NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

April 16, 2018

ENGINE EXAMINATION REPORT

WPR16FA157

This document contains 9 embedded photographs

Van Nuys, California

August 2, 2016

1322 PDT

Arion Aircraft Lightning LS-1 – N341AL

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HISTORY OF FLIGHT

On August 2, 2016, about 1324 Pacific daylight time, an Arion Lightning LS-1, N341AL, was substantially damaged after it collided with a building during a touch and go at Van Nuys Airport (VNY), Van Nuys, California. The private pilot was fatally injured. The personal flight was operated under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and no flight plan was filed for the local flight that departed Santa Monica Municipal Airport (SMO), Santa Monica, California at 1315.

According to an acquaintance, the pilot had planned to complete several touch and go maneuvers at VNY on the day of the accident. Preliminary Federal Aviation Administration (FAA) air traffic control audio indicated that the pilot requested to land on runway 16L. After a touch and go, he reported that he heard something "banging around" and asked the tower controller if he could see it. The controller informed the pilot that his left main landing gear was "dangling" from the airplane. After some further discussion, the pilot stated that he wanted to land at VNY, which was his final radio communication.

Several witnesses reported that the airplane was flying erratically during its departure from runway 16L. Two witnesses listened to the exchange between the pilot and the controller after

they observed a wheel fairing hanging from the left main landing gear of the departing airplane. Seconds after the pilot's final communication, they observed the airplane enter a hard left turn. One witness described the turn as a "fighter pilot maneuver." The airplane nose dropped through the horizon during the steep turn, which was immediately followed by a quarter spin to the left and then a nose down attitude. According to the FAA, the accident site features indicated that the airplane impacted a utility pole, a truck, and then slid on the ground into a section of alleyway between two buildings where it came to rest.

Postaccident Engine Examination

The carburetor was co-located with the main wreckage, but separated from the engine. The butterfly valve moved freely by hand. Both carburetor floats were intact; however, one float was bent down approximately 30 degrees. The carburetor float bowl was void of fuel. The choke was in the full OFF position and the throttle arm was separated from the unit. A slide piston within the carburetor normally moves as the result of differential pressure between the air surrounding the piston and the air above the diaphragm that contains air at the top of the dome. The dome top was removed, which revealed the presence of a green substance around the circumference of the dome mating surfaces. Pitting was observed in various areas along the dome rim. In addition, the substance was present along the circumference of the diaphragm. A small portion of the diaphragm rim displayed a tear approximately 2 inches in length. The carburetor will be shipped to the engine manufacturer's facility with the engine for testing.

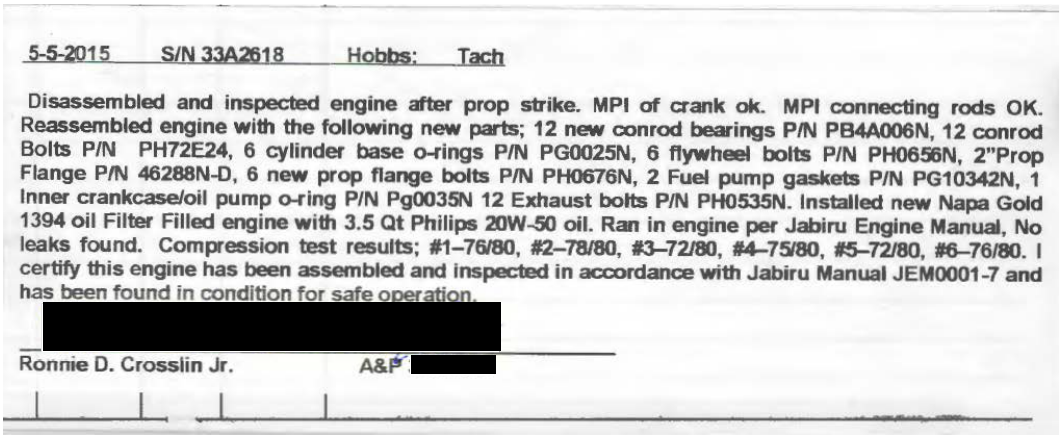
The engine will be placed in a crate and shipped to the engine manufacturer's facility in Shelbyville, Tennessee for further examination.

Photo 1: Airplane at Rest

Photo 2: Engine at Rest

ENGINE INFORMATION

Engine Manufacturer: Jabiru Aircraft
Engine Model Number: 3300A
Engine Serial Number: 33A 2618
Recent Inspection: Annual – 46.3 hours
Recent Recorded TSMOH: 46.3 hours – recorded at major overhaul following a propeller strike dated May 5, 2015



5-5-2015 S/N 33A2618 Hobbs: Tach

Disassembled and inspected engine after prop strike. MPI of crank ok. MPI connecting rods OK. Reassembled engine with the following new parts; 12 new conrod bearings P/N PB4A006N, 12 conrod Bolts P/N PH72E24, 6 cylinder base o-rings P/N PG0025N, 6 flywheel bolts P/N PH0656N, 2"Prop Flange P/N 46288N-D, 6 new prop flange bolts P/N PH0676N, 2 Fuel pump gaskets P/N PG10342N, 1 Inner crankcase/oil pump o-ring P/N Pg0035N 12 Exhaust bolts P/N PH0535N. Installed new Napa Gold 1394 oil Filter Filled engine with 3.5 Qt Philips 20W-50 oil. Ran in engine per Jabiru Engine Manual, No leaks found. Compression test results; #1–76/80, #2–78/80, #3–72/80, #4–75/80, #5–72/80, #6–76/80. I certify this engine has been assembled and inspected in accordance with Jabiru Manual JEM0001-7 and has been found in condition for safe operation.

[redacted]

Ronnie D. Crosslin Jr. A&P [redacted]

Photo 3: Recent Overhaul

INITIAL EXAMINATION AS RECEIVED

The engine was shipped from the recovery facility in Santa Paula, California to Jabiru's maintenance facility in Shelbyville, Tennessee via crate and bonded shipment. Upon receipt the engine was immediately logged and placed in bonded/secure storage and was not opened. The crate was viewed by the IIC as unopened and subsequently photographed and opened for examination. The propeller hub was bent and replaced with a serviceable unit.

Photo 4: Engine as Received

Photo 5: Engine After Secure Crate Removed

DETAILED EXAMINATION

After removal of the rear accessory drive rotation was achieved from the propeller hub to the accessory gears utilizing a wrench and rotating by hand. Rotation was smooth and unremarkable. End play was 0.017 inches as measured at the propeller flange. Minimum range is 0.008 inches to 0.032 inches. Deflection was 0.0012 inches, which is 6 times higher than the the manufacturer's prescribed deflection, a maximum of 0.0020 inches. The starter motor was removed as the mount had been damaged during the impact. The stator mount was fractured at the support brackets and the right magneto was broken. The engine motor mount, backing plate, distributor caps, ignition harness, and the number 6 intake pipe were replaced to facilitate an

engine run. Both the ignition harness and distributor caps were damaged in the accident and could not be used during the examination.

Compression Test

	Pre-Engine Run	Post Engine Run
Cylinder No. 1	50/80	78/80
Cylinder No. 2	22/80	68/80
Cylinder No. 3	78/80	70/80
Cylinder No. 4	52/80	64/80
Cylinder No. 5	40/80	66/80
Cylinder No. 6	5/80	64/80

Starter Motor

The starter motor did not have a data plate or any record of a part or serial number. According to the engine manufacturer, the starter motor was built by Jabiru and is a generic version of a Nippondenso starter motor.

Photo 6: Starter Motor

Carburetor

The carburetor was manufactured by Bing. A representative of the engine manufacturer reported that the unit's model designation was 94CV. The unit did not have a data plate, serial number, or part number listed. The needle valve diaphragm displayed a tear along the outer rim and one of the floats was canted. A green residue was observed along the rim of the dome; however, the manufacturer showed an exemplar factory new unit that contained a white power and a green residue.

A representative of the engine manufacturer reported that he had only seen two torn diaphragms in 17 years. In his experience, a torn diaphragm will produce a leak of differential pressure in the

piston channel. A leak will cause the ambient air to reach the top of the dome, which will reduce the piston's travel. Depending on the severity of the tear, the piston could drop into the jet, which will restrict fuel flow. An overly lean mixture and possible fuel starvation may result if the butterfly valve is open and the piston is near the top of the dome.

Futhermore, fuel starvation may occur when the airplane is not in coordinated flight or in a near knife edge position relative to the ground as fuel can deviate from the main jet, which will cause the fuel flow to cease. Slow airspeed (approximately 50 knots and below is when the propeller could stop) and a near knife edge or inverted attitude will cause the fuel to move to one side of the float bowl, thereby unporting the main jet.

According to manufacturer, if one float was level and the other float was canted towards the carburetor, then fuel may shutoff early. If one float is canted towards the carburetor case and the other was level, similar to the accident airplane, then the carburetor would continue to feed fuel to the engine, which would allow it to run. If power went to idle then carburetor would flood the engine.

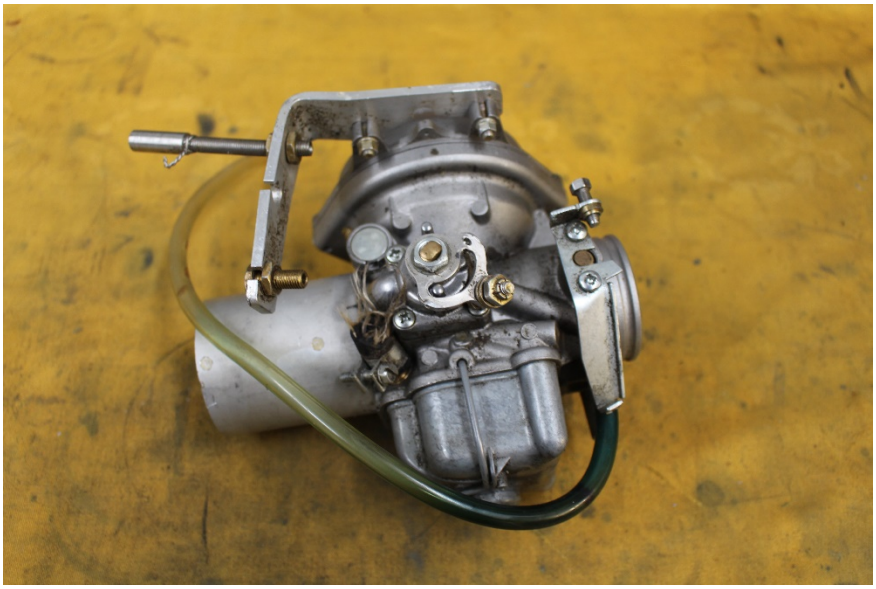


Photo 7: Carburetor

Fuel Pump

The fuel pump did not contain a serial number, part number or manufacturer name.

Left Magneto

According to the manufacturer, left magneto was a Honda unit. The magneto remained attached the stator mount. The magnetos are fixed at 25 degrees BTDC.

Right Magneto

According to the manufacturer, right magneto was a Honda unit. The magneto remained attached to one bracket of the stator mount; the unit had fractured free from the other mount. The magnetos are fixed at 25 degrees BTDC. The magneto was tested using a multimeter and measured approximately 4.8 ohms at the terminal end. The manufacturer prescribed range is 2 – 5 ohms.

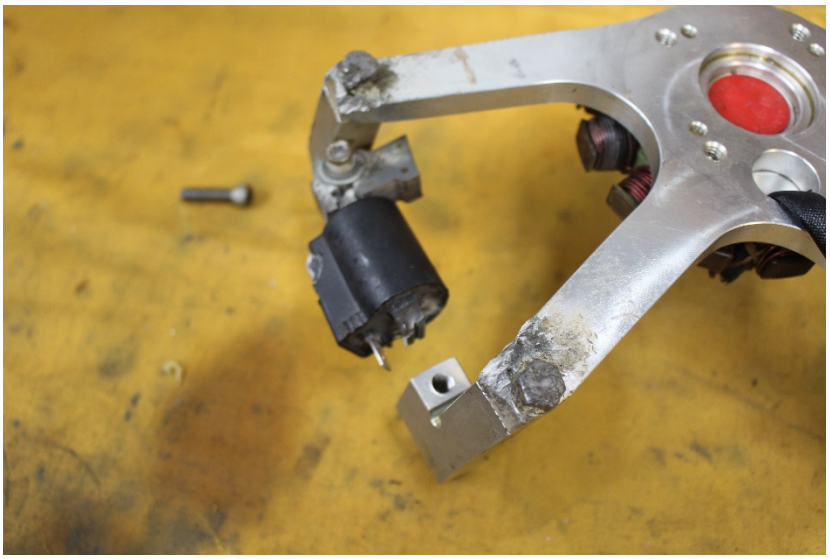


Photo 8: Right Magneto

Spark Plugs

The intake and exhaust spark plugs, manufactured by NGK (part no. D9EA), were removed and examined. The plugs displayed normal wear. The spark plug ground electrodes gaps measured 0.018. According to the engine manufacturer, the prescribed spark plug gap should be approximately 0.022.

According to the engine manufacturer they have seen people run spark plugs at 0.010 and the engine continues to run normally. A shorter gap means that the spark will be shorter, but the engine will continue to run normally.

Photo 9: Intake Spark Plugs

ENGINE TEST RUN

The left magneto from the accident airplane was installed on the stator mount; a serviceable used magneto was installed in the right magneto position. The engine test booth tachometer wire was connected to the right magneto ground wire to add RPM as test parameter. A used, but serviceable starter motor was installed prior to the engine run. The engine failed to start during the first attempt; however, a review of the starter motor revealed that the unit was not secured due to a missing bolt. After the bolt was installed the engine ran successfully at idle power, run-up power, and max continuous power. Towards the end of the exam the engine was rapidly throttled to maximum power and then rapidly retarded to idle power and ran continuously without any interruption in power.

SUMMARY

The engine test run results revealed a no. 5 cylinder head temperature of less than 100 degrees throughout the duration of the test, which indicates the cylinder was not firing. The no. 6 cylinder displayed similar temperatures when the engine functioning at idle power, but proceeded to function normal during the run-up and max continuous power tests. The engine reached a maximum power of 2,550 rpm with the throttle advanced to the full position. According to the manufacturer, max rated power for the Jabiru 3300A engine is 2,950 rpm, but in the test stand with the test propeller they typically see a maximum continuous power of 2,750.

The second engine test was completed the following day after the piston and diaphragm from the accident airplane were installed in the test cell carburetor. The engine power fluctuated at maximum power between 2,350 and 2,500 rpm, but did not exhibit any power interruptions. The cylinder no. 5 head temperature did not exceed 81 degrees F, which indicates that the cylinder was not firing. While the max engine power fluctuated, the engine was capable of producing

enough takeoff power for the load during the accident flight. The reduction in power from the first test was attributed to the tear in the diaphragm.

Engine Test #1 - Results

RPM	Oil Temp.	Oil PSI	Cylinder No. 1 (CHT)	Cylinder No. 2 (CHT)	Cylinder No. 3 (CHT)	Cylinder No. 4 (CHT)	Cylinder No. 5 (CHT)	Cylinder No. 6 (CHT)
1100 rpm	110° F	50 PSI	150° F	148° F	161° F	191° F	75° F	83° F
1780 rpm	130° F	43 PSI	194° F	215° F	232° F	261° F	90° F	196° F
2550 rpm	144° F	42 PSI	202° F	231° F	262° F	283° F	98° F	244° F

Engine Test #2 – Results

RPM	Oil Temp.	Oil PSI	Cylinder No. 1 (CHT)	Cylinder No. 2 (CHT)	Cylinder No. 3 (CHT)	Cylinder No. 4 (CHT)	Cylinder No. 5 (CHT)	Cylinder No. 6 (CHT)
1280 rpm	93° F	53 PSI	101° F	102° F	116° F	147° F	59° F	65° F
1750 rpm	104° F	47 PSI	155° F	150° F	199° F	223° F	70° F	139° F
2350 – 2500) rpm	140° F	47 PSI	190° F	205° F	229° F	278° F	81° F	265° F

Propeller

No propeller striations on the cowling. One propeller blade bent aft and other blade was not damaged.