



# **Aviation Investigation Final Report**

Location:	Holland, Minnesota	Accident Number:	CEN15FA321
Date & Time:	July 27, 2015, 19:47 Local	Registration:	N3FC
Aircraft:	CHRISTENSEN STEVE WHEELER EXPRESS	Aircraft Damage:	Substantial
Defining Event:	Loss of control in flight	Injuries:	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

# Analysis

The private pilot departed with two passengers for a personal, local flight in a Wheeler Express amateurbuilt airplane. Air traffic control data indicate that, after departing the airport, the airplane climbed and performed several maneuvers. A review of onboard flight data revealed that the airplane then maneuvered into a nose-high attitude while in a steep, right turn. As the airspeed decelerated below stall speed and the turn steepened, the airplane pitched nose down and entered a prolonged, right-turning spin until ground impact. Examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

Previous flight testing of a Wheeler Express kit airplane similar to the accident airplane revealed that it had poor yaw stability at low airspeed due to the aerodynamic design of the tail section. The testing also revealed that, during poststall and high-yaw maneuvering, the horizontal tail and elevators appeared to have an inadequate effect. Following bankruptcy of the original kit manufacturer, a variant of the Wheeler Express kit airplane was developed using the same wing and fuselage as the accident model but with a larger tail that had 40 percent more wetted area to provide additional yaw stability at low airspeed.

# **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 during a high-pitch, steep right turn, which resulted in the exceedance of the airplane's critical angle-of-attack and a subsequent aerodynamic stall, loss of

control, and impact with terrain. Contributing to the accident was the airplane's design, which resulted in poor yaw stability at low airspeed.

Findings	
Personnel issues	Aircraft control - Pilot
Aircraft	Airspeed - Not attained/maintained
Aircraft	Angle of attack - Not attained/maintained
Aircraft	Yaw control - Related operating info

# **Factual Information**

History of Flight
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Maneuvering

Loss of control in flight (Defining event)

On July 27, 2015, at 1947 central daylight time, a Wheeler Express amateur-built airplane, N3FC, was substantially damaged after impacting terrain near Holland, Minnesota. The pilot and two passengers were fatally injured. The airplane was registered to and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Day visual meteorological conditions prevailed for the flight, with no flight plan filed. The local flight departed from Pipestone Municipal Airport (PQN), Pipestone, Minnesota, about 1932.

A review of air traffic control (ATC) radar track/altitudes revealed the airplane proceeded 4 miles northeast of PQN and made several turning maneuvers between 2,100 and 3,400 ft above mean sea level (msl). Following these maneuvers, the airplane initiated a climb and continued northeast for an additional 4 miles. The airplane overflew Holland, Minnesota, at 6,600 ft msl, then made a right turn and proceeded south about 1 mile. Overhead the accident site at 6,200 ft msl, the airplane turned right and entered into a rapid descent. The last two radar returns, spaced 12 seconds apart, were at 5,400 and 3,600 ft msl.

A witness located about  $\frac{3}{4}$  mile from the accident site noticed the airplane spin about 1 to 1  $\frac{1}{2}$  revolutions while in a nose down attitude. He heard the engine appear to sputter on two occasions, followed by a loud bang.

Certificate:	Private	Age:	59,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Front
Other Aircraft Rating(s):	None	Restraint Used:	3-point
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 With waivers/limitations	Last FAA Medical Exam:	December 6, 2013
Occupational Pilot:	No	Last Flight Review or Equivalent:	December 27, 2013
Flight Time:	1204 hours (Total, all aircraft), 475 hours (Total, this make and model), 1204 hours (Pilot In Command, all aircraft), 7 hours (Last 90 days, all aircraft), 2 hours (Last 30 days, all aircraft), 0		

hours (Last 24 hours, all aircraft)

### **Pilot Information**

#### **Passenger Information**

Certificate:		Age:	18
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:	No	Last Flight Review or Equivalent:	
Flight Time:			

### **Passenger Information**

Certificate:		Age:	13
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:	No	Last Flight Review or Equivalent:	
Flight Time:			

The pilot, age 59, held a private pilot certificate with airplane single engine land and instrument ratings, as well as a repairman certificate - experimental aircraft builder. On December 6, 2013, the pilot was issued a Class 3 medical certificate, with a limitation that he must have glasses available for near vision. A review of the pilot's flight records indicated that he had logged 1,204 total flight hours and 475 flight hours in the accident airplane. The pilot had logged 36 flight hours during the last year and 7 flight hours during the last 90 days in the accident airplane.

#### Aircraft and Owner/Operator Information

Aircraft Make:	CHRISTENSEN STEVE	Registration:	N3FC
Model/Series:	WHEELER EXPRESS	Aircraft Category:	Airplane
Year of Manufacture:	2008	Amateur Built:	Yes
Airworthiness Certificate:	Experimental (Special)	Serial Number:	1001
Landing Gear Type:	Tricycle	Seats:	4
Date/Type of Last Inspection:	October 1, 2014 Condition	Certified Max Gross Wt.:	3200 lbs
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	481.4 Hrs as of last inspection	Engine Manufacturer:	Lycoming
ELT:	Not installed	Engine Model/Series:	IO-540-C4B5
Registered Owner:	CHRISTENSEN STEVEN J	Rated Power:	260 Horsepower
Operator:	CHRISTENSEN STEVEN J	Operating Certificate(s) Held:	None

The experimental amateur homebuilt airplane, N3FC, was certified based on the Wheeler Express airplane design. The four-place, low-wing airplane was completed by the pilot in August of 2008 and was equipped with a 'cruciform' (mid-mounted horizontal stabilizer) tail. The fuselage and empennage were made of composite materials and a 260-horsepower Lycoming IO-540-C4B5 engine powered the airplane. A review of the maintenance records revealed on Oct 1, 2014, the pilot performed a conditional inspection in accordance with 14 Code of Federal Regulation Part 43 Appendix D, with a total airframe time of 481.4 hours.

The airplane was equipped with a Chelton (Sierra Flight Systems) electronic flight information system (EFIS) and a Garmin 12-channel GPS system. Also onboard was an Appareo Stratus, which is a self-contained battery powered unit containing an internal attitude heading reference system (AHRS), a GPS receiver, and an automatic dependent surveillance – broadcast (ADS–B) receiver.

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
<b>Observation Facility, Elevation:</b>	KPQN,1736 ft msl	Distance from Accident Site:	7 Nautical Miles
Observation Time:	20:14 Local	Direction from Accident Site:	222°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	5 knots / None	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	150°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.82 inches Hg	Temperature/Dew Point:	27°C / 22°C
Precipitation and Obscuration:	No Obscuration; No Precipita	tion	
Departure Point:	Pipestone, MN (PQN )	Type of Flight Plan Filed:	None
Destination:	Pipestone, MN (PQN )	Type of Clearance:	None
Departure Time:	19:32 Local	Type of Airspace:	Class G

At 2014, the weather observation station at PQN, located about 7 miles southwest of the accident site, reported wind 150 degrees at 5 knots, 10 miles visibility, clear skies, temperature 27 degrees C, dew point 22 degrees C, and altimeter setting 29.83 inches of mercury.

Wreckage and Impact Information			
Crew Injuries:	1 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:	2 Fatal	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 Fatal	Latitude, Longitude:	44.071666,-96.190551(est)

The airplane impacted into a grassy drainage ditch adjacent to a corn field and was found lying upright. Both wings and fuselage showed damage consistent with ground impact at a high vertical and low forward speed.

The engine and airframe were examined at a recovery facility. Two of the propeller blades were bent aft and one blade was found relatively straight, with minimal rotation signatures. The top sparkplugs were automotive style Denso 27 Iridium Racing sparkplugs and appeared normal. The bottom plugs were Champion REM40E sparkplugs and also appeared normal as compared to the Champion Aviation Check a Plug Chart AV-27. The crankshaft was rotated by hand, thumb compression was established on all cylinders, and drive train continuity was established throughout the engine. The cylinders were borescope inspected, with no anomalies noted.

All flight control cables from the cockpit (pitch, roll, and yaw) remained attached to their respective cockpit controls. The flight control surfaces remained attached to their respective airframe surfaces. The flaps were in the up position. No anomalies were noted with the flight control system.

Examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

#### **Medical and Pathological Information**

On July 29, 2015, an autopsy was performed on the pilot by the Ramsey County Medical Office in Saint Paul, Minnesota. The cause of death was blunt force injuries. The Federal Aviation Administration's (FAA) Civil Aeromedical Institute in Oklahoma City, Oklahoma performed toxicology tests on the pilot's specimens. The results were negative.

#### **Tests and Research**

The Chelton EFIS, Garmin GPS, and Appareo Stratus were recovered from the accident airplane and sent to the NTSB Vehicle Records laboratory for examination. The Garmin GPS and Appareo Stratus did not contain data for the accident flight.

Chelton EFIS data was consistent with the ATC radar track/altitudes described previously. As the airplane flew overhead the accident site, it was pitched up to 34 degrees nose high while at low engine rpm. Indicated airspeed (IAS) decreased to 48 knots as the airplane banked 47 degrees to the right. As the right bank continued to steepen, engine rpm increased and the airplane pitched down to 84 degrees nose low. The airplane subsequently descended in a right turning, upright spin until ground impact. No engine anomalies were noted in the flight's EFIS data.

#### **Additional Information**

According to the airplane's flight manual, level flight stall speed with flaps retracted was 55 knots IAS.

A Wheeler Express performance report, sponsored and funded by the FAA and the Experimental

Aircraft Association (EAA), was completed in 1997. The Wheeler Express was the first 4-place homebuilt aircraft tested by this EAA program. According to the report, the design made its debut at the 1987 EAA Oshkosh fly-in, when orders for the kit were accepted. A fatal accident in 1990 led to a significant contraction in sales of the kit and the original designer's company declared bankruptcy. Following this bankruptcy, seventeen owners developed a variant having the same wing and fuselage, but with a larger tail having 40% more wetted area.

Eight test flights with the original (smaller) tail were conducted in 1997. The performance report identified that the 'cruciform' tail (mid-mounted horizontal stabilizer), wide tapering fuselage, and highly swept vertical stabilizer combined to produce low yaw stability. The report also identified that during post stall and high yaw maneuvering, the horizontal tail and elevators appeared to have an inadequate effect. The full performance report is located in the docket for this investigation.

### **Administrative Information**

Investigator In Charge (IIC):	Folkerts, Michael
Additional Participating Persons:	David Nelson; Flight Standards District Office; Minneapolis, MN Troy Helgeson; Lycoming; Williamsport, PA
Original Publish Date:	June 9, 2016
Last Revision Date:	
Investigation Class:	<u>Class</u>
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=91647

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