NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

February 13, 2020

ENGINE EXAMINATION

WPR18LA278

This document contains 11 embedded photos.

(12 Pages)

WPR18LA278

Kern Valley, California

September 30, 2018

0845 PT

Howard DGA-15P – N9471H

EXAMINATION PARTICIPANTS

Stephen Stein
Air Safety Investigator (IIC)
National Transportation Safety Board
Federal Way, Washington

Logan Simmons
Quality Control, Radial Division
Covington Aircraft
Okmulgee, Oklahoma

HISTORY OF FLIGHT

On September 30, 2018, about 0844 Pacific daylight time, a Howard Aircraft DGA-15P, N9471H, was destroyed during a forced landing at Kern Valley Airport (L05), Kernville, California. The airline transport pilot and passenger were not injured. The airplane was owned and operated by the pilot under the provisions of 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions (VMC) prevailed, and a flight plan was not filed for the local flight, which was originating at the time of the accident. The personal flight was destined for Bakersfield, California.

According to the pilot, he was returning home after attending a fly-in event at L05. After waiting for the engine oil to warm up to 60°C, he taxied the airplane to the airport run-up area and ran the engine up. During this time, he checked the rpm drop between magnetos, verified that the carburetor heat functioned normally, and cycled the propeller. After completing the run-up checklist, the pilot selected the center fuel tank, which was about 3/8 full. The forward tank was

about half full. He then waited about 10 minutes for the traffic pattern to clear and then entered the active runway where he began his takeoff roll. The airplane lifted off the ground about 70 mph and accelerated to about 85 mph in a 10° nose high attitude. The pilot recalled that the airplane reached about 50 ft above ground level before he encountered a total loss of engine power and started to descend rapidly. The airplane impacted the runway, both main landing gear separated and the airplane slid about 300 before it came to rest. The airplane was destroyed by postcrash fire. A video of the accident flight furnished by a witness corroborated the pilot's statement.

PERSONNEL INFORMATION

The pilot, age 36, held an airline transport certificate with ratings for single-engine land, multi-engine land, multi-engine sea and instrument airplane. Additionally, he held a flight instructor certificate with ratings for airplane multi-engine and instrument airplane. His most recent first-class medical certificate was issued on July 23, 2018, without any limitations. According to the pilot, he had amassed 7,800 total flight hours in all aircraft, of which 162 hours had been accumulated in the accident airplane make and model.

AIRCRAFT INFORMATION

According to FAA records, the airplane was manufactured in 1943 and registered to pilot/owner on January 6, 2016. The airplane was powered by a Pratt & Whitney R-985 AN-14B, air cooled, 450 horsepower radial engine. Maintenance records indicated that the airplane's most recent annual inspection was completed on April 26, 2018 at a total time of 2,208 flight hours. The engine had accrued a total of 5,683 total hours at the time of this inspection and 488 hours since the engine's most recent overhaul, which was completed on January 8, 1996. A maintenance record from June 2018 showed that the pistons to cylinder nos. 3 and 5 were removed and reinstalled to facilitate the installation of new piston rings.

METEOROLOGICAL INFORMATION

The 0856 recorded weather observation at China Lake Naval Air Weapons Station, China Lake, California, located about 37 nm east of the accident site, included wind 310° 4 knots, visibility 10 statute miles, clear skies, temperature 17° C, dew point 03° C, and an altimeter setting of 29.90 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest on the runway and was mostly consumed by postcrash fire. The engine compartment survived the fire with minimal thermal damage.

ADDITIONAL INFORMATION

Initial Observations

The engine was placed in a crate and shipped to Covington Aircraft where it remained unopened. A postaccident examination of the engine was completed on May 21, 2019 by a representative of Covington Aircraft with oversight from the National Transportation Safety Board Investigator-in-Charge (IIC). The engine was accessories had been removed from the accessory case before the engine was shipped.

Engine Examination

Engine Manufacturer: Pratt & Whitney Aircraft
Engine Model Number: R-985 AN-148
Engine Serial Number: 207018

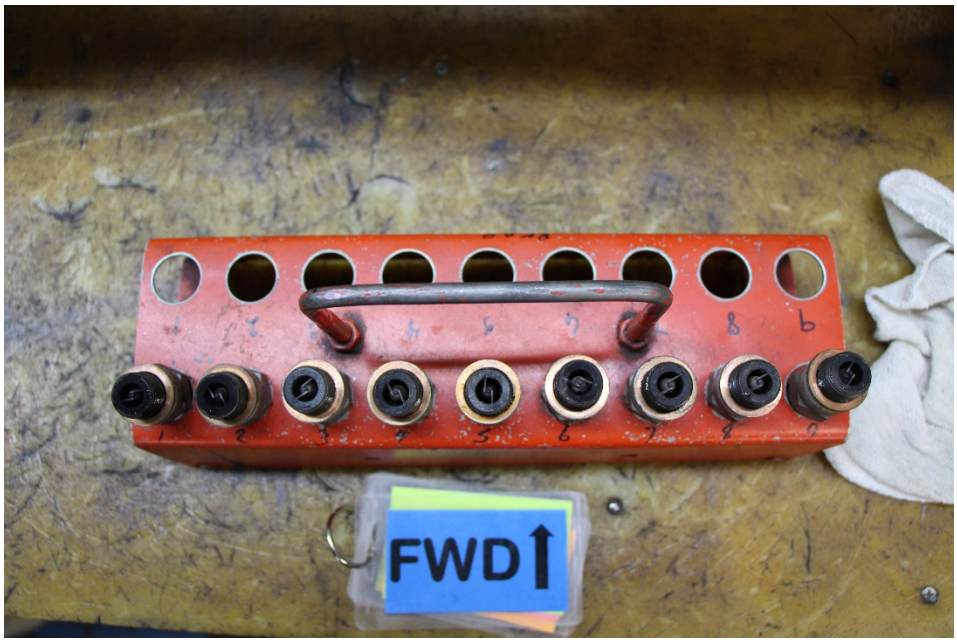
Photograph 1: Crated Engine Prior to Examination

Photograph 2: Engine as Received

Pre-Engine Run Examination

A visual inspection of the engine revealed trace amounts of thermal damage to the lower accessory case. The engine's physical condition was otherwise unremarkable. The spark plugs and rocker covers were removed for inspection. Mechanical continuity of the valvetrain was confirmed through rotation of the crankshaft, which was smooth and unremarkable. Crankshaft runout measured about 0.005 inches, which was within the published maximum of 0.006 inches. An inspection of the cam ring was performed through the cam ring inspection plug and did not reveal any evidence of binding. The oil screen showed trace amounts of debris. The front spark plugs were removed and displayed trace amounts of carbon and oil.

The engine case was then placed on an inspection test to verify magneto timing and the intake/exhaust valve clearances. Magneto timing for the left magneto was 25° before top dead center (BTDC), and the timing for the right magneto was 22° BTDC. According to an industry specialist, the magnetos should both be timed to 25° (BTDC). The recorded valve clearances are captured in the table below (table 1). An industry specialist reported that the valve clearances should measure between 0.012 and 0.017 inches.



Photograph 3: Forward Spark Plugs

Cylinder	**Exhaust** (inches)	**Intake** (inches)
1	0.020	0.014
2	0.014	0.012
3	0.014	0.010
4	0.025	0.020
5	0.012	0.012
6	0.020	0.012
7	0.014	0.014
8	0.012	0.008
9	0.014	0.014

Table 1: Exhaust and Intake Valve Clearances

The magneto P leads were removed from the magnetos, which both remained attached to the engine accessory case. Electrical continuity was confirmed for each P lead using an ohmmeter.

Accessories

Engine Starter

The engine starter was an Eclipse model no. 17, serial number 4. The unit had been removed from the engine and did not display any anomalies.

Photograph 4: Engine Starter

Generator

The engine generator was a Leece-Neville Coompany, drawing no. 24502, s/n 21427. The unit did not display any damage.

Photograph 5: Engine Generator

Carburetor

The carburetor was a Stromberg-Bendix, model NAR9-B, s/n 5801259. The unit's mixture control arm moved freely by hand. The throttle function could be rotated to the full open position, but could not return to the closed setting. The unit has been retained for further examination. The mounting flange did not exhibit any evidence of fretting or wear; however, multiple threads in each of the four mounting holes were sheared.

Photograph 6: Carburetor

Fuel Pump

The fuel pump was a Thompson, drawing no. TFD-900-5, s/n TF223693A. The unit did not display any abnormal wear; however, the drive shaft displayed limited rotation. The drive shaft splines and grooves were intact and displayed no play when inserted into the accessory case, which was also unremarkable.

Disassembly of the unit revealed rust along the inside and outside diameters of the rotor liner and surface rust on two of the rotor vanes. However, the valve clearances were within the manufacturer's published clearances. The parts were taken to Quality Aircraft Accessories in Tulsa, Oklahoma on May 22, 2019 by the NTSB IIC for further examination. The body was heated with a torch to remove the rotor liner. Measurements showed that the liner exceeded the manufacturer's published clearances. The bypass flapper valve exhibited a small leak, but was otherwise unremarkable.

Photograph 7: Fuel Pump

Auto Temperature Control Unit

The temperature control unit was P&W Aircraft, part no. 21507.

Propeller Governor

The constant speed propeller controller and hydraulic governor was a Hamilton Standard, model no. A2-05.

Vacuum Pump

The vacuum pump was a Rapco part no. RA216CW, s/n B13456. Disassembly of the unit revealed evidence of water contamination along the inside diameter of the rotor case and around the surface of the rotor.

Carburetor

The Bing carburetor remained attached to the engine along with the mixture and throttle controls. The carburetor bowl did not display fuel or foreign contamination. The diaphragm and needle valve were intact and unremarkable. Both butterfly valve floats were in the correct position and unremarkable.

Engine Run

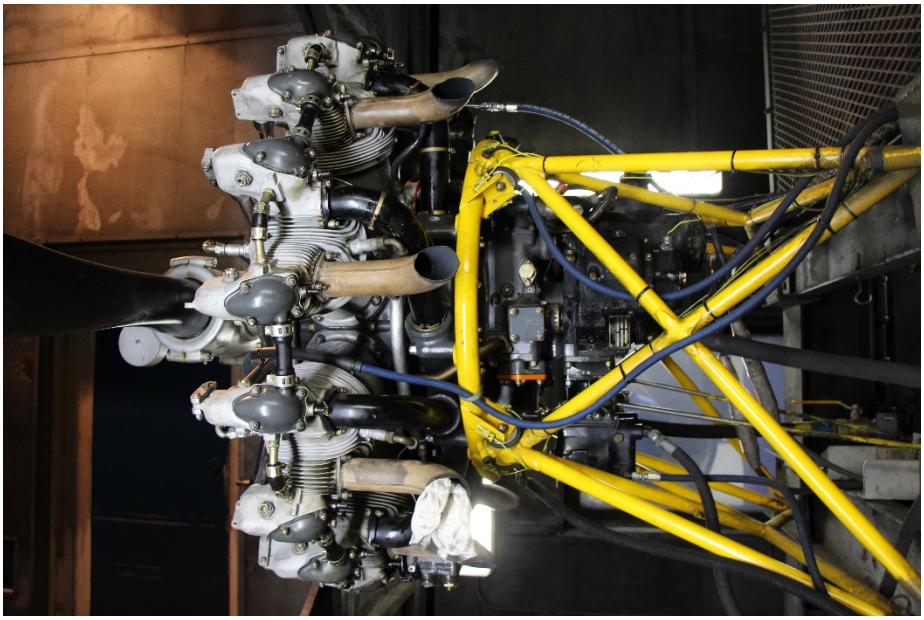
The engine was rigged to a test stand and prepared for an engine run with most of the accessories from the accident airplane: the starter, magnetos, spark plugs, and ignition harness. After the engine was mounted, each cylinder's pre-run compression cylinder compression was taken. The

same was performed following the engine run (table 2). The oil cooler from the test cell was used during the engine run as the oil cooler from the accident airplane was not among the accessories included in the shipment. Additionally, a test carburetor was installed on the engine along with a new gasket.

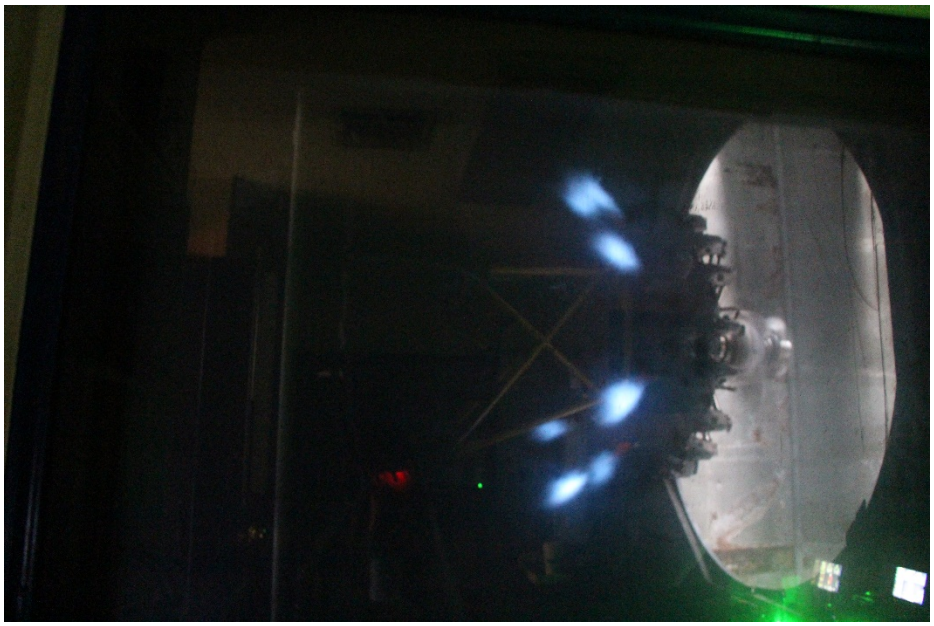
Cylinder	Pre-Engine Run	Post-Engine Run
1	15/80	71/80
2	8/80	78/80
3	10/80	80/80
4	63/80	76/80
5	79/80	80/80
6	15/80	76/80
7	80/80	76/80
8	31/80	75/80
9	79/80	77/80

Table 2: Pre and Post Engine Run Compression

The results of the engine run are included in Appendix A of this examination report. The engine was initially run for 10 minutes at 1,000 rpm and subsequently advanced 200 rpm every 10 minutes. During the 15 minute engine run at 1,800 rpm, the left and right magnetos were shut down individually, which revealed a drop of 60 rpm for the left magneto and 80 rpm for the right magneto. At the time, the ambient temperature was 73° F and barometric pressure was 29.51 inches Hg. Engine power was then advanced to 1,900 rpm for 15 minutes, 2,000 rpm for 15 minutes and finally 2,100 rpm for 5 minutes. The engine's maximum power achieved during the test was 2,300 rpm for about 1 minute at 37 inches of manifold pressure.



Photograph 8: Engine in Test Cell



Photograph 9: Engine During Test Run