Magneto Inspection Report
NTSB Docket WPR21LA171

NTSB Case Number	**WPR21LA171**				
Date of Accident	**4/21/2021**				
Aircraft Registration	**N2989P**				
Aircraft Make	**Consolidated Aeronautics Lake**				
Aircraft Model	**LA-4-200**	**Hours TT**	**N/A**		
Aircraft S/N	**NA**				
Engine Make	**Lycoming**	**Hours SMOH**	**N/A**		
Engine model	**IO-360-A1B**				
Engine S/N	**L-19989-51A**				
Component Information		**Part Number**	**Serial Number**	**Kelly O/H**	**Kelly Components**
Left Magento Make	**Bendix**	**10-349365-9**	**A230735**	**No**	**No**
Right Magneto Make	**Bendix**	**10-349305-1**	**A226860**	**No**	**Yes Capacitor**
Date of Examination	**10/14/2021**				
Participants					
Zoe Keliher, NTSB					
Harry Fenton, Kelly Aero					
Tim Davis, Kelly Aero					

Accident Summary

On April 21, 2021 the subject Lake LA-4-200 was damaged in an off airport landing near Twentynine Palms, CA subsequent to a reported engine performance issue. The pilot suffered minor injuries. The aircraft had been recently purchased by the pilot and the engine had been inspected and serviced as part of the pre-purchase inspection. The engine was inspected by an A&P mechanic 10 hours before the accident flight. The spark plugs were inspected and rotated in preparation of a flight the pilot planned to move the aircraft from CA to TX. The pilot had flown the airplane in familiarization training and had flown the aircraft for a few hours from the departure point of Novato, CA to a refueling stop at Twentynine Palms, CA. The pilot fueled the aircraft to maximum capacity at Twentynine Palms prior to departure.

KTNP altitude is 1888 MSL, the pilot reported that the engine experienced a partial loss of power at 200 feet AGL, or 2088 MSL. The engine began to vibrate, the pilot heard a loud mechanical chatter in engine area, and manifold pressure and rpm fluctuated. The pilot verified that the fuel boost pump was selected to “on” but was unable to maintain altitude. An off airport landing was attempted and the aircraft was damaged during the landing sequence.

The NTSB investigator performed an initial inspection of the magnetos and determined that the non-impulse 10-349305-1 produced a spark when the rotor shaft was turned and the 10-349365-9 impulse coupled magneto did not spark when the rotor shaft was turned. The magnetos were opened for inspection by the NTSB investigator. The 10-349305-1 did not exhibit any obvious anomalies. The 10-349365-9 was found to have a cut in the capacitor lead insulation, which exposed the center conductor wire. The contact point tungsten faces were both corroded and exhibited an oxide crust on the external surfaces of the tungsten.

On September 20, 2021 Zoe Keliher, NTSB, contacted Harry Fenton, Director of Product Support, to request that Kelly Aero be a party to the investigation and assist with an analytical inspection of the subject magnetos at Kelly Aero facilities in Montgomery, AL.

Magneto Service History
May 2002 500 hour Inspection , Aircraft TT 1339.0 hours
Replaced Drive end sealed bearing, oil slinger, distributor block felt washer, felt strip, carbon brush and coil wedges in both magnetos

09/01/2017 1493.13
Replaced Right magneto capacitor

03/01/2021 1727.9
Annual inspection. Mag timing set at 25 and mag check during engine runup documented

Additional engine information
Aftermarket turbocharger installed

Magneto Inspection
An inspection was conducted at the Kelly Aero factory in Montgomery, AL on October 14, 2021. Harry Fenton and Tim Davis, Director of Business Development, assisted with the inspection.

Both magnetos were observed to be complete, externally undamaged and in good overall condition. The dataplates and serial number ranges of both magnetos indicated that the core magnetos were original to the engine. The magnetos were opened prior to the inspection at Kelly Aero in the course of the initial NTSB investigation. The internal condition of the magnetos was good, the interiors were clean and free of any significant oil or dust contamination unrelated to normal operation. Both contact point bases were bright gold colored, relatively new looking in physical condition. Overall, the magnetos had the appearance of low hours of use since prior service. The rotor shafts of both magnetos turned freely. With a timing light connected to the capacitor and to magneto ground, the red painted tooth was visible in the center of the vent plug window when the contact points opened, an indicator that the internal timing of the distributor gear to E-Gap was correct. The distributor gears of both magnetos were rotated through 360° of travel and no broken or distorted gear teeth were observed.

The magnetos were marked “Left” and “Right”, but these references were opposite of the OEM defined datum for Left and Right positons on the engine. The standard Lycoming reference is looking from the rear of the engine, forward through the propeller to establish left and right orientation. The Lycoming installed in the LA-4-200 is a pusher configuration, so the magnetos face forward to the nose of the airplane. In this instance, the NTSB investigator reversed the standard left and right position

identification of the magnetos. For purposes of clarity of this report, the magnetos will be identified by part number and configuration: 10-349365-9 impulse coupled and 10-349305-1 non-impulse coupled, respectively.

The 10-349305-1 non-impulse coupled magneto was tested first. The test was conducted in accordance with the test criteria of the Continental Ignition Systems X42001, Revision 3, S-1200 Series Magneto Service Support Manual, Section 3, Paragraph 3-2 “Post Overhaul Testing”, page 3-2.

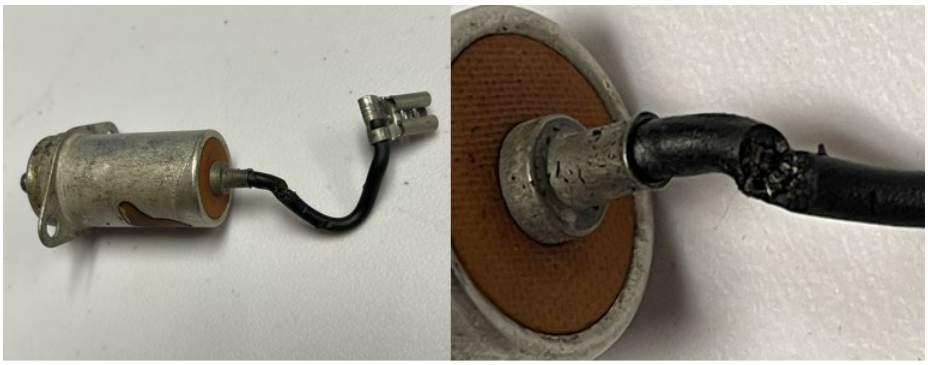
The magneto was installed on the test bench and spark was observed to be consistent at 150 RPM and 1000 RPM. The magneto was run at 2700 RPM, the maximum takeoff RPM of the subject engine and spark was consistent and smooth. The capacitor was shorted to ground at the P-lead to test the capacitor grounding characteristics, The magneto turned “off” when grounded which indicated the capacitor was working as designed. Overall, the magneto operated to the test parameters with no anomalies.

The 10-349365-9 impulse coupled magneto was also tested in accordance with the previously cited criteria from the X42001 1200 Series Service Manual. The magneto did not produce a spark at 150, 1000, and 2700 RPM. The impulse coupling mechanically engaged 75-150 RPM, and disengaged above 450 RPM.

The housing from the 10-349305-1 non-impulse magneto removed, and the operational capacitor was replaced with the capacitor with the damaged lead wire from the 10-349365-9 impulse coupled magneto. The magneto was tested and produced consistent spark at 150, 1000, 2700 RPM.

The corroded contact points were removed from the 10-349365-9 magneto and the contact points from the 10-349305-1 magneto were installed. The 10-349365-9 magneto was run with the capacitor and contact points from the 10-349305-1 magneto and produced consistent spark at 150, 1000, and 2700 RPM. The impulse coupling produced consistent spark from 75 RPM to 150 RPM.

The 10-349365-9 was then configured with the capacitor with the cut lead wire that was original to this magneto.

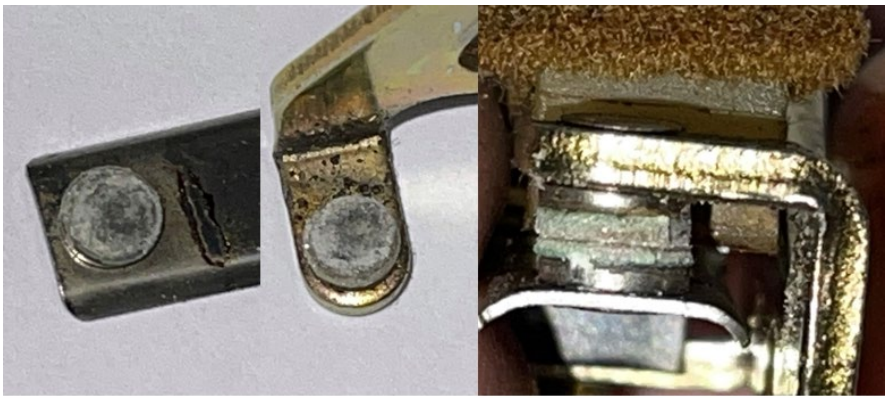


When run with the damaged capacitor and the operating contact points from the 10-349305-1 magneto, spark was strong and consistent at 150, 1000, and 2700 RPM.

Both magnetos were completely disassembled for inspection. Two small areas of discoloration were noted in the left and right magneto housings and one area of similar colored material was observed on the capacitor body installed in the 10-349365-9 magneto. The discoloration appeared to be mineral deposits, and were not obviously consistent with oxides or exfoliation attributable to magnesium corrosion, but had the appearance of dried mineral or chemical deposits.

The 10-349365-9 impulse coupled magneto rotor shaft was inspected and no anomalies were noted. The coil was removed and continuity and resistance checked: Nominal values are 1.0Ω to 1.5Ω for the primary circuit and 20KΩ to 26KΩ for the secondary coil circuit. The values for this coil were measured at 1.1Ω for the primary and 21.83KΩ for the secondary, which are within the nominal range. The capacitor values were not checked, but both capacitors were demonstrated to function normally when installed into this magneto. The bearings were inspected, no anomalies noted. The magneto frame was free of oil or contamination beyond what would be expected for normal operation. Light rust was noted on the surface of the frame laminations.

The contact points were disassembled and inspected using a 60X inspection microscope. The tungsten contact point heads are an assembly of a tungsten wafer and reinforcing steel backing material, fastened with a copper braze process. The tungsten contact assembly is secured to the contact base and spring by a material upset process similar to the upset of a rivet. The worked end of the rivet is compressed in height to increase the diameter and grip to secure the tungsten to the point base or spring. The tungstens of both sets of contact points were observed to be secured tightly with no discoloration of the worked end of the tungsten.

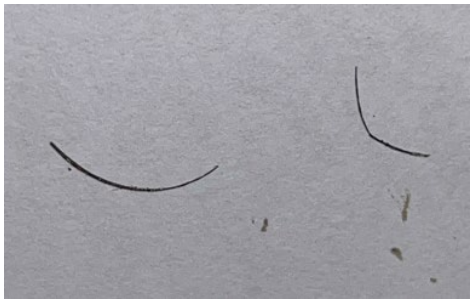


The contact point tungsten of the 10-349365-9 magneto exhibited surface discoloration degradation consistent with oxidation to the top layer of the tungsten assembly which functions as the discharge point for electrical energy. It is undetermined if the oxidation was due to an external corrosive material or due to galvanic reaction of the various materials of the tungsten contact head assembly, or a combination of both external and internal material degradation factors.

The nylon cam follower of the contact point assembly was secure and showed wear consistent with normal operation.

The impulse coupling cam assembly was the snap ring design and appeared to be in nearly new condition. The coupling was free of any corrosion and all subassemblies operated freely. The impulse coupling spring was free of corrosion and any observable defects. The impulse body did not exhibit any unusual wear marks and was in good condition.

Two small crescent shaped pieces of material approximately 1” long and the diameter of a human hair were found on the hub of the coupling, but there were no observable witness marks, evidence of component damage, or evidence of material loss to magneto components to indicate that this material was significant. One of the pieces was attracted to the magneto magnet and assumed, indicative that the material was ferrous.



The distributor block was disassembled and observed to be in good serviceable condition, with electrode wear and surface deposits consistent with normal operation. The distributor gear shaft and mating surface of bearing internal to the distributor block showed corrosion anomalies. The pitting appeared to be a result of corrosion. The shaft and bearing were absent of any indications or rotational impressions which would have resulted from sustained FOD interference between the shaft and the bearing.

The 10-349305-1 non-Impulse magneto was disassembled and all components were in good operating condition and showed normal wear characteristics. No anomalies were observed with this magneto.

At the completion of the examination, the components were bagged with their respective frames and housings. The components were shipped back to NTSB Investigator Zoe Keliher.