



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

September 3, 2019

ENGINE EXAMINATION

WPR19LA108

This document contains 11 embedded photos.

(12 Pages)

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Europa XS – N120EJ

EXAMINATION PARTICIPANTS

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Pilot and Builder of Accident Airplane
Dixon, California

HISTORY OF FLIGHT

On April 13, 2019, about 1145 Pacific daylight time, a Stockton Richard Europa XS, N120EJ, was substantially damaged during a landing roll following a forced landing in Winters, California. The airline transport pilot was seriously injured. The airplane was registered to and operated by the pilot as a personal flight, conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed and a flight plan was not filed for the local flight, which departed Yolo County Airport (DWA), Davis, California at 1040.

According to the pilot, he had not flown the airplane for six months. Two days prior to his departure, the pilot sprayed oil into each cylinder through the spark plug port holes. He then turned the engine over by hand about 30 times and did not observe any binding. After cleaning and reinstalling the spark plugs, the pilot attempted to start the engine, but the battery was weak. He charged the battery and two days later, the engine started normally. The pilot departed DWA

uneventfully and headed north before he turned west and climbed to 3,000 ft. He then turned south and checked his airspeed as he advanced the power to 2,950 rpm, but immediately heard a loud noise, which was accompanied by a sudden vibration and then a partial loss of power. The pilot turned towards his departure airport and reduced his engine power. During this time he observed the exhaust gas temperature on the multi-function display (MFD) and determined that cylinder no. 5 had failed. He advanced the throttle again and the engine continued to run with a vibration. He announced “Mayday” over the airport common traffic advisory frequency and then turned to the final approach leg of the airport, at which point he experienced a total loss of power. The pilot was about 2 nm from the runway when he received an advisory on his MFD for nearby traffic 300 feet beneath him. He turned west into the wind and selected a plowed field with farrows to attempt a forced landing. He entered the airplane into a slip, but descended too quickly and was forced to maneuver to avoid a weather station tower. As the airplane touched down, the nose landing gear dug into the dirt field and the airplane nosed over and came to rest inverted.

A review of photographs furnished by law enforcement personnel revealed substantial damage to the right wing and empennage.

PERSONNEL INFORMATION

The pilot, age 75, held an airline transport certificate and flight instructor certificate with multiple ratings, including airplane single-engine land. His most recent second-class medical certificate was issued on November 20, 2018, which included a limitation to wear corrective lenses. According to the pilot, his flight time included 14,985 hours of total flight time in all aircraft, of which 197 hours had been accumulated in the accident airplane make and model.

AIRCRAFT INFORMATION

According to FAA records, the airplane was manufactured in 2012 and registered to pilot/builder on November 15, 2011 after he purchased the kit from the previous owner. The airplane was powered by a Jabiru 3300, air cooled, 120 horsepower reciprocating engine. Maintenance records indicated that the airplane’s most recent conditional inspection was completed on May 11, 2018 at a total time of 185 flight hours. 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.

According to the pilot/builder, this was the last inspection that required him to remove and reinstall the piston wrist pins. The Jabiru 3300 engine overhaul manual contains instructions for installing the snap rings (circlips) in the wrist pin (gudgeon) journals. Each clip has a “rounded” side and a “flat” side. The instructions states that the “rounded” side face the item being retained and that the clip will not be able to carry as much load and will fail more easily if installed improperly. In the same section, the instruction state to compress the clip only by the bare minimum amount required and to not allow the eyelets to contact each other. Overcompressing the clip will result in permanent damage and is easier to dislodge. The installer should use circlip pliers to gently compress the snap ring, complete the installation and listen for a crisp “snapping” sound, which indicates the ring has dropped into place. After installation, the installer should

inspect the installation and use pliers or a small screwdriver to apply an expansion load to the snap ring. During this test, the snap ring should not spin in the piston.

The wrist pin snap ring installation section of the manual also provides a warning:

Clips that are loose will rotate in service and wear the piston circlip [snap ring] groove away resulting in a loose fit and, eventually, the gudgeon [wrist] pin being liberated & engine failure. Circlips must be fitted and inspected correctly or engine failure will result.

METEOROLOGICAL INFORMATION

The 1155 recorded weather observation at University Airport, Davis, California included wind 050° 4 knots, visibility 10 statute miles, clear skies, temperature 20° C, dew point 08 C, and an altimeter setting of 30.04 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest inverted in a dirt field about 1 nm southwest of the pilot's departure airport. An initial impact point was observed about 25 ft from the main wreckage, which was mostly intact with the exception of some skin fragments and the top engine cowling.

ADDITIONAL INFORMATION

Initial Observations

The airplane was recovered and to a secure facility in Pleasant Grove, California. A postaccident examination of the engine was completed on April 30 by the National Transportation Safety Board Investigator-in-Charge and two representatives of the Federal Aviation Administration. The accident pilot was present to provide technical support as he was the builder of the airplane.

Engine Examination

Engine Manufacturer: Jabiru Aircraft

Engine Model Number: 3300

Engine Serial Number: 33A 2120

Recent Inspection: 100 Hour – 185.76 hours

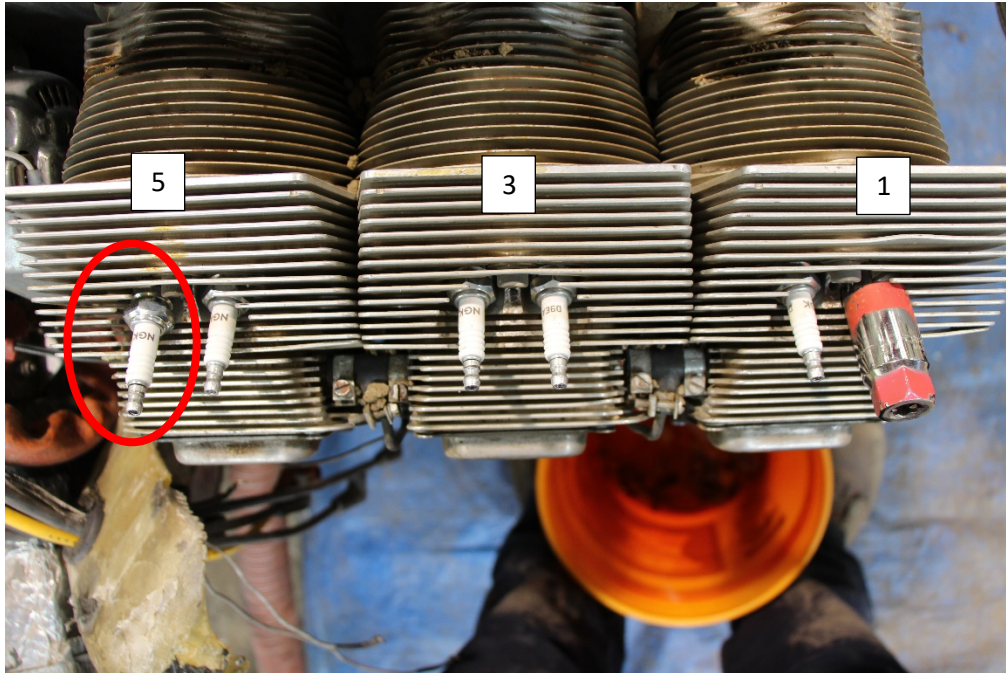


Photograph 1: Engine Firewall and Engine after Recovery

The engine was contaminated with dirt and debris from the airplane's impact with the ground; however, the engine case and accessories were not damaged. The vacuum pump had been removed by the owner; however, the pump gasket remained and the accessory gear was exposed. One propeller blade from the two-bladed whirlwind propeller was separated at the blade root and the other propeller blade remained attached to the propeller hub. The propeller spinner was fractured.

Ignition System

Each of the engine's 12 NGK spark plugs were removed and examined for their condition. Most of the spark plugs were gray in appearance, consistent with normal wear; however, both spark plugs from the no. 5 cylinder and the forward spark plug from the no. 2 cylinder displayed trace amounts of oil residue, but were not fouled. Additionally, the cylinder no. 5 aft spark plug was partially expelled from the spark plug porthole (photograph 2), and displayed some evidence of cross-threading near the plug core. The propeller was seized and could not be rotated by hand. The magnetos remained attached to their stator mounts.



Photograph 2: Spark Plugs to Cylinder Nos. 1, 3, 5

Oil System

Approximately 3 quarts of oil were drained from the oil sump, before the reservoir was removed and inspected. Numerous metallic fragments and a snap ring were recovered from the oil sump.

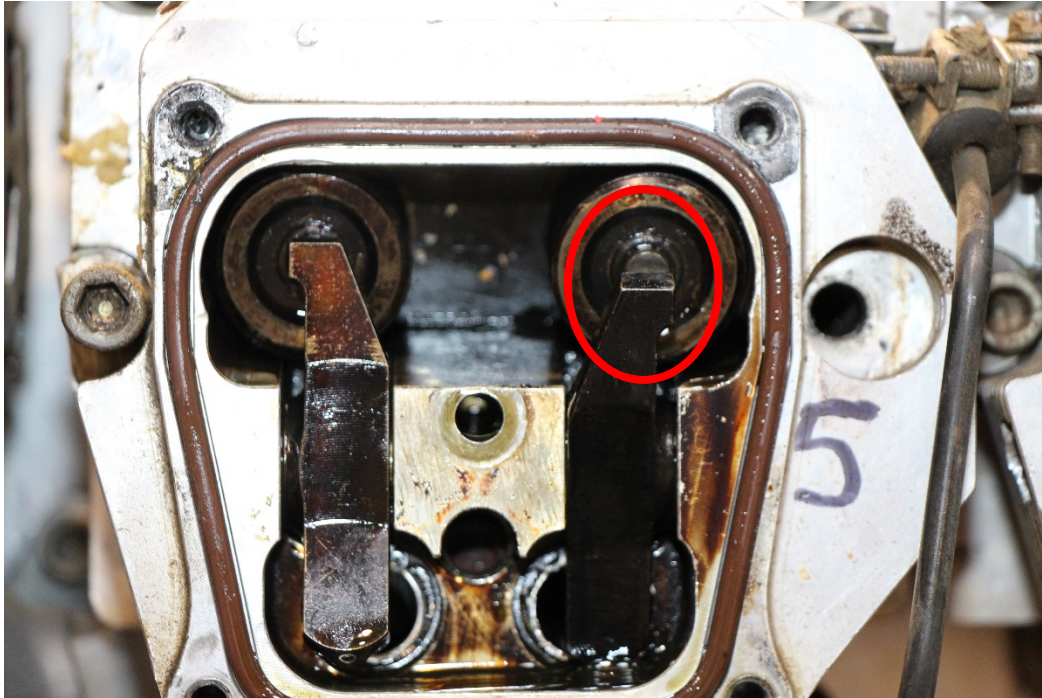
Carburetor

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.

Cylinders

The rocker box covers were removed and most of the rocker arms were normal in appearance and displayed resistance when force was applied, with the exception of the no. 5 exhaust valve rocker arm, which moved freely (photograph 3). Further examination revealed that the cylinder no. 5 exhaust valve push rod was partially inside the engine case and the exhaust valve lifter was missing. The cylinder heads were removed. Most of the piston heads were unremarkable with the exception of the cylinder no. 5, which exhibited multiple gouges along the circumference, striations, galling and some polishing (photograph 4). The cylinder walls to cylinder no. 5 also displayed gouges, scraping, and galling (photograph 5). A journal that houses the wrist pin (or gudgeon) on the backside of the piston had separated and was accompanied by a large gouge (photograph 6). The other wrist pin journal was damaged, but otherwise intact. The cylinder no. 5 wrist pin was found above the crankshaft inside the engine case (photograph 7). Both wrist pin snap rings were found inside the engine; one snap ring was intact and retrieved from the oil sump

and the other snap ring was found in two pieces within the engine case (photograph 8). The other cylinder walls, pistons, and wrist pins were undamaged and unremarkable. Most of the intake and exhaust valves were normal in appearance; however, the valves to cylinder no. 5 were both canted.



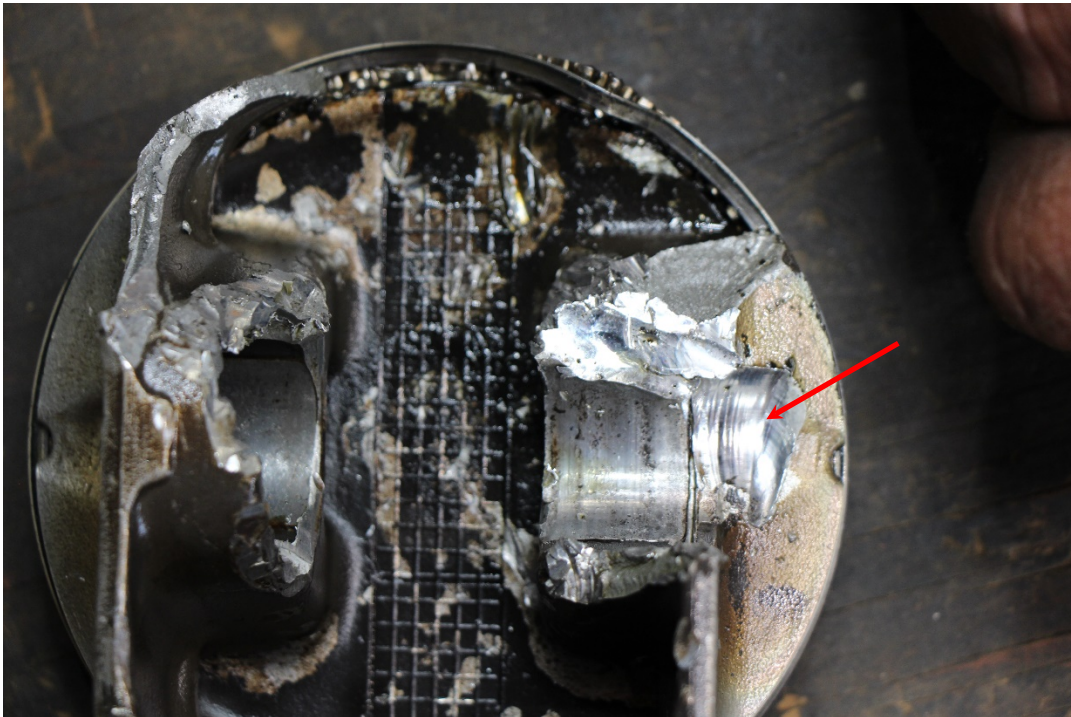
Photograph 3: Cylinder no. 5 with Rocker Box Cover Removed



Photograph 4: Cylinder No. 5 Piston Face



Photograph 5: Cylinder No. 5, Cylinder Wall



Photograph 6: Cylinder No. 5 Piston Backside



Photograph 7: Cylinder No. 5 Piston Wrist Pin



Photograph 8: Piston Wrist Pin Snap Rings

Engine Case

The engine accessories were removed and the crankcase was separated to examine the internal condition of the engine. The cylinder no. 5 valve journal bank was separated from the engine case (photograph 9). A large indentation was observed in the crankcase opposite the no. 5 cylinder that appeared after the cylinder no. 5 connecting rod was removed (photograph 10). A small section of the cylinder no. 5 connecting rod remained attached to the crankshaft (photograph 11).



Photograph 9: Cylinder No. 5 Lifter Journals



Photograph 10: Engine Crankcase Opposite No. 5 Cylinder



Photograph 11: Portion of Cylinder No. 5 Connecting Rod

Camshaft

The camshaft was lubricated and the camshaft lobes were unremarkable.