



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

June 12, 2019

Airframe and Engine Exam

WPR19FA148

This document contains 6 embedded photos.

ACCIDENT:

Location: Alpine, UT

Date: 05/17/2019

Aircraft: Robinson R44 II, Registration Number: N744TW

NTSB IIC: Jack Vanover

EXAMINATION PARTICIPANTS:

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SUMMARY

Examination of the airframe and engine took place on June 12, 2019, at a secure facility in Phoenix Arizona. Party members from Lycoming and Robinson Helicopter Company were in attendance and the National Transportation Safety Board (NTSB) investigator-in-charge (IIC) provided government oversight. No anomalies were found during the exam that would have precluded normal operation.

AIRFRAME

Main rotor and tail rotor continuity was established either visual or through manual rotation. All separations were identified as being overload impact damage. The tail rotor drive shaft exhibited torsional overload consistent with turning during impact. 19 wire wraps from the cooling duct wire were wrapped around the clutch shaft. Two of four v-belts displayed evidence of rotational scoring and all four were displayed from the sheave grooves. The main rotor blades were rotated by hand and rotational continuity was established through the tail rotor drive train. The sprag clutch operated properly and no anomalies were noted. Forward face of upper sheave showed evidence of rotational scoring along with the adjacent frame tube. The tachometer was unremarkable. All three hydraulic servos were manually actuated.

The main fuel tank separated from the airframe and the fuel cap separated from the tank and both were found within the wreckage. An unknown quantity of fuel remained in the tank. The fuel line was dripping fuel on scene and the smell of fuel was present. The main fuel feed line and the fuel crossover line were found fracture separated on scene. The auxiliary tank remained attached to the airframe with no fuel observed. The fuel cap was found secured. The fuel bladder was not compromised on either tank.

The auxiliary fuel strainer was removed, and no debris was noted. The primary fuel tank strainer was removed and no debris was noted.

Gascolator displayed extensive thermal damage. Fuel valve was found in the on position. All fuel lines were either connected, fractured overloaded, or thermally damaged.

The auxiliary fuel pump thermally destroyed.

The air intake duct was crushed, and no evidence of delamination was identified.

With the exception of the *governor off light*, which was extensively damaged and unable to be examined, all 15-bulb filaments were examined, and none appeared to be illuminated during impact.

Governor, and hydraulic switches were found in the **ON** position. All circuit breakers were found closed.

All four cabin doors were found at the wreckage and all sustained extensive impact damage.

Rotational scoring and paint transfer was noted on the outer diameter of the cooling fan and adjacent aft cross tube.

The alternator pulley and cooling fan were distorted with scoring noted on the aft cross tube.

Several individual contact marks were noted on the oil cooler adjacent to the starter ring gear on the flywheel.

Landing Gear

All four attachment points were found separated from the airframe. Both skid tubes were found fractured at the forward strut and bent at the aft strut. Forward cross tube was bent upward at the ends. Aft cross tube was bent upward and fractured at the right elbow. The tail skid was bent upward into the empennage.

Main Rotor Blades

Blade (5999) was bowed downward about midspan and bent aft near the blade tip. Cord-wise coarse scuff marks were noted on the leading edge near the tip.

Blade (6002) was bowed slightly downward near the blade root and slight upward and aft at the tip. Cord-wise coarse scuff marks were noted on the leading edge near the tip, with extensive impact damage noted on the tip. The outboard 14 inches of the afterbody separated from the spar and was found near the main wreckage.

Both elastomeric teeter stops were slightly smashed across the centers. Both droop stops were unremarkable.

Tail Rotor Blades

(SN 4673) was fractured near the root. Impact damage to the leading edge was noted. Tip cap edge was separated and found within the main wreckage.

(SN4678) was bent outward near the root and impact damaged to the leading edge was noted.

Airframe

The cabin was twisted and crushed. Thermal damage was noted on both sides of the vertical firewall. Tail cone was folded near the forward mounts. The aft bulkhead was fractured. The empennage and tail rotor gear box were fracture separated from the bulkhead.

Flight Control Continuity

The flight controls on the left side of the helicopter were removed. Flight control continuity of the right side was established. There were multiple breaks in the cyclic, collective and tail rotor control tubes throughout the helicopter. All breaks were consistent with overload.

ENGINE

The Lycoming IO-540-AE1A5, SN: L-30076-48A was removed from the airframe for examination. The engine meter was recorded at 2,137.2 hours. Impact crushing was noted to the rocker box covers and rocker arms on cylinder Nos. 5 and 6. Both magnetos, oil filter, and engine driven fuel pump remained attached to the accessories case and no impact damage was noted. The alternator was partially separated from the engine but remained attached to the electrical line and part of the bracket. Figure 1. Showing where impact damage was found.

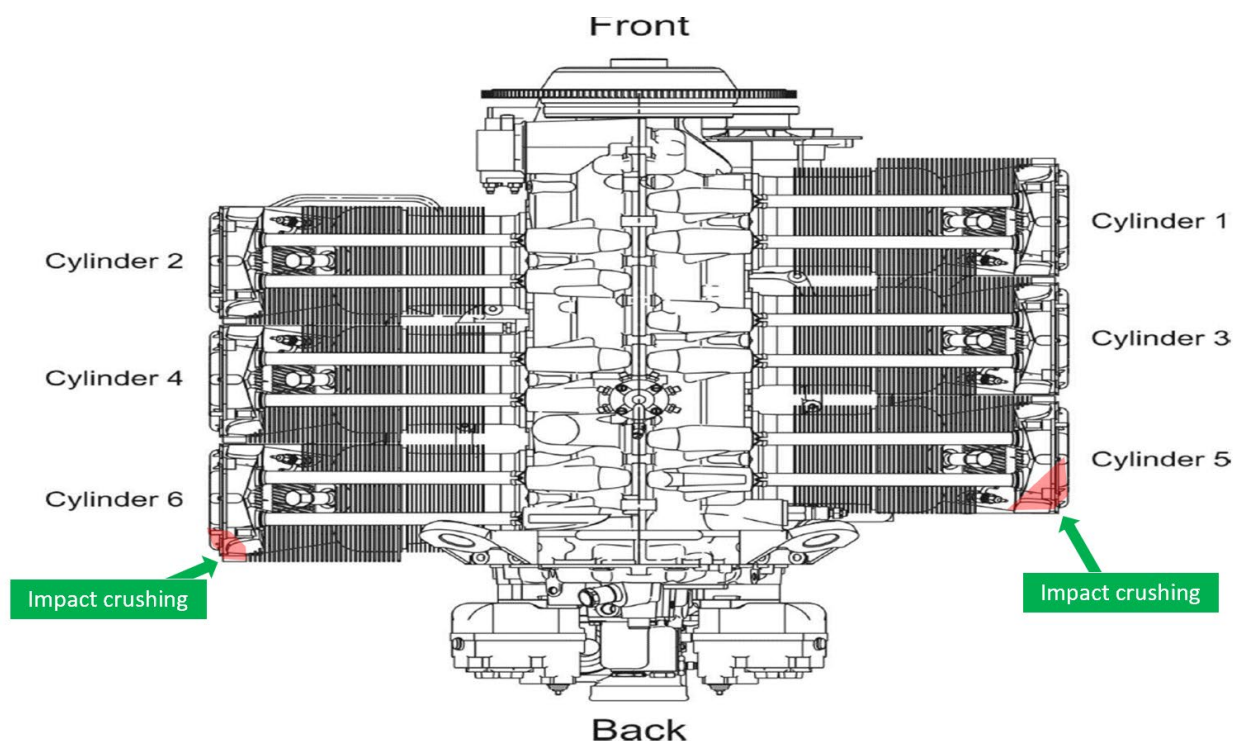


Figure 1. Drawing of engine showing location of damage.

The accessories gear housing was removed, and no anomalies were noted. No damage was noted to the crankshaft gear or dowel pin.

The top spark plugs (Campion REM38S) were removed and exhibited normal wear (Figure 2.)

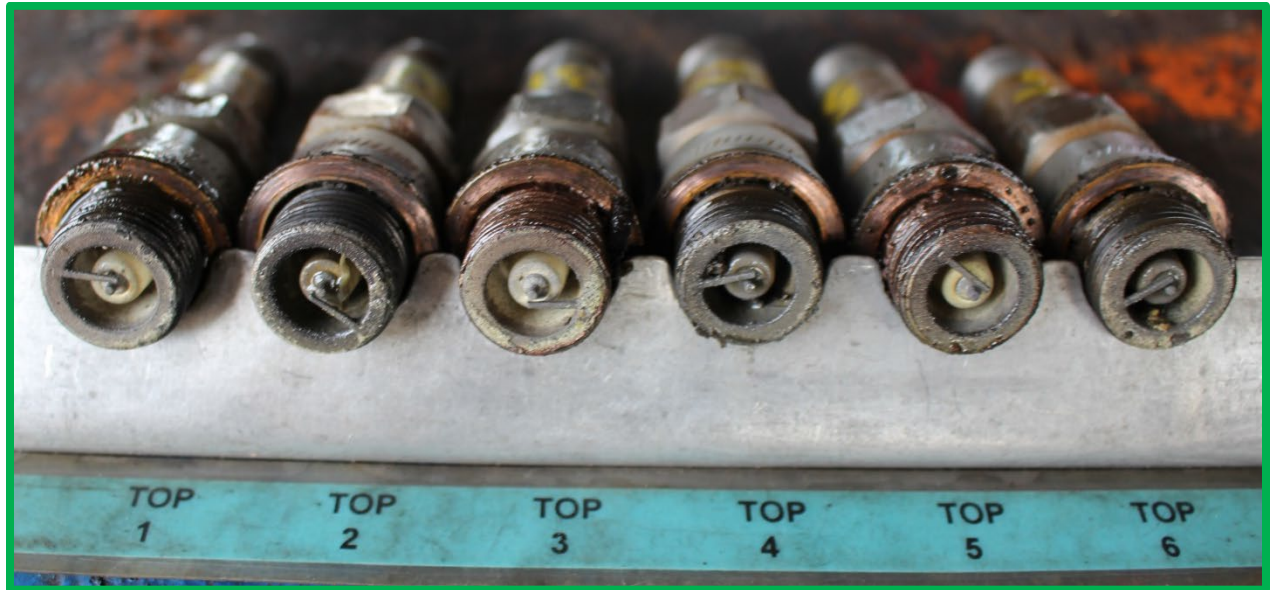


Figure 2. Showing top spark plugs and normal wear indications.

The rocker box covers were removed, and the cooling fan wheel was manually rotated and drive train continuity was established. Cylinder Nos. 1 and 6-were not able to get thumb compressions initially. A borescope was used on all six cylinders and no anomalies were noted. The exhaust rocker arm was damaged on cylinder No. 6 during impact and preventing the valve from seating—it was removed, and thumb compression was obtained. The No. 1 cylinder exhaust valve was seated, and thumb compression was obtained.

The fuel lines were removed from the injectors and the injectors were removed from the cylinders and examined with no anomalies noted. The flow divider disassembled and examined and no anomalies were noted. Figure 3 shows the flow divider disassembled.

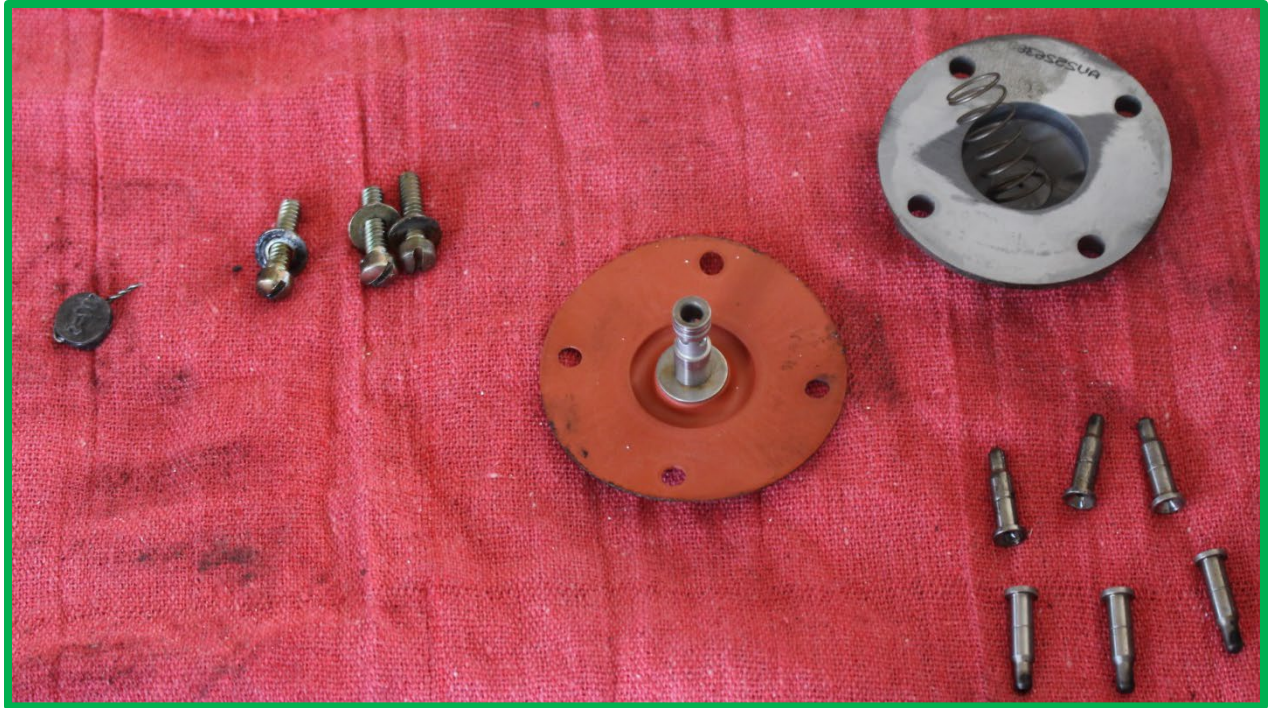


Figure 3. Showing flow divider disassembled.

The engine driven fuel pump was removed and disassembled. Extensive thermal damage was noted to the fuel diaphragm.

The oil filter was cut open and the middle section was cut and removed for examination—no anomalies were noted.

The oil suction screen was removed and no anomalies were noted.



Figure 4. Showing the fuel and oil strainer screens.

The Precision fuel servo was found separated from the engine. Model RSA10AD1 (Serial No. 2576630-4) was examined and no anomalies were noted. Damage to the top and bottom of the throttle body was noted. The throttle linkage was bent and bound. The throttle control arm was fracture separated. The fuel inlet screen was removed, and no debris were noted. The fuel diaphragm was removed, and impact damage was noted to both the fuel and air side.

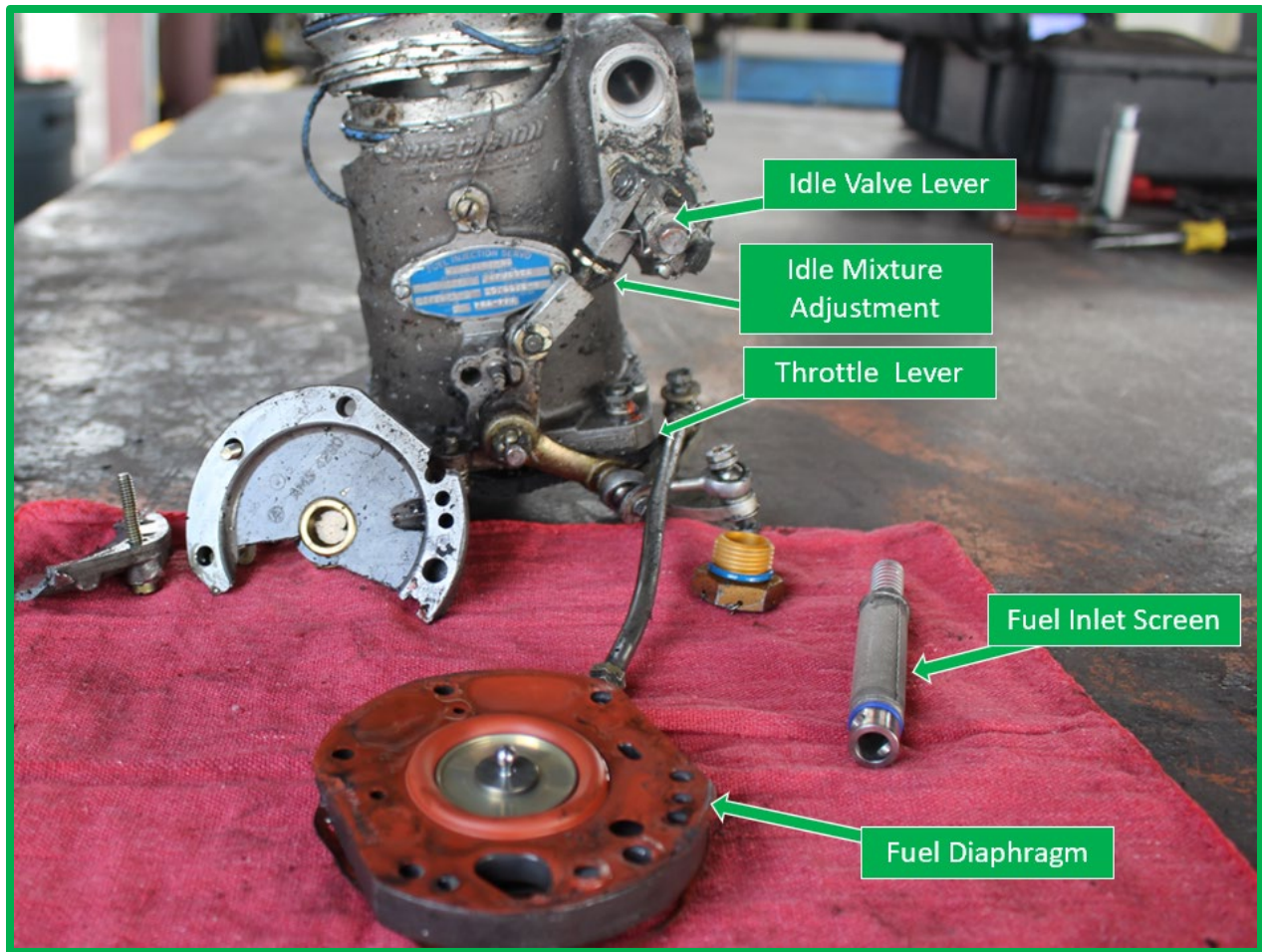


Figure 5. Showing the fuel servo, fuel inlet screen and fuel diaphragm.

Both magnetos were removed and examined. The drive couplers were manually rotated, and spark was observed on all six ignition leads on both magnetos. The left magneto was timed at 23° and the right was timed at 20°.



Figure 6. Left and right magnetos.