Aviation Investigation Final Report

Location:	Sioux Falls, South Dakota	**Accident Number:**	CEN16LA201
Date & Time:	May 27, 2016, 09:15 Local	**Registration:**	N76MD
Aircraft:	Cessna 402B	**Aircraft Damage:**	Substantial
Defining Event:	Fire/smoke (non-impact)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The commercial pilot in the left seat and the airline transport pilot in the right seat were conducting new-hire training for the left-seat pilot. While maneuvering for a practice approach, the pilots noticed the left engine was running rough. The left-seat pilot activated the auxiliary fuel pump, and the roughness resolved temporarily. Shortly thereafter, the left engine tachometer went to zero, and the left-seat pilot noticed flames emitting from the left engine cowling. The pilots declared an emergency, secured the left engine, and landed the airplane uneventfully; the wing structure was damaged by the fire. Examination of the left engine revealed thermal damage to the No. 4 cylinder, consistent with a preexisting crack condition that allowed exhaust gas to erode the cylinder head and resulted in an engine fire.

Probable Cause and Findings

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

The failure of the No. 4 cylinder head, which resulted in an engine fire and subsequent damage to the wing structure.

Findings

Aircraft	Recip eng cyl section - Failure

Factual Information

History of Flight

Approach	Fire/smoke (non-impact) (Defining event)

On May 27, 2016, at 0915 central daylight time, a Cessna 402B airplane, N76MD, experienced an in-flight left engine fire while maneuvering near the Joe Foss Field Airport (FSD), Sioux Falls, South Dakota. The airline transport pilot and commercial pilot were not injured, and the airplane sustained substantial damage to the left wing. The airplane was operated by Encore Air Cargo, Sioux Falls, South Dakota, as a 14 Code of Federal Regulations Part 91 instructional flight. Visual meteorological conditions prevailed at the time of the accident and a company flight plan was filed. The local flight departed FSD at 0840.

According to the airline transport pilot, while maneuvering for a practice approach, the flight crew noticed a rough running left engine. The commercial pilot activated the auxiliary fuel pump, and the engine then operated without issue. Shortly thereafter, the left engine tachometer went to zero and the commercial pilot, who was seated in the left seat, noticed flames emitting from the left engine cowling. The flight crew declared an emergency and secured the left engine. The airplane landed uneventfully and taxied to the company ramp.

Postaccident examination of the airplane by a Federal Aviation Administration inspector and company mechanics revealed substantial damage to the left wing structure and firewall. In addition, the number 4 cylinder was burned through at the exhaust port. The number 6 cylinder valve cover displayed thermal damage consistent with the observed damage to the number 4 cylinder. The number 4 cylinder was removed and sent to Continental Motors Group, Mobile, Alabama, for further examination.

On October 13, 2016, the number 4 cylinder was examined by the Continental Motors Group under the supervision of a National Transportation Safety Board investigator. Examination of the cylinder showed a burned through area at the cylinder head exhaust port, consistent with a preexisting crack that allowed exhaust gas to erode the cylinder head. A preexisting crack could not be determined due to the erosion of the burned through area. In addition to the burned through area, a crack was noted on the opposite side of the exhaust port.

According to the maintenance records, the number 4 cylinder was overhauled 178.3 hours prior to the accident.

Pilot Information

Certificate:	Airline transport; Flight instructor	**Age:**	33,Female
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	July 24, 2015
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	March 9, 2016
Flight Time:	3997 hours (Total, all aircraft), 1849 hours (Total, this make and model), 2945 hours (Pilot In Command, all aircraft), 54 hours (Last 90 days, all aircraft), 14 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	28,Female
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	November 12, 2015
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 30, 2014
Flight Time:	1248 hours (Total, all aircraft), 10 hours (Total, this make and model), 975 hours (Pilot In Command, all aircraft), 90 hours (Last 90 days, all aircraft), 13 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N76MD
Model/Series:	402B B	**Aircraft Category:**	Airplane
Year of Manufacture:	1977	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	402B1055
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	March 4, 2016 Annual	**Certified Max Gross Wt.:**	6300 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	13479 Hrs at time of accident	**Engine Manufacturer:**	CONT MOTOR
ELT:	C91 installed, not activated	**Engine Model/Series:**	TSIO-520-E
Registered Owner:	On file	**Rated Power:**	300 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	On-demand air taxi (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	FSD,1429 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	08:56 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	10000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Overcast / 12000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.78 inches Hg	**Temperature/Dew Point:**	17°C / 13°C
Precipitation and Obscuration:	Light - None - Rain		
Departure Point:	Sioux Falls, SD (FSD)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Sioux Falls, SD (FSD)	**Type of Clearance:**	Traffic advisory;VFR flight following
Departure Time:	08:40 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	Joe Foss Field Airport FSD	**Runway Surface Type:**	Concrete
Airport Elevation:	1429 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	15	**IFR Approach:**	None
Runway Length/Width:	8000 ft / 150 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	In-flight
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	43.582778,-96.742774(est)

Administrative Information

Investigator In Charge (IIC):	Sauer, Aaron
Additional Participating Persons:	Lori Thomasson; Federal Aviation Administration; Rapid City, SD
Original Publish Date:	January 18, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=93282