National Transportation Safety Board
Aviation Accident Final Report

Location:	Sioux Falls, SD	**Accident Number:**	CEN12FA100
Date & Time:	12/09/2011, 1424 CST	**Registration:**	N421SY
Aircraft:	CESSNA 421C	**Aircraft Damage:**	Substantial
Defining Event:	Aerodynamic stall/spin	**Injuries:**	4 Fatal
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Non-scheduled		

Analysis

Shortly after the airplane lifted off, the tower controller informed the pilot that a plume of smoke was visible behind the airplane. No communications were received from the pilot after he acknowledged the takeoff clearance. Witnesses reported that white smoke appeared to be trailing from the area of the left engine during takeoff. The witnesses subsequently observed flames at the inboard side of the left engine. The airplane began a left turn. As the airplane continued the turn, the flames and trail of white smoke were no longer visible. When the airplane reached a southerly heading, the nose dropped abruptly, and the airplane descended to the ground. Witnesses stated that they heard an increase in engine sound before impact. A postimpact fire ensued. The accident site was located about 3/4 mile from the airport.

A postaccident examination determined that the left engine fuel selector and fuel valve were in the OFF position, consistent with the pilot shutting down that engine after takeoff. However, the left engine propeller was not feathered. Extensive damage to the right engine propeller assembly was consistent with that engine producing power at the time of impact. The landing gear and wing flaps were extended at the time of impact. Teardown examinations of both engines did not reveal any anomalies consistent with a loss of engine power. The left engine oil cap was observed to be unsecured at the accident site; however, postaccident comparison of the left and right engine oil caps revealed disproportionate distortion of the left oil cap, likely due to the postimpact fire. As a result, no determination was made regarding the security of left engine oil cap before the accident.

Emergency procedures outlined in the pilot's operating handbook (POH) noted that when securing an engine, the propeller should be feathered. Performance data provided in the POH for single-engine operations were predicated on the propeller of the inoperative engine being feathered, and the wing flaps and landing gear retracted. Thus, the pilot did not follow the emergency procedures outlined in the POH for single-engine operation.

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 shutting down one engine, which resulted in an inadvertent aerodynamic stall and impact with terrain. Contributing to the accident was the pilot's failure to follow the guidance contained in the pilot's operating handbook, which advised feathering the propeller of the secured engine and retracting the flaps and landing gear.

Findings

Aircraft	Airspeed - Not attained/maintained (Cause)
Personnel issues	Aircraft control - Pilot (Cause)
	Decision making/judgment - Pilot (Factor)
	Use of checklist - Pilot (Factor)

Factual Information

HISTORY OF FLIGHT

On December 9, 2011, at 1424 central standard time, a Cessna 421C, N421SY, was substantially damaged when it impacted terrain after takeoff from the Joe Foss Field Airport (FSD), Sioux Falls, South Dakota. The pilot and three passengers were fatally injured. The aircraft was registered to S & S Aviation LLC and operated by Quest Aviation, Inc. under the provisions of 14 Code of Federal Regulations Part 135 as an on-demand air taxi flight. Visual meteorological conditions prevailed for the flight, which was operated on an instrument flight rules flight plan. The flight was originating at the time of the accident. The intended destination was the Rapid City Regional Airport (RAP), Rapid City, South Dakota.

At 1422:07 (hhmm:ss), the FSD Air Traffic Control Tower (ATCT) controller issued a takeoff clearance to the accident flight. At 1423:32, the controller informed the pilot that a “plume” was visible behind the airplane; although, he could not determine the source. The controller subsequently advised the pilot that the “plume” was no longer visible. At 1423:59, the controller cleared the flight to land. No communications were received from the pilot after he acknowledged the takeoff clearance.

Witnesses reported that the airplane appeared to be trailing white smoke from the area of the left engine during takeoff from runway 33. They subsequently observed flames at the inboard side of the left engine. The airplane began a left turn and as the turn continued, the flames and trail of white smoke were no longer visible. When the airplane reached a south heading, the nose dropped abruptly and it impacted the ground from an altitude of 800 to 1,000 feet above ground level. They stated that they heard an increase in engine sound prior to impact. A postimpact fire ensued.

Radar track data associated with the discrete transponder code assigned to the accident flight was plotted by the National Transportation Safety Board. The initial radar data point was recorded at 1423:11, and positioned approximately 2,100 feet from the approach end of runway 33. According to the track data, the airplane drifted to the left of the runway centerline as it climbed out. About 1423:38, the airplane began a left turn from a position about 0.21 nautical miles (nm) northwest of the departure end of runway 33 at 2,000 feet msl. The left turn continued until the final radar data point, which was recorded at 1424:07. The final data point was positioned about 0.41 nm west of the departure end of runway 33. The associated altitude was 1,900 feet msl. This was about 0.13 nm (790 feet) west of the accident site. The diameter of the turn was approximately 0.31 nm.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate, with single and multi-engine land airplane, and instrument airplane ratings. He also held a flight instructor certificate with single and multi-engine airplane, and instrument airplane ratings. He was issued a first class airman medical certificate on August 15, 2011, with a restriction for corrective lenses. The pilot's most recent regulatory checkride was completed on November 10, 2011.

A review of the pilot's logbook revealed a total logged flight time of 3,848.8 hours. This included 1,320.8 hours in multi-engine airplanes and 357.4 hours in Cessna 421 airplanes. He

had logged 107.7 hours within the preceding 90 days, with 55.6 hours in Cessna 421 airplane in that time period. This included flights in the accident airplane totaling 4.4 hours, dated December 8th, the day prior to the accident.

AIRCRAFT INFORMATION

The accident airplane was a Cessna 421C, serial number 421C0051. It was a twin-engine, low wing airframe configuration, with a retractable tricycle landing gear. The airplane was accessed by a single entry door at the left, rear area of the cabin. The cabin was configured for a maximum of 9 occupants. According to maintenance records, an annual inspection was completed on December 5, 2011, at 4,882.1 hours total airframe time.

The airplane was powered by two 375-horsepower Continental Motors GTSIO-520-L turbocharged, reciprocating engines. The left engine, serial number 239805-R, was overhauled and installed on the airframe in April 2004. At the time of the inspection, it had accumulated 1,499.9 hours since overhaul. The right engine, serial number 272006-R, was overhauled and installed on the airframe in October 2011. At the time of the annual inspection, it had accumulated 24.7 hours since overhaul. The maintenance records did not reveal any evidence of unresolved airworthiness issues.

METEOROLOGICAL CONDITIONS

Weather conditions recorded by the FSD Automated Surface Observing System (ASOS), recorded at 1356, were: wind from 300 degrees at 11 knots, visibility 10 miles, clear skies, temperature -07 degrees Celsius, dew point -21 degrees Celsius, and altimeter 30.36 inches of mercury.

At 1456, the FSD recorded weather conditions were: wind from 290 degrees at 10 knots, visibility 10 miles, clear skies, temperature -07 degrees Celsius, dew point -21 degrees Celsius, and altimeter 30.36 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane impacted an open field about 3/4 mile northwest of the airport. It came to rest upright, with the aft fuselage separated immediately forward of the vertical stabilizer. The main fuselage and the separated portion of the aft fuselage were oriented on approximate magnetic headings of 078 degrees and 151 degrees, respectively. A scorched area about 230 feet long by 40 feet wide emanated from the fuselage oriented approximately 120 degrees.

All major airframe components were located at the accident site. The cockpit, cabin, wings, and aft fuselage were discolored consistent with the effects of a postimpact fire. The fire had consumed the top and portions of the sides of the fuselage; the cockpit and cabin areas were exposed. The airplane also exhibited damage consistent with impact forces. The wings were in position relative to the fuselage, with both engines remaining attached to their respective engine mounts and in position relative to each wing. The horizontal and vertical stabilizers remained attached to the separated portion of the aft fuselage. The elevators and rudder remained attached to their respective stabilizers. No anomalies consistent with a preimpact failure of the elevator or rudder control systems were observed.

The left wing structure outboard of the engine pylon/nacelle exhibited fire damage, with limited portions being consumed. The left aileron and flap remained partially attached to the

wing. The entire right wing structure exhibited fire damage, with extensive portions being consumed. Portions of the right aileron and flap were observed in position adjacent to the wing. No anomalies consistent with a preimpact failure of the aileron control system were observed. The flap drive chain was positioned consistent with a 40-degree flap deflection. Both main landing gear assemblies had collapsed aft, consistent with the landing gear in the extended position at the time of impact.

Examination of the left engine assembly did not reveal any anomalies consistent with a preimpact failure. The cylinders remained attached to the crankcase. The crankcase exhibited transverse cracks across both the left and right halves at the upper, forward portion of the case, consistent with impact forces. The pistons, crankshaft, and connecting rods appeared intact. The left engine fuel valve was positioned consistent with the valve being in the OFF position. The oil cap was not secured to the filler neck when first observed at the accident site. The filler neck was deformed at the base and the cap was retained to the filler neck by the chain. A comparison of the left and right engine oil caps noted distortion of the left oil cap. (Detail photos of the engine oil caps are included with the docket material associated with this accident case.)

Examination of the right engine assembly did not reveal any anomalies consistent with a preimpact failure. The cylinders remained attached to the crankcase. The crankcase was fractured at the lower, forward portion of the case, consistent with impact forces. The pistons, crankshaft, and connecting rods appeared intact. The right engine fuel valve was not observed consistent with it being consumed by the postimpact fire. The oil cap was secured to the filler neck when first observed at the accident site. The filler neck was deformed at the base and the cap was retained by the chain.

The left propeller assembly remained attached to the engine. The hub was fractured and one blade had separated from the hub. The blade was located under the engine. The remaining two blades were retained by the hub. They appeared undeformed and exhibited light chordwise scratches. The blades appeared to be in a low pitch position. Witness marks on the hub due to the blade counterweights were positioned consistent with low pitch at the time of impact.

The right propeller hub was fractured and all three blades were separated from the hub. Fragments of the hub were located in the debris path. One propeller blade was embedded into the ground adjacent to the right horizontal stabilizer. The second blade came to rest within the scorched area about 140 feet from the right engine. The third blade came to rest on a dirt embankment about 300 feet from the right engine. The blades exhibited bending, twisting, and chordwise scratching.

The cockpit fuel selector for the left engine was observed in the OFF position at the time of the on-scene examination. The right engine fuel selector was in the ON position. The emergency fuel shutoff lever located between cockpit fuel selectors was in the OFF (disengaged) position.

The engine tachometer was identified among the cockpit and instrument panel debris. The unit was discolored due to the postimpact fire. The glass face was not present in the unit. The indicating needles (left and right engine) remained attached to the center post and appeared intact. The needle denoted with "L" was positioned to indicate approximately 1,000 rpm. The needle denoted with "R" was positioned to indicate approximately 2,250 rpm.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy of the pilot was completed by the Minnehaha County Coroner on December 10,

2011, in Sioux Falls, South Dakota. The pilot's death was attributed to blunt force injuries sustained as a result of the accident. The report also noted the presence of postmortem thermal injuries. However, the report stated that no soot was observed in the pilot's airway.

FAA Civil Aerospace Medical Institute toxicology testing was negative for all substances in the screening profile.

ADDITIONAL INFORMATION

The pilot's operating handbook (POH) contained data related to climb performance with one engine inoperative. Based on the weather conditions present on the day of the accident, the single engine climb performance would have been expected to be about 480 feet per minute. That performance data was predicated on having the wing flaps and landing gear retracted, and the propeller of the inoperative engine feathered.

The Engine Securing Procedure contained in the Emergency Procedures section of the POH noted that the throttle be closed, the propeller feathered, the mixture set to idle-cutoff, and the fuel selector set to off.

History of Flight

Takeoff	Fire/smoke (non-impact) Powerplant sys/comp malf/fail
Maneuvering	Aerodynamic stall/spin (Defining event) Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Airline Transport; Flight Instructor	**Age:**	54, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 With Waivers/Limitations	**Last FAA Medical Exam:**	08/15/2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	11/10/2011
Flight Time:	3848 hours (Total, all aircraft), 357 hours (Total, this make and model), 3712 hours (Pilot In Command, all aircraft), 107 hours (Last 90 days, all aircraft), 31 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	**Registration:**	N421SY
Model/Series:	421C	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	421C0051
Landing Gear Type:	Retractable - Tricycle	**Seats:**	8
Date/Type of Last Inspection:	12/05/2011, Annual	**Certified Max Gross Wt.:**	7450 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	4882 Hours as of last inspection	**Engine Manufacturer:**	Continental
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	GTSIO-520-L
Registered Owner:	S & S Aviation LLC	**Rated Power:**	375 hp
Operator:	Quest Aviation Inc.	**Operating Certificate(s) Held:**	On-demand Air Taxi (135)
Operator Does Business As:		**Operator Designator Code:**	OW5A

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	FSD, 1429 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	1356 CST	**Direction from Accident Site:**	321°
Lowest Cloud Condition:	Clear	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	300°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.36 inches Hg	**Temperature/Dew Point:**	-7°C / -21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Sioux Falls, SD (FSD)	**Type of Flight Plan Filed:**	IFR
Destination:	Rapid City, SD (RAP)	**Type of Clearance:**	IFR
Departure Time:	1422 CST	**Type of Airspace:**	

Airport Information

Airport:	Joe Foss Field (FSD)	**Runway Surface Type:**	Concrete
Airport Elevation:	1429 ft	**Runway Surface Condition:**	Dry
Runway Used:	33	**IFR Approach:**	None
Runway Length/Width:	8000 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	3 Fatal	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 Fatal	**Latitude, Longitude:**	43.592222, -96.751944

Administrative Information

Investigator In Charge (IIC):	Timothy Sorensen	**Report Date:**	04/10/2013
Additional Participating Persons:	Darryl Anderson; FAA -- Rapid City Flight Standards; Rapid City, SD Mark Lehrkamp; Quest Aviation; Aberdeen, SD Steve Miller; Cessna Aircraft Company; Wichita, KS Peter Basile; Cessna Aircraft Company; Wichita, KS Chris Lang; Continental Motors Inc.; Mobile, AL Phillip Grice; Continental Motors Inc.; Mobile, AL Rick Roper; RAM Aircraft LP; Waco, TX Danny Ball; McCauley Propeller Systems; Wichita, KS		
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