The National Transportation Safety Board

Office of Aviation Safety
Central Region
Memorandum for the Record
Engine Examination Findings
CEN18FA368
St Ignace Michigan
August 31 2018

General

Divers from the Michigan State Police (MSP) located the airplane wreckage in 44-feet of water, about 1-mile from the departure end of runway 7. They recovered the wreckage and it was transported to a secure facility at 83D for examination by the NTSB. Detailed examinations of the airframe, engine, and propeller were conducted on August 5-6. The airframe was severely damaged, and deformations were consistent with a slightly right wing down, nose low, high speed impact with the water.

Engine Examination Findings

The engine and airframe wreckage as first viewed was placed on the floor of a hangar at 83D. The engine remained attached to the airframe by cables. The cowling had been destroyed in the impact and recovery of the wreckage from the bottom of the lake. The propeller was impact separated and was laying on the floor near the engine. The engine from the airframe and suspended it from an engine hoist. The fuel injector and intake plenum were impact separated and remained attached to the engine by the control cables. The number one cylinder had sustained impact damage in the fin area of the cylinder head. The intake piping was missing and not recovered.

To facilitate the examination of the engine and its components, the following were removed:

- The rocker covers were removed.
- The remainder of the fuel injection system were removed.
- The vacuum pump was removed.
- The propeller governor was removed.
- The top spark plugs, and the number two-cylinder bottom plug were removed.
- The engine driven fuel pump was removed.
- All remaining exhaust were removed except for the cylinders one, three and five, exhaust header.
- The turbocharging system was removed.

A turning tool was inserted in the vacuum pump pad, and the engine was rotated. Valve train continuity was observed, all gears were observed rotating at the back of the engine. Thumb compression was observed on all cylinders except the number two cylinder. It was noted that the cylinder number two intake valve was not fully closing. The number two cylinder was removed. During the removed of the cylinder, the intake valve closed fully. An inspection of the valve guides and valves revealed no damage and the valve sticking issue could not be duplicated.

Turbo System

The only components of the turbocharging system that were recovered were the turbocharger, pressure relief valve and the waist gate controller (no data plate on the waist gate controller). The turbocharger intake and exhaust turbines rotated freely by hand with no binding. No Anomalies were found on the turbocharger.

Lubrication

An unmeasured amount of used engine oil was observed in the engine during the examination.

Vacuum Pump

The vacuum pump was secure on its mount. It was removed and disassembled. No defects were observed.

Starter/Alternator/Ignition System/Spark Plugs

The starter was removed, and no defects were noted. The alternator was secure on its mount and sustained impact deformation. The ignition harness was intact. The leads were cut to facilitate the removal and testing of the magneto. The magneto was secure on its mount. It was removed, and the magneto was rotated by hand via the impulse coupling. The magneto furnished spark at all outlets. The top spark plugs were removed, and the cylinder number two bottom spark plug was removed. They exhibited normal wear.

Fuel System

The fuel injector and intake plenum were impact separated from their mount. The throttle and mixture controls remained attached to the injector. The fuel inlet screen was removed and no contaminates were observed. Nothing was observed on the fuel injector or intake plenum that would have precluded normal operation prior to initial impact. The engine driven fuel pump was secure on its mount. It was removed and no defects were noted. All fuel injector nozzles were removed and examined. All cylinder nozzles were observed obstructed with unknown debris except for the number five-cylinder nozzle, it was observed clear.

Propeller

The propeller was impact separated from the crankshaft. The propeller blades were marked as Blade “A”, and Blade “B” for photo and documentation purposes. The two-blade Hartzell propeller hub was fracture separated from the crankshaft propeller flange. Both blades remained in the hub. For examination purposes, the blades were marked “A” and “B”. Blade “A” was rotated in the hub to a position beyond normal limits and was bent aft approximately mid-span. Blade “B” was rotated in the hub beyond normal limits. Blade “B” was bent aft about mid-span and exhibited twisting.

A Hartzell propeller investigator was consulted via telephone while the propeller was examined. It was noted that the blade pitch stops were damaged, and impact damage was observed on the preload plate on the high pitch end. They were photographed and the photos were sent to the Hartzell investigator. He reviewed the photos and stated that the damage was consistent with moderate to high power setting on the propeller. He stated that the propeller blades were deformed in a way that is consistent with a high velocity water impact. The propeller governor was removed, and the gasket screen was examined, no contaminants were observed. The propeller control rod was impact fractured. The Hartzell Propeller Examination Report is included in the docket.

Alexander Lemishko

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Senior Air Safety Investigator
NTSB Central Region Aviation