Aviation Investigation Final Report

Location:	Mountain Home, Arkansas	**Accident Number:**	CEN15LA023
Date & Time:	October 21, 2014, 17:45 Local	**Registration:**	N601WR
Aircraft:	TUBERVILLE ZODIAC XL	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	1 Serious, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot reported that he had recently built the airplane. The pilot operated the engine for about 4 hours, and the engine operated normally during the ground tests. During takeoff on the airplane's first flight, he advanced the throttle slowly to 2,550 rpm, and the airplane lifted off the runway about 60 mph. About three-quarters down the runway and about 50 ft above ground level, the engine began to lose power. The pilot attempted to return to the runway by turning left. The pilot completed a 180-degree left turn, but the engine rpm had reduced to about 1,925 rpm, and the airplane was unable to maintain altitude. Data from the airplane's engine monitoring device (EMD) indicated that the airplane reached a maximum airspeed of about 65 mph; the last airspeed reading before ground impact was 41 mph. The pilot attempted to land in a small clearing, but the airplane clipped a tree before landing. The airplane sustained substantial damage to the wings and fuselage during the ground impact.

Data from the EMD also indicated that the engine operated for about 12 minutes from engine start to ground impact. The data indicated that the engine oil pressure, engine oil temperature, and fuel pressure were normal throughout the flight but that the Nos. 2, 3, and 5 cylinder head temperatures exceeded 500 degrees F. A postaccident examination of the engine and carburetor revealed no evidence of mechanical malfunctions, heat distress, or failures that would have precluded the engine's operation. The reason for the increased cylinder head temperature indications and the partial power loss could not be determined.

Probable Cause and Findings

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

The partial loss of engine power during takeoff for reasons that could not be determined because postaccident engine examinations revealed no anomalies that would have precluded normal operation.

Findings

Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Takeoff	Loss of engine power (partial) (Defining event)
Approach-VFR pattern downwind	Collision with terr/obj (non-CFIT)

On October 21, 2014, about 1745 central daylight time, an experimental amateur-built Tuberville Zodiac XL airplane, N601WR, sustained substantial damage when it struck a tree and impacted the ground during a forced landing due to a partial loss of engine power after takeoff from the Baxter County Airport (BPK), Mountain Home, Arkansas. The pilot received minor injuries and the pilot-certificated passenger received serious injuries. The airplane was registered to and operated by a private individual under the provisions of the 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed for the flight, which was not operated on a flight plan. The airplane was departing BPK on a local flight at the time of the accident.

The pilot reported that he purchased the airplane from a previous owner in 2011 when it was still in the build stage. The pilot completed building the airplane in 2014. The airplane was in the Phase I flight testing process, which required at least 40 hours of operation in the assigned geographic area. The accident flight was the first flight of the airplane.

The pilot asked the pilot-certificated passenger to fly with him on the first flight because the pilot-certificated passenger was an experienced agricultural pilot with numerous flight hours in other experimental amateur-built airplanes. The pilot-rated passenger reported that he went on the first flight to assist the pilot, but not to fly the airplane.

The pilot reported that he had operated the engine for about 4 hours prior to the first flight. The ground tests of the engine included static run-ups, taxi and high-speed taxi tests, and "crow hops." The pilot explained that crow hops were high-speed taxi tests where the pilot would get the airplane airborne to about 15 to 20 feet in the air, and then reduce the throttle and land on the airplane on the runway. He reported that the engine operated normally during the ground tests.

The pilot reported that during the ground run-up prior to the first flight, he advanced the throttle to 2,550 rpm and the engine operated normally. During takeoff from runway 5 (5,001feet by 75 feet, asphalt) at BPK, he advanced the throttle slowly to 2,550 rpm and the airplane lifted off the runway about 60 mph. About 3/4 down the runway and about 50 feet above ground level (agl), the engine began to lose power. The pilot attempted to return to the runway by turning left. About 90 degrees through the turn, the pilot heard the cylinder head temperature (CHT) audible warning. The pilot had completed a 180 degree left turn, but the engine rpm was about 1,925 rpm and the airplane was unable to maintain altitude. The pilot attempted to land in a small clearing, but clipped a tree prior to landing. The airplane sustained substantial damage to the wings and fuselage during the ground impact.

The airplane was equipped with an engine monitoring device which the pilot downloaded. The data indicated that the engine was operated about 12 minutes from engine start to ground impact. The data indicated that the engine was delivering 2,583 rpm during takeoff and climbed to about 64 feet agl. About one minute after takeoff, the engine rpm began to decline to 1,924 rpm. The airplane impacted the ground about 2 minutes after takeoff. The data indicated that the No. 2, No. 3, and No. 5 CHTs reached 628 degrees F, 586 degrees F, and 524 degrees F, respectively, while still airborne. The pilot reported that the CHT audible warning was set to sound when 500 degrees F was reached. The data indicated that the engine oil pressure, engine oil temperature, and fuel pressure were normal throughout the flight. The data indicated that the maximum airspeed reached was about 65 mph. The last airspeed reading before ground impact was 41 mph.

The engine was examined at an engine overhaul facility under National Transportation Safety Board oversight. The visual examination of the engine revealed that the distributor cap was broken. The oil filter was crushed. The upper right baffling was damaged. The cylinder head temperature wires were cut. The carburetor was not sent with the engine, and the air intake tubes to the carburetor were not sent. The valve cover over the No. 6 cylinder had slight crush damage.

The engine timing was checked using an ohm meter. The points opened about 10 degrees before top dead center. The firing order of the cylinders was 1, 4, 5, 2, 3, and 6. The cold cylinder compression test obtained the following results: No. 1 - 70/80; No 2 - 50/80; No. 3 - 40/80; No. 4 - 50/80; No. 5 - 15/80; and No. 6 - 64/80. The spark plugs were examined. The No. 3 spark plug ground strap had bluing. The other plugs exhibited a rich, but normal appearance. The No. 3 cylinder had some oil in it during the compression test.

The No. 6 rocker arm was slightly loose. Otherwise, the rocker arms and push rods were normal with no anomalies. The Nos. 1, 3, and 5 cylinder head was removed. The Nos. 1 and 3 cylinders exhibited some exhaust blow-by. The breakout torques had felt low to the technician as he removed the lower bolts. The Nos. 2, 4, and 6 cylinder head was removed with a torque wrench to measure the break-out torque values. The minimum torque value was listed as 27 foot pounds. The bottom head bolts had breakout torques below 27 ft/lbs. The top head bolts had a breakout force of about 30 ft/lbs. There was no blow-by observed on the Nos. 2, 4, and 6 cylinder head.

The No.5 piston exhibited score marks on the side of the piston above the top compression ring. The top compression ring was stuck next to the two score marks. There were score marks inside the cylinder wall associated with the two score marks above the top compression ring. The top of the No. 5 piston was normal. The second compression ring was normal. The piston rings on the other pistons moved freely and normal. There was light scoring noted on Nos. 2, 3, and 4 cylinders.

The crankshaft, camshaft, connecting rods, and bearings were normal and no discoloration was present. Drivetrain continuity was confirmed with the distributor moving. There was no evidence of extreme temperatures in any of the cylinders, and no evidence of detonation or pre-ignition. The cylinder head temperature (CHT) probes were normal.

There was normal carbon buildup on all the pistons except No. 4. The No. 4 piston, cylinder head, exhaust and intake valves did not exhibit carbon buildup. The No. 4 exhaust valve was not seating completely. There was leakage toward the top of the valve seat. The No. 4 exhaust valve exhibited some erosion of the aluminum cylinder head casting next to the exhaust valve seat area. The No. 2 cylinder

exhibited some exhaust valve leaking. The No. 5 cylinder head exhaust valve seat was sunken slightly deeper in the head than the Nos. 1 and 3 exhaust valve seats. The No. 5 exhaust valve was not seating. The Nos. 2, 4, and 5 exhaust valves exhibited some leaking. All intake valves were seating.

The carburetor was examined at a component overhaul facility under NTSB oversight. The examination revealed that the throttle shaft was stiff due to the throttle arm being bent. The stop was broken due to impact damage. The float bowl was clean and the metal floats and the float level were normal. It had a one-piece verturi and the venturi main discharge was clean. The accelerator pump was normal.

Pilot Information

Certificate:	Sport Pilot	**Age:**	36
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Sport pilot None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	152 hours (Total, all aircraft), 3 hours (Total, this make and model), 3 hours (Last 90 days, all aircraft), 3 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	TUBERVILLE	**Registration:**	N601WR
Model/Series:	ZODIAC XL	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special); Experimental light sport (Special)	**Serial Number:**	6-4958
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	September 23, 2014 Condition	**Certified Max Gross Wt.:**	1320 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	4 Hrs at time of accident	**Engine Manufacturer:**	Wynn Corvair
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	
Registered Owner:	TUBERVILLE ANDREW D	**Rated Power:**	100 Horsepower
Operator:	TUBERVILLE ANDREW D	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BPK,928 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	16:53 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.17 inches Hg	**Temperature/Dew Point:**	23°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Mountain Home, AR (BPK)	**Type of Flight Plan Filed:**	None
Destination:	Mountain Home, AR (BPK)	**Type of Clearance:**	None
Departure Time:	17:45 Local	**Type of Airspace:**	

Airport Information

Airport:	Baxter County Airport BPK	**Runway Surface Type:**	Asphalt
Airport Elevation:	928 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	05	**IFR Approach:**	None
Runway Length/Width:	5001 ft / 75 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 Minor	**Latitude, Longitude:**	36.368888,-92.470558(est)

Administrative Information

Investigator In Charge (IIC):	Silliman, James
Additional Participating Persons:	Bill Aldrich; FAA Little Rock FSDO; Little Rock, AR
Original Publish Date:	June 9, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=90287