

NATIONAL TRANSPORTATIONS SAFETY BOARD
Office of Aviation Safety
Washington, DC 20594

SUMMARY OF ENGINE EXAMINATION

-- CEN18FA310 --

A. ACCIDENT

Location: Ponca City, Oklahoma
Date: August 4, 2018
Time: 1045 CDT
Aircraft: Extra EA-400, N13EP

B. PARTICIPANTS

Craig Hatch
Aerospace Engineer
National Transportation Safety Board
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National Transportation Safety Board
Denver, Colorado

C. DETAILS OF ENGINE EXAMINATION

A post-recovery engine examination was conducted at Air Salvage of Dallas, Lancaster, Texas, on November 4, 2020.

D. SUMMARY OF ENGINE EXAMINATION

Airframe – Extra EA-400

Engine – Teledyne Continental Motors TSIOL-550-C(1) s/n 803304

- The engine was removed from the manufacturer's shipping crate
- The engine assembly was damaged consistent with impact forces and a post-impact fire.
- The engine was mostly covered in hardened dirt and debris. The debris was loosened and separated in order to facilitate the examination.
- A large, 3 to 4 inch hole was observed on top of the case, just before the No. 3 cylinder. The damage appeared to be downward toward the inside of the case.
 - The examination later found the connection rods/cam and crankshaft all in place.

Summary of Engine Examination

- All cylinders remained attached with mostly superficial impact damage. The valve covers sustained impact damage. The No. 2 valve cover was fragmented and impact damaged.
- Oil filter date 7/25/18 417 hours. Tempest SpinEZ filter remained attached to its mount and exhibited impact damage to one side of the can.
- The oil pump remained mounted and intact with no apparent external damage. The unit was disassembled and contained oil and no apparent debris. The gears were intact with no apparent damage. The unit was also absent any indication of hard material passage.
- The water reservoir was intact with minimal damage and remained attached to its mount. There were no signs of engine overheating so the unit was not disassembled.
- The throttle body was impact damaged and fragmented and a majority of the unit was missing. A small portion of the body remained attached via one fuel line. The butterfly remained attached to this small portion of the body and was intact and bent.
- Engine driven fuel pump was intact. Mixture arm moved freely from stop to stop. The mixture cable had been previously impact separated/cut. The fuel pump drive shaft was intact and not sheared. The fuel pump was disassembled with no anomalies noted.
- The fuel manifold remained attached on top of the case and the fuel lines were mostly intact with some impact damage. The unit was disassembled. The inside was unremarkable and dry. The diaphragm was in good shape and the screen was clear of debris and contaminants.
- In order to view the engine internals and crankshaft, all of the cylinders were removed.
- The No. 6 cylinder was removed first. Water and light brown/tan sediment were found in the cylinder. A soft, wet, crystalized sediment was adhered to the piston face. The spark plugs remained installed, but the top plug was fractured and damaged.
- The No. 1 cylinder was removed next. The cylinder contained white/gray, ashy debris. The valves were intact and appeared in good shape. The piston face contained a dry, white, crystalized substance similar to ash. The piston was removed from the connecting rod which appeared in good shape. The spark plugs remained installed, but the top plug was fractured. The lifter on the right side was jammed and prevented full crankshaft rotation. Once the lifter was freed up, the engine was free to rotate.
- The No. 3 cylinder was removed next and was in good shape. Both spark plugs remained installed. The valve cover was intact and mostly undamaged. The valves appeared undamaged and the cylinder was in good shape overall. There was a small amount of ashy debris in the cylinder near the valves.
- The No. 5 cylinder was removed next and appeared in good shape. The cylinder contained water and orange/brown muddy debris. The bottom spark plug was intact with the ignition lead installed. The top plug was installed but fractured. The face of the piston contained a wet sediment.
- The No. 2 cylinder was removed next. It contained dirt, mud, water, and debris. The piston, valves and cylinder were intact with some external impact damage. The spark plugs remained installed. The bottom plug was broken and bent upward.
- The No. 4 cylinder was removed last. It contained dirt, mud, and debris. The piston, valves and cylinder were intact with some external impact damage. The spark plugs remained installed and intact.
- The engine accessory gears were intact with no apparent damage. The camshaft and accessory gears rotated freely when the crankshaft was manually rotated.
- All ignition leads were mostly damaged and mangled on top of the case. Several top spark plugs were impact damaged and separated from their spark plug holes.
- The left magneto was loose from its mount but remained intact with minimal damage. Slick Magneto s/n 02080388 m/n 6320. The impulse coupling operated. When rotated with an impact driver, a spark was obtained from each lead.

Summary of Engine Examination

- The right magneto was missing and not with the engine. The magneto cap remained and was still attached to some of the ignition leads.
- The starter drive assembly remained mostly intact with damage to the mounting area. The ball bearings and gear teeth were intact with no apparent damage or wear. The drive could not be rotated by hand. The starter was impact separated from the drive unit.
- The spinner was missing. The baffling around the propeller hub was compressed against the propeller hub. All four of wooden propeller blades were separated at the hub. The propeller hub remained attached to the crankshaft.
- The direct drive alternator remained attached to the mount at the front of the engine. The unit sustained impact damage to the housing and portions of the unit were missing.
- The belt driven alternator had been impact separated from the engine. The unit sustained impact damage. A ~1 ft long portion of the drive belt was still wedged onto the pulley.
- The turbocharger had been separated from the engine. The compressor had separated from the turbine at the connecting shaft. The shaft appeared to be fractured due to impact. There was no apparent smearing/scoring that would be consistent with rotation at the time of separation. The compressor rotor manually rotated with a minimal amount of binding in one small area. There were some scoring marks on the wall. The turbine blades were seized and would not rotate when attempted manually. There was about a one-inch score mark on the turbine wall from the blades
- The oil pan was crushed and flattened upward with several tears and separations.
- The oil sump was unremarkable but contained mud and organic debris. There was a light oil residue that remained. The dipstick was bent about 90 deg into the oil sump area.
- The oil pick up screen was crushed upward into the No. 1 cylinder right side lifter. This caused the lifter to be jammed and extended outward, which prevented full crankshaft rotation. Once the lifter was freed up, the engine crankshaft, camshaft and accessory gears were free to rotate through.
- There were no preimpact anomalies noted during the engine examination.

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