



MEMORANDUM FOR RECORD

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Eastern Region

Date: 07/18/2025
Subject: Examinations and testing of N545PZ
NTSB Case Number: ERA24FA001

N545PZ came to rest after striking an embankment in a right-wing, nose-low attitude about 15 feet below the top of a plateau at Lake Placid Airport (LKP), Lake Placid, New York. The airplane then slid about 30-feet down the embankment and came to rest on the side of the slope upright, perpendicular to the embankment with its left wing facing uphill, and its right wing facing downhill. Measurements indicated that the embankment was located about 440 feet from the approach end of runway 14, approximately 250 feet left of centerline, and had an approximate 70-degree slope which led down to a ravine located off the approach end of the runway.

Examinations and testing of N545PZ occurred over the course of the investigation. The following is a summary of the examinations and testing that occurred:

On Scene Airplane Examination

On 10/03 and 10/04, 2023, The airplane was examined on site at Lake Placid Airport (LKP), Lake Placid, New York.

Examination of the wreckage revealed that during the impact sequence the right wing had sustained upward buckling from the wingtip inboard to the aileron/flap junction. The fuselage and empennage were slightly buckled along the right side from the aft side of the cabin door to approximately Fuselage Station (FS) 225.

Control cable continuity was established from the flight control surfaces to the cockpit controls. The flaps were extended approximately 10 degrees; the stabilator trim was neutral. The fuel strainer bowl was fractured during the impact sequence and only a portion of it was observed. The fuel strainer screen was clean. The fuel selector handle operated normally in all positions and positively engaged in the detents. The position of the fuel selector valve was confirmed to be on "BOTH" by rotating the handle through all positions while defueling the aircraft through the

inlet line of the fuel strainer. The fuel caps were closed and secured. The position of the fuel pump switch could not be determined due to impact damage. There were no obstructions noted in the fuel or fuel vent system from the wing tanks to the inlet of the fuel strainer. First responders reported that fuel was draining from the airplane upon their arrival.

The nose landing gear was crushed aft during the impact sequence which separated the actuator; its position could not be determined. The landing gear was in an intermediate position. The single main landing gear actuator was observed attached to its frame. The sector gear teeth were intact. There was no observable damage to the main landing gear down locks or gear legs. The main landing gear wheels were also observed to be in contact with the buckled lower fuselage and not in the wheel wells.

The electrical and lighting switch positions were damaged during the impact sequence and their positions could not be determined.

The cowl flap handle was in the "OPEN" position.

The mixture control was in the full rich position, the propeller control was in the high rpm / fine pitch position, and the throttle was out about 2-inches and bent slightly up and to the left about 30-degrees.

The fuel selector was found in the "BOTH" Position. All detents were functional. No blockages were discovered in the fuel system and 17 gallons of fuel were recovered from the right wing fuel tank. The fuel was tested using water finding paste with a negative result.

On Scene Engine Examination

On 10/03 and 10/04, 2023, The engine was examined on scene at Lake Placid Airport (LKP), Lake Placid, New York.

As first viewed, the engine remained attached to the accident aircraft through its respective engine mount. The engine mount sustained damage from the impact sequence in the form of fractures and bends to various tube sections and was canted, to the right of the aircraft centerline. The engine mount was cut to free the engine from the firewall along with disconnecting and / or separating various fuel hoses and control cables. The spinner was impact fractured and only half remained attached to the propeller hub. The propeller hub was found cracked from the impact sequence with a section missing and one blade partially dislodged from the hub.

The top sparkplugs were all found intact, undamaged, and tightly installed in each cylinder. The top sparkplugs were removed, and a lighted borescope inspection was conducted on each cylinder. The borescope revealed no abnormalities within the cylinders. The drive train was rotated by the propeller in its normal direction of rotation, suction and compression was noted on all cylinders through the top spark plug holes with movement of all rocker arms noted during rotation.

All 8 sparkplugs were removed and checked with a Champion Check-A-Plug chart. Coloration across the plugs was from normal to black carbon fouled with normal wear to the electrodes. No mechanical electrode damage was noted or observed on any plug. Bottom plugs for cylinders 1 and 3 were oil soaked, consistent with orientation of the engine at the accident site and oil within the cylinders.

The single drive dual magneto was found securely installed to the rear of the engine, removed, and rotated using an electric drill. The magneto produced spark at all ignition leads when rotated. No damage was observed to the magneto housing, but both ignition harnesses had sustained varying levels of impact damage in the form of cuts and abrasions to multiple leads.

The oil dipstick was found securely installed to the filler neck and the dipstick indicated that 6 quarts of oil was in the engine. Oil was also found to be draining from the impact damaged No. 3 cylinder exhaust tube due to the orientation of the airplane at the accident site, and oil was also found on the accessory section of the engine around the oil filter as the oil filter housing (can) had sustained a high level of impact damage and had been separated from the oil filter's threaded base. A portion of the filter element was removed, inspected, and found to be clean with no metallic particles or any debris. The oil suction screen plug was found to be tight, and safety wired to the oil sump. The plug was removed, and its screen examined. The screen was found to be unobstructed and clear of any debris.

The fuel system including the engine driven fuel pump, fuel manifold, and fuel servo were all found attached to the engine. The fuel pump 45-degree outlet fitting was found slightly loose with the mating hose tight to the fitting. No fuel staining was observed from the fitting or on the fuel pump housing itself. The fuel divider was tightly installed to the top of the engine with all the fuel injection lines tight and secure to each fuel injection nozzle. The manifold was disassembled with no debris or tears noted to its diaphragm. The fuel servo was attached to the lower side of the engine with all lines tight and secure, but all 4 hold down nuts were found loose when slight pressure with a wrench was applied. Torque stripes were present on the studs and nuts. The torque stripes did not appear to be disturbed or misaligned. When the throttle arm was actuated manually, the throttle plate would move freely within the servo, but the threaded rod for the idle thumb screw adjustment was found fractured and not connected. The fuel injection nozzles were removed from each cylinder and found to be free and clear of any debris within each nozzle.

The vacuum pump was found securely installed to the accessory section of the engine and removed for disassembly. The rotor and vanes were all found intact with no fractures or damage observed. The drive coupling was present with no damage observed and the entire unit spun freely when rotated by hand.

The prop governor was found securely installed to the rear of the engine and removed. Its screen was found free and clear of any debris and oil flowed from the unit when rotated by hand making the normal gurgle sound during manual rotation.

Follow on Wreckage Examination

On 01/11/2024 a follow-on wreckage examination was conducted, at Anglin Aircraft Recovery Services in Clayton, Delaware.

During the examination, the extension portion of the reservoir drain control was found to be installed 90° forward on the arm assembly with the tang over the aft side of the arm; little to no movement was observed at either drain valve assembly when the extension was pulled forward and no fuel drained from either drain tube.

The actuating cables for both drain valves were found to be bent approximately 50° due to impact damage. The extension portion of the reservoir drain control was then removed from the arm assembly and installed in line with the arm per the engineering drawing; a small amount of movement was observed at both drain valve assemblies when the extension was pulled forward and fuel was observed dripping from the right drain tube. No fuel was observed from the left drain tube.

Approximately 16 ounces of blue aviation fuel was drained from the right reservoir tank; no fuel was drained from the left reservoir tank as the vent line was disconnected during the on-site investigation.

Each reservoir tank was examined with a lighted endoscope; no anomalies were noted in the right tank. A small amount of debris was observed in the left tank. The left reservoir tank was then removed from the airplane and shaken over a clean paper towel. A small amount of debris which appeared to be dirt/sand was expelled from the tank.

The fuel selector valve was removed from the airplane and compressed air was blown through the valve in each of the four positions. No obstructions were noted and the valve operated normally. The auxiliary fuel pump was also operationally tested with no discrepancies noted.

Factory Engine Examination

A factory engine examination occurred at Lycoming Engines, Williamsport, Pennsylvania on 04/24 and 04/25, 2024.

During the examination, all the cylinders were removed from the engine along with the corresponding pistons from each cylinder. All rocker arms, valves, and springs were removed from each cylinder. Examination of each component did not reveal any anomalies and all were found unremarkable. The valve stems showed no signs of material transfer, scoring, or damage. All the pushrods were removed and found to be straight with no bending along the length of each rod.

The engine case was separated to allow examination of the crankshaft and camshaft. Both were found to be unremarkable with the journals and lobes in good condition. The connecting rod bearings and main bearings were present and in good condition.

The engine driven oil pump was removed from the accessory housing and both its gears and housing were unremarkable. The accessory housing portion of the pump showed some pitting

and wear to the aluminum surface which may have been present from past operation before engine overhaul.

The remaining portion of the oil system was examined starting with the oil pressure relief valve spring. The spring was tested to new production limits and found to be within tolerance at 8.6 lb. The acceptable range per the Lycoming Drawing is 8.5 to 9.5 lb. under compressed load.

The vernatherm was present within the oil filter adapter and was removed for examination. The vernatherm was tested within a heated oil bath and measuring fixture used for vernatherm testing. The subject unit was placed in the oil bath and heated to various temperatures during the test. Results of the test showed that the vernatherm moved at all testing temperatures and met the required length of travel between the 150° and 185° test points.

Propeller Examination and Governor Testing

Propeller examination and governor testing occurred at McCauley Propeller, Wichita, Kansas on 06/18/2024.

The propeller displayed sudden-failure type damage and gross part deflections typically associated with impact forces. Approximately the aft half of the circumference of the #2 blade socket was missing. The fracture surface of the hub was consistent with gross structural overload. All six propeller attachment studs were present and straight. The examination found no evidence of fatigue failure. There were no indications of propeller failure or malfunction prior to the impact sequence.

The blade angle actuation components exhibited gross part deflection and structural overload failure associated with the impact sequence. Both blades were able to be twisted by hand in their sockets. Both links were broken, and the piston rod was bent. The piston was captured inside the deformed cylinder in a position consistent with the propeller blades being at or near the low pitch stop. Witness marks on the spacer in front of the piston and witness marks on the front of the piston were consistent with the propeller being at the low pitch stop at the time of impact. Witness marks consistent with the coils of the piston return spring were found on the butt face of both propeller blades. The orientation of the spring coil indentations was consistent with both propeller blades being at or near the low pitch stop at the time of impact.

Lubricating grease was found inside the propeller hub and on the blade retention bearing components. Engine oil was found inside the actuating cylinder. Both were consistent with normal propeller function.

The propeller blades had chordwise scratches and leading edge damage. The outer 2 inches of the No.1 blade were separated from the blade by shearing action. The outer 15 inches of the No.1 blade was bent slightly aft and had significant leading edge gouges and paint removal. The No. 2 blade had leading edge scratches and paint removed on the outer 28 inches of the blade. The outer 28 inches of the blade were bent slightly forward. These observations were consistent with a high amount of rotational energy during the impact sequence. The power setting at time of impact was not able to be determined.

The governor cable mounting bracket and a short piece of governor control cable were attached to the top of the governor. The bracket was slightly deformed, and one of its four attachment screws was missing, however witness marks indicated that a screw and washer had previously been installed at that location. (While on site, the governor had to be removed and was not separated from the engine during the accident and the control cable had been cut by the recovery team to remove the governor). The remaining portion of the control cable was intact. The screws that attach the top cap of the governor were flat slotted screws drilled for lockwire, where socket head cap screws were expected to be found. According to AC 43.13-1B Section 3, this hardware substitution was permitted. The fastener type did not affect the correct operation of the governor. The input shaft and control arm of the governor were free to move by hand. The mounting gasket and mounting face of the governor were dirty but otherwise in good condition.

After removing the bracket and control cable and cleaning dirt from the mounting face, the governor was mounted to a governor test bench and operationally tested. The following data were recorded along with the allowable ranges:

- 297 psi max, 290 ± 20 psi allowed.
- 5.5 qt/min pump volume, 5 qt/min minimum.
- 13 qt/hr leak rate, 30 qt/hr maximum.
- 2240 max rpm, 2295 ± 10 rpm allowed.

Given the governor drive pad ratio of 0.850 for the IO-360-A1B6D, a governor rpm of 2240 would result in a propeller speed of $2240 / 0.850 = 2635$ rpm. It should be noted that the maximum rpm achieved on governor test benches is subject to vary from the maximum rpm achieved on the aircraft installation. Final rpm adjustments must be made after governors are installed on the aircraft.

After recording the maximum governor rpm with the governor in the as-received condition, the safety wire was removed from the set screw that limits the maximum movement of the control arm. The set screw was adjusted, and it was confirmed that the governor was able to be adjusted to run at the specified maximum rpm.

Valve Lifter Testing

Hydraulic valve lifter testing and examination occurred at Lycoming Engines, Williamsport, Pennsylvania on 08/15/2024.

For the testing, all the hydraulic lifters were prepped with test fluid before being placed onto the test fixture. The fixture was used to test all new production lifter assemblies for Lycoming Engines to the requirements of traveling .125 in 0-50 seconds.

All the lifters were found operational and functional as part of the test with no stuck or frozen lifter assemblies observed. All bled down at varying rates. The test fixture is calibrated to test from 0-50 seconds and ceases at 50 seconds ending the test. Only two assemblies bled down over 50 seconds (The No.1 Exhaust and the No.2 Intake).

Magneto Testing and Examination

Magneto testing and examination occurred at Hartzell Engine Technologies, Montgomery, Alabama on 12/04/2024.

The approach of this exam was to assess the initial condition of the magneto and if it appeared serviceable, and to perform functional tests on the test bench. The cover was removed to assess internal condition. The spark plug wire grommets remained in the distributor block and the ignition wire insulator/braiding pulled from the wire jacket/shielding.

Resistance from each capacitor to the cover body (specification of 3 mΩ maximum) was measured as follows:

- Left capacitor to cover = 0.09 mΩ.
- Right capacitor to cover = 0.569 mΩ.

The capacitors were removed from the cover. Although the capacitor-to-cover resistance met specification, the external capacitor mounting area had not been brightened per the Service Manual and still had paint under the lock washer and nut area.

The following items were checked/observed to assess condition:

- Overall good condition, no remarkable damage, or abnormal characteristics.
- The magneto turned freely and smoothly by hand force from the impulse coupling.
- The impulse coupling spring and cam assembly were intact and functioned normally.
- There were no missing gear teeth on any gears.
- Cam, cam followers, and contact assemblies were in good condition, with no indication of excessive heat.
- Correct L/R alignment while keeping in neutral position with timing marks in center of window.
- Internal Timing: Left Magneto was 4° past L mark, Right magneto was 5° past L mark.” (L represents 8° E-gap from neutral “K” mark.) The two magneto circuits were synchronized within the specified 1° max difference.
- The magneto mounting base flange appeared normal and undamaged.

The capacitors were installed in a test cover for bench testing. The test cover had full ignition harnesses and a window in the center section to observe the contact assemblies during operation. The aircraft harness remnants/grommets were removed from the distributor block and the test cover was installed on the subject magneto with the proper screws and lock washers.

The magneto with the test cover and harnesses were then mounted in a test bench. The magneto was run on the test bench to check impulse coupling function, grounding function and verify mechanical and electrical operation at 1000 and 2700 RPM. The impulse coupling was not removed so the coming-in speed was not determined. The impulse coupling functioned normally and was fully disengaged by 350 RPM with spark verified at each gap. Grounding was checked

at 1000 RPM and functioned normally. Mechanical and electrical operation was normal at 1000 and 2700 RPM with spark at each gap. The magneto was operated at 1000 RPM for several minutes to simulate idle, pre-takeoff operation, then accelerated to 2700 RPM to simulate a takeoff. The magneto functioned normally throughout the bench test.

The magneto was removed from the test bench. The test cover was removed and point gaps measured. The left point gap was 0.014” and right gap 0.012.” Nominal gap specification is 0.016.”

The lubrication felt around the cam follower was cut to view the cam follower condition. Both left and right cam followers were in serviceable condition with no appreciable wear or signatures of heat damage.

X-Ray Examination of Lifters

An X-ray examination of the Hydraulic Valve Lifters was conducted at Lycoming Engines, Williamsport, Pennsylvania on 01/13/2025.

All 8 lifters were X-rayed within the Lycoming Metallurgic laboratory which revealed no anomalies, foreign object damage, or cracks to any of the lifter assemblies.

The check valve portion was mechanically removed from each lifter body, x-rayed, and examined under a scanning electron microscope. No anomalies were found on any of the check balls and corresponding seats. The seat surfaces were uniform and shiny with no burrs or corrosion noted.