Aviation Investigation Final Report

Location:	Sussex, New Jersey	**Accident Number:**	ERA15LA071
Date & Time:	December 4, 2014, 11:00 Local	**Registration:**	N8296Z
Aircraft:	Cessna 210 5(205)	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	1 Minor, 5 None
Flight Conducted Under:	Part 91: General aviation - Skydiving		

Analysis

The pilot reported that, shortly after the skydiving flight departed, the engine experienced a "mechanical failure" and that he then executed a forced landing in a farm field south of the airport. The airplane nosed over in the mud, which resulted in structural damage to the airframe.

During a postaccident test run of the engine on the airframe, lower-than-normal exhaust gas temperature indications were observed on the engine's left-side (Nos. 2, 4, and 6) cylinders. Excessive soot and smoke were also observed on the engine's left side. During a subsequent test run, the engine initially did not achieve full power. Further examination revealed that both of the No. 2 cylinder intake valve springs were fractured, and visible rust was observed on the surfaces of the springs. The springs showed evidence of fatigue fractures that had originated from rust pits on the fracture surfaces. After the valve springs were replaced, the engine was capable of operating normally at full power.

An annual inspection was completed on the engine less than 2 months (13 engine operating hours) before the accident. As part of the annual inspection, the engine manufacturer's operating manual required the removal of the cylinder rocker covers and inspection of the valve area for breakage and proper lubrication. It is likely that maintenance personnel did not adequately inspect the No. 2 cylinder valve area during the annual inspection, which allowed the rust to go undetected and resulted in the in-flight failure of the No. 2 cylinder valve springs.

Probable Cause and Findings

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

Maintenance personnel's inadequate inspection of the No. 2 cylinder valve area during the most recent annual inspection, which resulted in the in-flight failure of the intake valve springs due to rust on the spring surfaces and subsequent fatigue cracking.

Findings

Aircraft	Recip eng cyl section - Inadequate inspection
Personnel issues	Scheduled/routine inspection - Maintenance personnel
Aircraft	Recip eng cyl section - Fatigue/wear/corrosion
Aircraft	Scheduled maint checks - Inadequate inspection

Factual Information

History of Flight

Prior to flight	Aircraft inspection event
Initial climb	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing
Landing-landing roll	Nose over/nose down

On December 4, 2014, about 1100 eastern standard time (EST), a Cessna 205, N8296Z, was force landed in a farm field following a total loss of engine power during the initial climb from Sussex Airport, Sussex, New Jersey (FWN). The commercial pilot had minor injuries and five passengers were not injured. The airplane was substantially damaged. The airplane was registered to Markelwin Aviation LLC and was operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a skydiving flight. Day, visual meteorological conditions prevailed, and no flight plan was filed. The flight was originating at the time of the accident.

The pilot reported the following. About 1,200 to 1,300 feet above mean sea level, or about 800 to 900 feet above the ground, during the initial climb, a "mechanical failure" of the engine occurred. Due to the low altitude, he force landed the airplane in a muddy farm field, south of the airport. The airplane's nose gear struck a ditch and the airplane nosed over before coming to a stop. The pilot and passengers exited the airplane without further incident.

An inspector with the Federal Aviation Administration responded to the accident site and examined the wreckage. The aft fuselage and empennage exhibited structural damage from impact forces. The propeller was bent aft and the engine remained attached at the firewall. The engine turned freely when the propeller was rotated manually.

On December, 17, 2014, the engine was test run on the airframe, which was equipped with a digital engine monitor, displaying EGT for each cylinder. Due to vibration as a result of impact damage, the engine was not run higher than 1,700 rpm. During the run, the left side cylinders (numbers 2, 4, and 6) experienced a drop in EGT while the right side of the engine ran within the normal range. Black exhaust smoke was observed from the left side engine exhaust manifold. After the test run, the fuel nozzles for the left side of the engine were observed to be clogged with a black substance and the spark plugs were soot-covered. The fuel manifold valve was opened and no anomalies or obstructions were observed. Additionally, each spark plug lead produced spark when the propeller was rotated by hand. The fuel nozzles and spark plugs were then cleaned and the engine was test run again, with the same result of the left side exhibiting significantly less EGT verses the right side (200 degrees F versus 1,000 degrees F) after about 1 minute of operation. Prior to the EGT drop, a magneto check was performed at 1,700 rpm with no anomalies noted. After the second test run, the air intake and exhaust were inspected and observed to be free of obstructions. Some oil was noted inside the number 2 cylinder.

The engine was shipped to the manufacturer's facility for further examination. After an initial inspection, the engine was prepared for a run in the test cell. Once installed, the engine started on the first attempt

without hesitation. The engine speed was brought to 1,000 rpm to warm up the engine to normal operating temperatures. The engine was run at 1,200 rpm for five minutes to stabilize. The engine throttle was advanced to 1,600 rpm, 2,100 rpm, and 2,450 rpm and held for five minutes at each rpm setting to stabilize. The engine throttle was then advanced to the full open position and the engine began to "stumble" and lose power.

Investigators then began troubleshooting the fuel system. Subsequent engine runs would result in the engine only being capable of attaining 1,800 rpm. Further troubleshooting revealed both number 2 cylinder intake valve springs were broken. Visible rust was observed on the surfaces of the springs. The broken valve springs were replaced and the engine was run again. After replacing the valve springs, the engine was capable of operating normally at full power. The engine throttle was rapidly advanced from idle to full throttle six times, where it performed normally without any hesitation, stumbling or interruption in power. No further anomalies noted that would have prevented normal operation or production of rated horsepower.

The fractured inner and outer intake valve springs from the number 2 cylinder were subsequently examined by investigators. Both springs showed fatigue fractures originating from rust pits on the surfaces.

A review of the engine maintenance logbooks revealed that a 100 hour/annual inspection was completed on October 14, 2014, at 7,857.8 hours tachometer time. About 13 hours of operating time had accrued since the last inspection of October 14. About 1,501 hours had accumulated on the engine since its last major overhaul. According to the engine manufacturer's operating manual, under the 100-hour inspection procedures, it states, "Remove valve rocker covers, and inspect visible parts of the valve mechanism for breakage and lack of lubrication. All parts should be covered with oil."

Pilot Information

Certificate:	Commercial	**Age:**	46
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	July 19, 2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	490 hours (Total, all aircraft), 40 hours (Total, this make and model), 428 hours (Pilot In Command, all aircraft), 110 hours (Last 90 days, all aircraft), 40 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N8296Z
Model/Series:	210 5(205)	**Aircraft Category:**	Airplane
Year of Manufacture:	1963	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	205-0296
Landing Gear Type:	Tricycle	**Seats:**	1
Date/Type of Last Inspection:	October 1, 2014 Annual	**Certified Max Gross Wt.:**	2899 lbs
Time Since Last Inspection:	13 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	7870 Hrs at time of accident	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed	**Engine Model/Series:**	IO-470-S
Registered Owner:	On file	**Rated Power:**	260 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:	FWN,421 ft msl	**Distance from Accident Site:**	5 Nautical Miles
Observation Time:	10:53 Local	**Direction from Accident Site:**	220°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.28 inches Hg	**Temperature/Dew Point:**	4°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Sussex, NJ (FWN)	**Type of Flight Plan Filed:**	None
Destination:	Sussex, NJ (FWN)	**Type of Clearance:**	None
Departure Time:	11:00 Local	**Type of Airspace:**	

Airport Information

Airport:	Sussex Airport FWN	**Runway Surface Type:**	Asphalt
Airport Elevation:	421 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	21	**IFR Approach:**	None
Runway Length/Width:	3499 ft / 75 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	5 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor, 5 None	**Latitude, Longitude:**	41.193054,-74.627777(est)

Administrative Information

Investigator In Charge (IIC):	Hicks, Ralph
Additional Participating Persons:	Harry Soudas; FAA/FSDO; Allentown, PA Kurt Gibson; Continental Motors, Inc.; Mobile, AL Steve Miller; Textron Aviation; Wichita, KS Henry Soderlund; Textron Aviation; Wichita, KS
Original Publish Date:	October 19, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=90461