



MEMORANDUM FOR RECORD

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Date: April 3, 2017
Subject: Wreckage Examination
NTSB Accident Number: ERA17LA092

Examination of the wreckage for N979BA resulted in the following observations:

Control cable continuity was established for all flight controls from the flight control surfaces, to the breaks in the system and from the breaks in the system to the forward cabin. The right flap actuator indicated the right flap was retracted. The inboard left wing was consumed by fire and the left flap actuator was not observed. The left and right elevator trim actuator measurements were unreliable due to impact damage.

The left and right elevator control rods in the aft tail area were fractured. The right rod appeared to have been bent in half and fractured due to impact. The left rod was fractured at both ends immediately adjacent to the rod end bolt threads. The inspection holes in the left and right rod were covered by the rod end bolt threads. The separated portion of the left elevator control rod was not bent and remained in one piece.

The aircraft was equipped with an Amsafe Aviation inflatable restraint system for the pilot and co-pilot seats. Three seat belt buckles were found latched in the fire damaged cabin. Air bag deployment was undetermined.

The instrument panel was consumed by the post-impact fire, and the fuel selector valve and strainer assembly sustained thermal damage.

The engine remained attached to the firewall via the engine control cables, the exhaust pipe clamps, the starter motor, the alternator wiring, and the exhaust gas temperature and cylinder head temperature wires. The engine mounts were fractured. The engine sustained impact-related damage that fractured the crankshaft aft of the propeller flange and forward of the thrust flange. The crankcase was damaged, and the propeller seal was not observed. The fuel injection lines were deformed downward around the cylinders. There was light soot evident over the cylinders. The cooling baffle behind the magnetos was thermally damaged. The throttle, propeller, and

mixture control cables remained attached to their cockpit controls and respective levers, but the propeller control shaft was fractured from the housing. The cockpit controls were thermally damaged.

Torque putty, consistent with that used at the factory, was observed on all the cylinders and the fuel injection lines. The fuel inlet fitting on the engine-driven fuel pump was fractured and the vapor return line fitting was displaced in the housing. All three of the fuel metering unit fittings were fractured.

The magnetos remained secured in place and the ignition harnesses remained secured to the magnetos and the terminal ends were secured to their respective sparkplugs.

The induction system remained mostly intact with the intake manifold on both the left side, and the right side, sustaining puncture damage. The intake filter was separated from the throttle body and the filter was deformed within its cowling bracket. The throttle valve was in the fully open position and some dents were noted on the balance tube and intake tubes.

The left magneto remained attached to its mounting pad and remnants of the slip putty were still in place with no signs of movement between the magneto and the mounting pad. Manual manipulation of the magneto revealed that it was secured in place. The ignition harness remained attached to the magneto. The magneto was tested on the engine through the ignition harness and the sparkplugs. Three of the six sparkplugs produced a spark during crankshaft rotation. The impulse coupling could be heard snapping during crankshaft rotation. The magneto was removed, and the driveshaft was manually rotated with spark observed on some of the sparkplugs. The magneto was then placed on a test bench with the original ignition harness. It produced a spark from each of the leads. The impulse coupling came in and out of operation around 300-400 RPM. No anomalies were noted with the magneto during the test bench functional test.

The right magneto remained attached to its mounting pad and remnants of the slip putty were still in place with no signs of movement between the magneto and the mounting pad. Manual manipulation of the magneto revealed that it was secured in place. The ignition harness remained attached to the magneto. The magneto was tested on the engine through the ignition harness and the sparkplugs. Five of the six sparkplugs produced a spark during crankshaft rotation. The impulse coupling could be heard snapping during crankshaft rotation. The magneto was removed, and the driveshaft was manually rotated with spark observed on some, but not all, of the sparkplugs. The magneto was then placed on a test bench with the original ignition harness. It produced a spark from each of the leads, but only after it reached a shaft rotation speed of approximately 1,200 RPM. The magneto then produced a spark from all but one lead throughout all operating speeds. The intermittent operation could not be duplicated on the test bench. The impulse coupling came in and out of operation around 300-400 RPM.

The ignition harnesses remained secured to their respective magnetos. There were some small, isolated areas of impact related damage noted on the ignition wire insulation. However, during the functional testing of the magnetos, the ignition harnesses produced a spark from each of the terminals except for one lead on the right harness.

The sparkplugs were secured in their respective cylinders and the ignition terminals were secured to the sparkplugs. The top sparkplugs were removed from the cylinders. All of them appeared to be near new with no evidence of carbon or lead fouling. All the sparkplugs were oil soaked (the engine came to rest inverted and oil was noted in some of the cylinders during the examination). The top sparkplugs were utilized during the magneto testing and each were subjected to a sparkplug tester with no anomalies noted during their functional tests.

The fuel pump remained secured to the backside of the engine. The fuel inlet fitting was fractured, and the vapor return line fitting was displaced in the housing. Removal of the fuel pump from the engine revealed that its drive coupling was intact. Manual rotation of the drive coupling while inserted into the drive shaft resulted in a free rotation of the fuel pump. The pump was disassembled, and no pre-accident anomalies were noted with the internal components.

The throttle body and fuel metering unit remained secured to the bottom of the engine. The throttle and mixture control cables remained secured to the control levers. The throttle valve was observed in the fully open position. Slip marks were placed on the levers and shafts and the controls were operated through their full range. No slipping was noted between the levers and the shafts and both controls moved from stop-to-stop with no binding noted. All three fuel fittings were fractured on the fuel metering unit. The unit was removed from the engine and it was noted that the mixture control shaft was bent. The fuel inlet screen was removed and there was no debris noted. The fuel metering unit was disassembled with no preaccident anomalies noted with its internal components.

The fuel manifold valve remained secured to the topside of the engine. The fuel injection lines sustained deformation damage in a downward direction (the engine came to rest inverted at the accident site). Remnants of the original torque putty remained in place on the fuel injection lines. The original safety wires on the housing cap screws were in place. The fuel line between the fuel manifold valve and the fuel flow transducer was removed and fuel consistent in color and odor as 100LL aviation gasoline poured from the line. The fuel manifold valve was disassembled and 100LL aviation gasoline was observed in the housing. The screen was clear. The diaphragm was intact and pliable, and the plunger was attached with no preaccident anomalies noted.

The fuel injection lines remained in place though they sustained deformation damage. The fuel injection nozzles were also in place and the original torque putty was intact between the line and the nozzle. There was no sign of fuel leakage around any of the nozzles. The nozzles were removed and all, but the No.3 were clear. The No.3 nozzle appeared to have oil glazing around the jet and there was no sign of lead fouling.

The oil sump remained secured to the bottom of the two crankcase halves. There were no signs of pre-impact oil leaks from the oil sump. The oil quantity gauge was checked and though it registered no oil, all the observed internal components appeared to be well lubricated and all residual oil appeared to be relatively fresh.

The oil pump housing did not reveal any pre-accident anomalies. Though the pump was not disassembled and examined, the observed components appeared to be well lubricated with no signs of operational distress. The crankshaft rotated smoothly with no binding noted from the main bearings.

The oil filter sustained thermal and impact-related damage but remained secured to its mounting pad and the safety wire was intact. The oil filter was removed, and relatively fresh residual oil was observed on the mounting adapter. The following was handwritten on the side of the filter: 12/16/2017 251.9. The oil filter was cut open and no metal debris was noted in the oil filter pleats.

The oil cooler sustained impact related damage on its outer edge, but it remained secured to the 1 ft aft side of the engine. No pre-accident anomalies were noted with the cooler.

All 6 cylinders remained attached to the crankcase with no external anomalies noted. The original torque putty was present on the cylinder attaching hardware. Borescope inspection of the cylinders revealed no pre-accident anomalies with the pistons, barrels, valves, or valve seats. Thumb compression and suction was obtained on all cylinders during crankshaft rotation and valve operation was confirmed with no anomalies noted with the rocker arms or valve springs.

The crankcase remained intact with no external anomalies noted. The front of the crankcase was fractured at the thrust flange area and the propeller seal was not observed. Rotational gouges were noted on the crankcase around the crankshaft fracture. There was no sign of main bearing binding during crankshaft rotation.

The crankshaft was fractured aft of the propeller flange and just forward of the thrust flange. The fracture surface was irregular with smearing and discoloration of the metal. The crankshaft was rotated manually using a tool inserted into the accessory drive gear. Crankshaft continuity was confirmed from the backside of the engine to the front and out to each connecting rod through the pistons. No binding was noted during crankshaft rotation. All the crankshaft gear bolts were in place and their safety wire was intact.

Camshaft continuity was confirmed during crankshaft rotation when all rocker arms and valves went through their range of motion during a compression check. No pre-accident anomalies were noted with the camshaft or valve train.

The starter motor remained attached to the starter adapter, but the mounting flange was fractured, and the motor was somewhat displaced. There were no external anomalies noted with the starter motor.

The starter adapter remained attached to the backside of the engine with no pre-accident anomalies noted. The starter motor mounting flange was fractured. The drive pulley was intact and rotated with crankshaft rotation.

The alternator remained attached to the front right side of the engine with no pre-accident anomalies noted.

The propeller governor remained attached to the front left side of the engine. The control shaft was fractured and separated from the governor. The flyweights were visible through the fractured housing.

The propeller remained attached to the propeller flange. The hub remained intact and all three blades remained secured to the hub. The spinner was displaced aft around the hub and blades. The blades were labelled A, B, and C, for the purposes of this report. Blade A displayed large leading-edge gouges near the tip, with the outermost portion of the blade tip torn away. The blade was bent aft slightly around mid-span and the tip was bent forward. Blade B was twisted toward low pitch and displayed heavy leading-edge gouges and chord-wise scratching at the tip. Blade C was twisted toward low pitch with the tip showing curling toward low pitch along with chord-wise scratching and leading-edge gouging.