanwise and chordwise on the cambered side.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot at the Maricopa County Office of The Medical Examiner, Phoenix, Arizona, on December 16, 2011. The cause of death was reported as "Thermal burns."

The FAA's Civil Aerospace Medical Institute performed forensic toxicology on specimens from the pilot. The report stated no carbon monoxide and no cyanide was detected in the Blood, no ethanol detected in the Vitreous, and 12.39 (ug/ml, ug/g) Acetaminophen detected in Urine.

TESTS AND RESEARCH

The NTSB IIC retained custody of the PFD and MFD. Both components were shipped to the NTSB Vehicle Recorder Laboratory In Washington, D.C. for examination and analysis by a vehicle recorder specialist who reported the following:

PFD

The PFD was damaged by impact forces and fire. The circuit card which contained the 2 Flash memory chip was extracted from the damaged housing and placed in a surrogate PFD unit for download.

The PFD contained approximately 17 hours of flight data, including the accident flight.

MFD

The exterior of the MFD unit was damaged by fire. However, the MFD card was undamaged and data was recovered normally.

The specialist reported that a review of the recovered data revealed that the flight departed SOW at 0913 and climbed to a cruise altitude of 8,400 feet. Between 0932:13 and 0940:00, no data was recorded on the PFD; this is a known behavior with this version of PFD software. At 0940:20, the airplane began its descent at approximately 1,000 feet per minute (fpm). At 0954, the airplane experienced an upset, rolling rapidly from 35 degrees left wing down to over 77 degrees left wing down, before rapidly rolling to 25 degrees right wing down. At this time the airplane's rate of descent was in excess of 3,000 fpm.

ADDITIONAL INFORMATION

According to the Aeronautical Information Manual (AIM), 7-3-8 Pilot Responsibility, the following information is provided to pilots relative to wake turbulence:

(b) Wake turbulence may be encountered by aircraft in flight as well as when operating on the airport movement area.

(c) Pilots are reminded that in operations conducted behind all aircraft, acceptance of instructions from ATC in the following situations is an acknowledgment that the pilot will ensure safe takeoff and landing intervals and accepts the responsibility for providing wake turbulence separation:

1. Traffic information

2. Instructions to follow an aircraft;

3. The acceptance of a visual approach clearance

According to the US Department of Transportation publication "Wake Turbulence Training Aid," DOT/FAA/RD-95/6, dated April 1995, the phenomenon that creates wake turbulence results from the forces that lift the aircraft. High pressure air from the lower surface of the wings flows around the wingtips to the lower pressure region above the wings. A pair of counter-rotating vortices are shed from the wings; the right wing vortex rotates counterclockwise, and the left wing vortex rotates clockwise. This region of rotating air behind the aircraft is where wake turbulence occurs. The strength of the turbulence is predominantly determined by the weight, wingspan and speed of the aircraft. The usual hazard associated with wake turbulence is that the induced rolling moment can exceed the roll control of the encountering aircraft. Counter control is most effective and induced roll minimal where the wingspan of the encountering aircraft is outside the rotational flow field of the vortex. Additionally, counter control is more difficult for encountering aircraft with wingspans that are relatively shorter than that of the generating aircraft. Pilots of short span aircraft and high performance aircraft must be especially alert to vortex encounters. Flying at or above the flight path provides the best method for avoidance. Maintaining a vertical separation of at least 1000 feet when crossing below the preceding aircraft may be considered safe.

Federal Aviation Administration Advisory Circular 90-23F, Aircraft Wake Turbulence released February 20, 2002, "is intended to alert pilots to the hazards of aircraft wake turbulence and recommends related operational procedures." Under the heading of "6, Induced Roll" the circular stated

that "...the capability of an aircraft to counteract the roll imposed by the wake vortex primarily depends on the wingspan and counter-control responsiveness of the encountering aircraft."

Pilot Information

Certificate:	Private	**Age:**	62
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Waiver time limited special	**Last FAA Medical Exam:**	March 31, 2010
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 13, 2010
Flight Time:	700 hours (Total, all aircraft), 62 hours (Total, this make and model), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CIRRUS DESIGN CORP.	**Registration:**	N7850P
Model/Series:	SR22	**Aircraft Category:**	Airplane
Year of Manufacture:	2005	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1351
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	Annual	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, not activated	**Engine Model/Series:**	IO-550-N
Registered Owner:	FRANK M SMITH & ASSOCIATES INC	**Rated Power:**	310 Horsepower
Operator:	FRANK M SMITH & ASSOCIATES INC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SDL,1510 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	09:53 Local	**Direction from Accident Site:**	35°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.18 inches Hg	**Temperature/Dew Point:**	8°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Show Low, AZ (SOW)	**Type of Flight Plan Filed:**	None
Destination:	Scottsdale, AZ (SDL)	**Type of Clearance:**	VFR
Departure Time:	09:13 Local	**Type of Airspace:**	

Airport Information

Airport:	Scottsdale SDL	**Runway Surface Type:**	Asphalt
Airport Elevation:	1510 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	03	**IFR Approach:**	Visual
Runway Length/Width:	8249 ft / 100 ft	**VFR Approach/Landing:**	Full stop;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Serious	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	33.608333,-111.93

Administrative Information

Investigator In Charge (IIC):	Pollack, Wayne
Additional Participating Persons:	Jonas Goldberg; Federal Aviation Administration; Scottsdale, AZ Brad Miller; Cirrus; Duluth, MN Andrew Swick; Continental Motors, Inc.; Mobile, AL
Original Publish Date:	February 3, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=82522