Aviation Investigation Final Report

Location:	Bell Glade, Florida	**Accident Number:**	ERA19LA069
Date & Time:	December 17, 2018, 12:10 Local	**Registration:**	N4886B
Aircraft:	Cessna 152	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot reported that, while conducting a personal, cross-country flight and descending from cruise level, the engine began gradually losing power, so he applied carburetor heat, which initially restored cruise power. Several minutes later, the engine again lost partial power and began to vibrate. The engine continued to lose power, and the airplane was unable to maintain altitude. The pilot chose to execute a forced landing on a field, during which the nosewheel dug into the ground, and the airplane subsequently nosed over.

Examination of the engine revealed that the No. 1 intake valve was stuck in the valve guide and that the upper valve spring seat on the No. 1 cylinder was broken. Detailed examination revealed contact marks on the interior and end faces of the valve keeper and pitting and radial cracks in the intake valve head. The valve springs' strength was found to be within serviceable limits. The rocker arm contact wear pattern on the valve tip was abnormal.

It is likely that, during operation, the intake valve keeper was dislodged and then became wedged in the valve spring seat until the valve spring seat fractured, at which time the intake valve became stuck in the valve guide. This resulted in a loss of compression to that cylinder and the subsequent partial loss of engine power. The contact marks on the interior and end faces of the valve keeper indicate that the keeper had been dislodged for some time while the engine operated and that the valve spring seat was intact. The pitting and radial cracks in the intake valve head indicate that the engine was operated while the valve was not seating properly, which is also consistent with operation with a dislodged valve keeper. The lack of a normal rocker arm contact wear pattern on the valve tip indicates that the valve keeper likely became dislodged soon after the valve was placed into service.

The engine manufacturer's Operator's Manual recommended periodic inspections (every 400 flight hours) of the intake valve. During a review of the engine maintenance records, no records were found

indicating whether the periodic valve inspections were completed. If these inspections had been completed, the abnormal wear pattern on the valve and the dislodged valve keeper would likely have been detected.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A partial loss of engine power due to the No. 1 cylinder's valve keeper becoming dislodged, which ultimately resulted in the intake valve becoming stuck in the valve guide and in the loss of compression to the cylinder.

Findings

Aircraft	Recip eng cyl section - Malfunction
Environmental issues	Soft surface - Effect on operation

Factual Information

History of Flight

Enroute	Powerplant sys/comp malf/fail
Enroute	Loss of engine power (partial) (Defining event)
Enroute	Off-field or emergency landing
Landing	Nose over/nose down

On December 17, 2018, about 1210 eastern standard time, a Cessna 152, N4886B, was substantially damaged during a forced landing near Bell Glade, Florida. The private pilot and pilot-rated passenger were uninjured. The airplane was registered to Troupial Aviation and operated by Orange Wings Aviation as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Day visual meteorological conditions prevailed at the time of the accident and no flight plan was filed for the flight. The flight originated from Lakeland Linder Regional Airport (LAL), Lakeland, Florida around 1035 and was destined for Pompano Beach Airpark (PMP), Pompano Beach, Florida.

According to the pilot, they departed LAL and climbed to a cruise altitude of 5,500 ft mean sea level (msl) for the flight to PMP. After the initial descent and level-off at 2,500 msl, the engine gradually began losing power. The pilot applied carburetor heat which initially restored cruise power. Several minutes later another partial loss of engine power occurred, accompanied by engine vibration. The pilot applied carburetor heat, however the engine continued to lose power and the airplane was unable to maintain altitude. He declared an emergency and elected to execute a forced landing to a plowed field. During the landing rollout, the airplane nosed over shortly after the nosewheel made ground contact.

The pilot held a private pilot certificate with a rating for airplane single-engine land. His most recent Federal Aviation Administration (FAA) first-class medical certificate was issued January 6, 2017, with the limitation "must wear corrective lenses." A review of the pilot's logbook revealed 66.3 total hours of flight experience, all of which were in the accident airplane make and model.

Examination of the wreckage by an FAA inspector revealed that the airplane came to rest inverted at the edge of the field. The top third of the vertical stabilizer was fractured and bent about 80° to the left. The right horizontal stabilizer and elevator were impact damaged. One propeller was bent aft with little or no chordwise scratching.

The engine was examined at the direction and under the supervision of an FAA inspector after it was recovered to the operator's facility. During the examination the inspector noted that the No. 1 intake valve was found stuck in the valve guide, and that the upper valve spring seat on the No. 1 cylinder was broken. The cylinder was retained for further examination.

The No. 1 cylinder and components, including valves, valve springs, valve spring seats and valve keepers, were sent to the National Transportation Safety Board's Materials Laboratory for examination. The examination revealed contact marks on the interior and end faces of the valve keeper consistent with engine operation with a dislodged keeper while the valve spring seat was intact. The examination also

noted pitting and radial cracks on the intake valve head, consistent with engine operation while the valve was not seating properly. The strength of the valve springs was checked and found to be within serviceable limits. A normal rocker arm contact wear pattern was not present on the valve tip. More information can be found in the Materials Laboratory Factual Report in the public docket for this investigation.

According to FAA airworthiness records, the airplane was manufactured in 1979. It was equipped with a Lycoming O-235-L2C, 115-horsepower engine that drove a fixed-pitch propeller. According to engine maintenance logbooks, a field overhaul was performed on the engine on March 8, 2016, at a tachometer time of 2,984.3 hours, with "unknown" total hours noted for the engine. The logs indicated that the engine time was "returned to zero" at the conclusion this field overhaul and the logbook endorsement sticker for the overhaul was partially obscured and incomplete. Following the overhaul, the No. 2 cylinder was replaced August 28, 2018, due to a cracked exhaust valve. The most recent 100-hour inspection was completed on November 16, 2018. At that time, the airframe had accumulated 3,657.9 total hours of operation and the engine had accumulated 1,326.4 hours since the overhaul. According to the Lycoming Operator's Manual, the following maintenance check should be made after every 400 hours of operation: "Valve Inspection – Remove rocker box covers and check for freedom of valve rockers when valves are closed. Look for evidence of abnormal wear or broken parts in the area of the valve tips, valve keeper, springs and spring seat. If any indications are found, the cylinder and all of its components should be removed (including the piston and connecting rod assembly) and inspected for further damage." There was no evidence in the engine logbooks indicating that this inspection had been completed. A separate log maintained by the operator showed that the airplane had flown about 45 hours since the last inspection.

Pilot Information

Certificate:	Private	**Age:**	21,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	January 6, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	68.8 hours (Total, all aircraft), 68.8 hours (Total, this make and model), 28.3 hours (Pilot In Command, all aircraft), 68.8 hours (Last 90 days, all aircraft), 49.5 hours (Last 30 days, all aircraft)		

Pilot-rated passenger Information

Certificate:	Private	**Age:**	19,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	April 12, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	106 hours (Total, all aircraft), 106 hours (Total, this make and model), 50.5 hours (Pilot In Command, all aircraft), 46.7 hours (Last 90 days, all aircraft), 26.3 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N4886B
Model/Series:	152 No Series	**Aircraft Category:**	Airplane
Year of Manufacture:	1979	**Amateur Built:**	
Airworthiness Certificate:	Utility	**Serial Number:**	152-83691
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	November 16, 2018 100 hour	**Certified Max Gross Wt.:**	1669 lbs
Time Since Last Inspection:	13 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	14845.3 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C91 installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-235-L2C
Registered Owner:		**Rated Power:**	115 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:	KBCT,13 ft msl	**Distance from Accident Site:**	24 Nautical Miles
Observation Time:	12:53 Local	**Direction from Accident Site:**	101°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	310°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	21°C / 12°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lakeland, FL (KLAL)	**Type of Flight Plan Filed:**	None
Destination:	Pompano Beach, FL (KPMP)	**Type of Clearance:**	None
Departure Time:	10:35 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	26.45111,-80.53778

Preventing Similar Accidents

Mechanics Manage Risk and Follow Procedures

Mistakes made while performing aircraft maintenance and inspection procedures have led to in-flight emergencies and fatal accidents. System or component failures are among the most common defining events for fatal general aviation accidents. Mechanics should learn about and adhere to sound risk management practices to prevent common errors; even well-meaning, motivated, experience technicians can make mistakes. Fatigue can be a hazard even for mechanics, and it can be linked to forgetfulness, poor decision-making, reduced vigilance, and ultimately interfere with the mechanic's ability to do the job safely.

Mechanics should carefully follow manufacturers' instructions to ensure that the work is completed as specified. Also, up-to-date instructions and manuals should be used; other qualified mechanics are also a great resource. Mechanics need to pay close attention to the safety and security of the items that undergo

maintenance, as well as the surrounding components that may have been disconnected or loosened during the maintenance.

Inspecting maintenance work is a great way to ensure that it is done correctly. Routine inspections should be thorough and items needing immediate attention should be addressed rather than deferred.

See http://www.ntsb.gov/safety/safety-alerts/documents/SA_022.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Spencer, Lynn
Additional Participating Persons:	Anthony Cresswell; FAA/FSDO; Miramar, FL
Original Publish Date:	April 13, 2020
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=98786