

N737NB Lycoming field notes

There was no National Transportation Safety Board (NTSB), Federal Aviation Administration (FAA), Textron Aviation or Lycoming Engines travel to the mishap site.

The airplane was recovered to a secure facility at the Palm Springs Airport, where an examination was conducted April 13, 2021.

The metal two bladed fixed pitch propeller was displaced from the crankshaft flange at the mechanical attachment area of the hub. The fracture surfaces exhibited signatures consistent with overload due to the absorption of rotational energy.



The propeller blades remained attached to the propeller hub. The propeller blades displayed leading edge gouging, torsional twisting, chordwise striations across the cambered surface and trailing edge "S" bending. The signatures were consistent with the absorption of rotational forces applied at the crankshaft at the time of impact.

All engine compartment fuel lines were found to be in place and secure at their respective fitting of each fuel system component.

The carburetor remained undamaged and securely attached at the mounting flange. The throttle/mixture controls were found securely attached at their respective control arms of the carburetor. The castellated nut and cotter pin remained secure and the serrated interface at the throttle arm remained securely mated.

The carburetor was opened for examination. The fuel bowl remained free of visible contaminants. The float assembly remained secure at the mounting and free of damage. The float pontoons exhibited no evidence of rubbing against the wall of the bowl. All internal locking tabs and safety devices of the carburetor were in place and properly secured. The fuel inlet screen was found properly installed and free of contamination. No external fuel staining was observed. The fuel accelerator pump plunger seal remained pliable and intact.

The subject carburetor was equipped with an temperature probe at the venturi.

The carburetor and induction system were examined and observed to be free of obstruction. The carburetor heat control valve within the airbox was captured in the "heat on" position.

The fuel system utilizes gravity fed fuel, there is no engine driven fuel pump.

The single-drive dual magneto had sustained impact energy damage and was slightly displaced from the mounting pad. Magneto to engine timing could not be ascertained. The magneto was observed to produce spark at all eight plug leads during hand rotation of the drive. The impulse coupler drive was observed to be intact and properly safetied.

The spark plugs were secure at each position with their respective spark plug lead attached. The spark plug electrodes remained mechanically undamaged, and according to the Champion Spark Plugs Check-A-Plug chart AV-27, the spark plug electrodes displayed coloration consistent with normal operation.

The ignition harness was attached at the magneto cap and at each spark plug lead.

The starter was displaced from the engine and destroyed. The subject starter was not examined.

The alternator was securely attached at the mounting brackets with the electrical connections secure at each post.

The vacuum pump was displaced from the engine at the mounting pad. The fracture surface signatures were consistent with overload. The drive was intact.



The oil filter was secure at the mounting pad and was not removed for examination. The oil suction screen was found secure and contained visible metallic debris. There was no evidence observed of any pre-mishap lubrication system malfunction found during the examination.

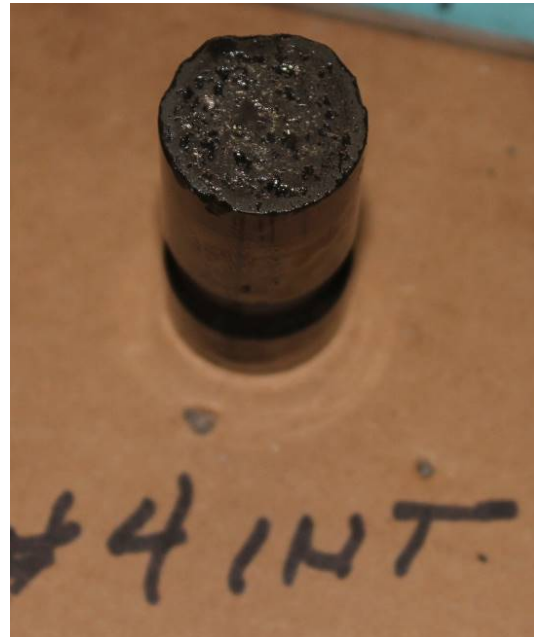
The powerplant is a four-cylinder, air cooled, direct drive, horizontally opposed, normally aspirated (carburetor), internal combustion engine rated at 160hp @ 2700rpm.

The engine remained attached to the airframe by the engine mount. The engine mount was displaced aft. The engine had sustained impact energy damage to the forward lower area of the number two-cylinder head. Visual examination of the engine revealed no evidence of pre-impact catastrophic mechanical malfunction or fire.

The top spark plugs were removed, examined and photographed. The vacuum pump was removed and the crankshaft was rotated by hand through the drive pad utilizing a drive tool. The crankshaft was free to rotate in both directions. "Thumb" compression was observed in proper order on all four cylinders. The complete valve train was observed to operate in proper order and appeared to be free of any pre-mishap mechanical malfunction. Normal "lift action" was observed at each exhaust rocker assembly; however, the intake valve rocker at each cylinder exhibited diminished movement estimated at 60% less than normal. Clean, uncontaminated oil was observed at all four rockerbox areas. Mechanical continuity was established throughout the rotating group, valve train and accessory section during hand rotation of the crankshaft. The combustion chamber of each cylinder was examined through the spark plug holes utilizing a lighted borescope. The combustion chambers and bottom spark plug electrodes remained mechanically undamaged and there was no evidence of foreign object ingestion or detonation. The valves were intact and undamaged. There was no evidence of valve to piston face contact observed. The gas path and combustion signatures observed at the spark plugs, combustion chambers and exhaust system components displayed coloration consistent with normal operation. There was no oil residue observed in the exhaust system gas path. The exhaust system and muffler were found free of obstructions.



To facilitate further internal examination, holes were drilled through the top of the engine case material in-line with the rotational plane of each connecting rod at cylinder one and three. A lighted borescope was inserted into the hole to visualize the intake camlobes and tappets. The intake lobes characteristic elliptical shape was significantly diminished at each intake valves shared lobe. The intake tappets exhibited severe spalling. The tappets from cylinder two and four were removed for further examination, which found chipped edges and missing material.



Lycoming Engines Mandatory Service Bulletin SB301B, dated February 18, 1977 provides guidance for maintenance procedures and service limitations for valves. In particular Paragraph 1, (b) states "Rotate the engine by hand and check to determine that all cylinders have normal lift and that rockers arms operate normally" a 400-hour inspection interval.

Lycoming Engines Mandatory Service Bulletin SB480F provides guidance when inspecting oil system screens and filters for contamination during inspection cycles.

Additionally, the Lycoming O-320-H series engines require the use of an oil additive LW-16702, IAW AD 80-04-03 R2, Lycoming MSB 446E that have anti-wear additive which reduces cam wear and tappet spalling. NE-06-31R5 dated October 19, 2011 provides for an Alternate Means of Compliance (AMOC) to this AD.