Aviation Investigation Final Report

Location:	Sugar Land, Texas	**Accident Number:**	CEN18LA382
Date & Time:	September 19, 2018, 15:04 Local	**Registration:**	N247F
Aircraft:	Cessna 206	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	1 Minor, 2 None
Flight Conducted Under:	Public aircraft		

Analysis

The airline transport pilot and the flight instructor were conducting an instructional flight in a public aircraft with an observer on board and proceeded to an airport to conduct instrument approaches. After crossing the final approach fix and before arriving at the missed approach point, the engine lost power. The instructor took control and maneuvered the airplane over a set of power lines. He attempted to maneuver under a second set of power lines when the right wing struck one of the lines. The airplane touched down on a roadway, and its left wing struck a passing vehicle. The landing gear struck the concrete median, yawing the airplane clockwise, and the airplane's tail struck a second vehicle.

Postaccident engine examination revealed the No. 1 cylinder intake valve had failed. Fractured pieces of the intake valve had been drawn into the intake plenum. The No. 1 cylinder was extensively damaged, and all of the piston heads had impact marks or pieces of valve embedded in the heads. The No. 1 cylinder, No. 1 piston, its intake and exhaust valve train components (springs, pushrods, and rocker arms), and 12 hydraulic lifters were sent to the engine manufacturer for metallurgical examination, which revealed that the No. 1 cylinder intake valve had failed in fatigue; however, the root cause of the failure could not be determined due to the extensive damage after the valve failure. Both the intake and exhaust rocker arms had nonconforming shoe heights. In addition, nine of the hydraulic lifters failed the leak-down test, including the No. 1 intake. Maintenance information revealed the engine had been overhauled 4 years earlier, during which all 12 hydraulic lifters were replaced. The intake and exhaust rocker arms had been reworked and reused, and about 0.01 inch of material had been removed from the shoe pads during the overhaul. While the nonconforming rocker arm shoe height and lifter may have contributed to a malfunction of the valve, the investigation could not determine with certainty the reason for the fatigue failure. The fatigue failure of the No. 1 cylinder intake valve resulted in the loss of engine power.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
Fatigue failure of the No. 1 cylinder intake valve, which resulted in the loss of engine power.

Findings

Aircraft	Recip engine power section - Failure
Aircraft	Recip eng cyl section - Fatigue/wear/corrosion
Environmental issues	Wind sock - Contributed to outcome
Environmental issues	Ground vehicle - Contributed to outcome
Environmental issues	Wall/barricade - Contributed to outcome

Factual Information

History of Flight

Approach-VFR pattern final	Loss of engine power (partial) (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)
After landing	Collision with terr/obj (non-CFIT)

****This report was modified on 12/11/2019. Please see the docket for this accident to view the original report.****

On September 19, 2018 at 1504 central daylight time, a Cessna 206H airplane, N247F, struck power lines and terrain after the engine lost power while on landing approach to Sugar Land Municipal Airport/Hull Field (SGR), Sugar Land, Texas. There were no injuries to the two pilots aboard. The observer sustained minor injuries. The airplane was registered to Silver Creek Aviation Services and was being operated as a 14 Code of Federal Regulations Part 91 by an entity of the United States Government, both of Fort Worth, Texas, as a public use instructional flight. Visual meteorological conditions prevailed at the accident site, and no flight plan had been filed. The local flight originated from Conroe-North Houston Regional Airport (CXO), Houston, Texas.

Information obtained from the operator indicated that the commercial-rated pilot, under the oversight of a flight instructor, had flown in the Houston Class B airspace for an hour, and was flying the area navigation (RNAV) global positioning system (GPS) instrument approach to runway 17 at SGR. After crossing CASOB, the final approach fix, and before arriving at the missed approach point (MAP), the engine lost power. The instructor took control and maneuvered the airplane over a set of power lines. He was attempting to maneuver under a second set of power lines when the right wing struck one of the lines. The airplane touched down on a roadway, but its left wing struck a passing vehicle. The landing gear then struck the concrete median, yawing the airplane clockwise, and the tail struck a second vehicle. According to the operator, the airplane had about 30 to 32 gallons of fuel in each fuel tank.

The airplane was transported to a secure facility in Alliance, Texas, where a cursory examination was made. The engine, a six-cylinder Lycoming IO-540, was installed new on February 2, 2005. Maintenance information revealed the engine had been overhauled between November 4, 2013, and March 17, 2014. At that time, the engine had accrued 1,983.9 hours. During the overhaul, all 12 hydraulic lifters were replaced. The intake and exhaust rocker arms were reworked and reused.

The engine was rotated manually by rotating the propeller. The propeller moved about 200-degree arc before coming to a stop. The engine was removed from the airframe and disassembled. Borescope examination revealed the no. 1 cylinder intake valve had failed. All the cylinders and pistons were removed. Fractured pieces of the intake valve had been drawn into the intake plenum. The no. 1 cylinder was extensively damaged by fractured intake valve pieces as was the no. 1 piston head. The other piston heads either had impact marks or pieces of valve embedded in their heads. No metal was found in the oil pump, but there were signs of blow-by on the piston skirts. Damage was noted to sparkplugs 1 and 2.

The no. 1 cylinder, no. 1 piston, its intake and exhaust valve train components (springs, pushrods, rocker arms) and 12 hydraulic lifters were sent to Lycoming Engines for metallurgical examination. According to their Materials Laboratory Investigation Report, the no. 1 intake valve had failed in fatigue that initiated from the key recess fillet radius surface, and the fatigue crack radiated across approximately 2/5 of the cross section. Both the intake and exhaust rocker arms had nonconforming gauge shoe heights after about 0.01" material had been removed from the shoe pads during their re-work at overhaul. Except for the nos. 2 and 5 intakes and the no. 1 exhaust, the 9 hydraulic lifters failed the leak-down test, including the no. 1 intake. All other intake valve train components (valve springs, valve keys, spring seats, rotator cap) were undamaged.

According to the Lycoming report, the no. 1 intake valve failed in fatigue, but the root cause of the fatigue failure could not be determined with any degree of certainty. The intake lifter and nonconforming rocker arm may have contributed to a malfunction in the No. 1 intake valve train. The valve stem tip had separated from stem at the keeper fillet radius. The stem was bent, and head was fractured into several pieces. Damage to the bent stem and fractured head seating was caused by post-fracture contacts with the piston and combustion chamber. The fracture surface of intake valve tip was severely smeared by secondary impact and imbedded with some bronze from the intake valve guide.

The propeller assembly was examined at McCauley Propellers in Wichita, Kansas, under FAA oversight. According to McCauley's Teardown Inspection Report, both blades sustained impact damage and bore indications consistent with "a low amount of rotational energy absorption." No indications of propeller failure or malfunction were found. The propeller governor (Model: DC290D1F-T37, P/N: D-20893-37, S/N: 090066) was sent to Textron Aviation-McCauley Propeller Systems in Wichita, Kansas. The governor was externally examined and functionally tested to manufacturing requirements.

The observer's seatbelt was found released despite her tightening it prior to impact. The seatbelt was sent to AMSAFE for evaluation. According to AMSAFE'S report, the system housing may have taken some crushing damage which created drag on the push button assembly, allowing a partial connection to be made with the pawl. This would only occur "when attempting to lightly engage the connector into the buckle assembly." The report concluded that the connector engaged 100% each time it was tested. "Abrasion was shown in the inner half of the top and side buckle covers as well as along the push button," indicating that the unit "may have been smashed or restricted at some point."

A fuel sample from the left wing was sent to Aviation Laboratories in Kenner, Louisiana, for testing. Their report indicated a slightly elevated water content, but" sample test results appear normal."

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor; Private	**Age:**	42,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	May 1, 2018
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	May 18, 2018
Flight Time:	4919 hours (Total, all aircraft), 1044 hours (Total, this make and model), 4638 hours (Pilot In Command, all aircraft), 124 hours (Last 90 days, all aircraft), 46 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Pilot Information

Certificate:	Commercial; Private	**Age:**	33,Male
Airplane Rating(s):	Single-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):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	September 8, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 16, 2018
Flight Time:	328 hours (Total, all aircraft), 205 hours (Total, this make and model), 228 hours (Pilot In Command, all aircraft), 118 hours (Last 90 days, all aircraft), 34 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N247F
Model/Series:	206 H	**Aircraft Category:**	Airplane
Year of Manufacture:	2005	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	20608247
Landing Gear Type:	Tricycle	**Seats:**	3
Date/Type of Last Inspection:	August 9, 2018 Annual	**Certified Max Gross Wt.:**	3605 lbs
Time Since Last Inspection:	45 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3636 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-540-AC1A5
Registered Owner:		**Rated Power:**	300 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KSGR,82 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	14:53 Local	**Direction from Accident Site:**	170°
Lowest Cloud Condition:	Few / 4700 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	210°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.92 inches Hg	**Temperature/Dew Point:**	34°C / 23°C
Precipitation and Obscuration:			
Departure Point:	Conroe, TX (KCXO)	**Type of Flight Plan Filed:**	None
Destination:	Conroe, TX (KCXO)	**Type of Clearance:**	VFR;IFR
Departure Time:	14:00 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	Sugar Land Regional SGR	**Runway Surface Type:**	Concrete
Airport Elevation:	82 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	17	**IFR Approach:**	Global positioning system;Practice;RNAV;Visual
Runway Length/Width:	8000 ft / 100 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor, 2 None	**Latitude, Longitude:**	29.644443,-95.656112

Administrative Information

Investigator In Charge (IIC):	Scott, Arnold
Additional Participating Persons:	Todd B Prince; U.S. Drug Enforcement Administration; Fort Worth, TX William Pritchard; U.S. Drug Enforcement Administration; Fort Worth, TX John Butler; Lycoming Engines; Arlington, TX Ricardo Asensio; Textron Aviation (Cessna Aircraft); Wichita, KS Craig Hatch; National Transportation Safety Board; Arlington, TX
Original Publish Date:	February 11, 2020
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=98324