



NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety-Eastern Region
Ashburn, Virginia 20147
July 17, 2018

FUEL INJECTION SERVO EXAMINATION FIELD NOTES

A. ACCIDENT:

Location: Sutherlin Lake, MT
Date: July 24, 2017
Time: 1930 CST
Aircraft: N233JD, Robinson R44 II

B. COMPONENT GROUP:

Chairman: Timothy W. Monville
National Transportation Safety Board (NTSB)
Senior Air Safety Investigator, Office of Aviation Safety
Ashburn, Virginia

C. SUMMARY

On July 24, 2017, a Robinson Helicopter Company R44 II, N233JD, sustained substantial damage during a forced landing following a loss of engine power near Sutherlin Lake, Montana. The airline transport pilot and his passenger were not injured. The helicopter was registered to a private individual and operated by the pilot under the provisions of *14 Code of Federal Regulations Part 91* as a personal flight. Visual meteorological conditions prevailed and no flight plan was filed for the cross-country flight. The flight originated from White Sulphur Springs, Montana, with a destination of Sutherlin Lake.

D. DETAILS OF THE INVESTIGATION

Following recovery of the helicopter from the lake, the fuel injection servo (fuel servo) was removed from the engine and shipped to the NTSB investigator-in-charge, who in turn sent it to a NTSB investigator in Florida via UPS airbill 1ZA4E7150390084433; it was delivered on April 5, 2018.

The fuel servo and pressure switch with attached electrical lead was hand carried by NTSB to the manufacturer's facility on May 9, 2018 for operational testing and examination.

According to personnel from the manufacturer representative, the fuel servo was released to Lycoming as a new unit on March 24, 2016, and there was no record that it had been returned to them since being shipped to Lycoming.

Examination of the Avstar Fuel Systems fuel injection servo, model RSA-10AD1, S/N AV22748451, parts list AV2576630-4 revealed the inlet fitting was not capped and was open to the environment. A flexible fuel hose with fire sleeve and attached fuel flow meter which was covered by a fire sleeve remained connected to the outlet fitting which was also not capped and open to the environment. The fire sleeve that covered the fuel flow meter was cut off exposing the fuel flow meter (Figure 1) which was marked with "Floscan Model 201", stamped with "134626", and marked in permanent marker with "2954." Examination of the fuel inlet strainer revealed slight fuzz about 1 inch inside the strainer. The mixture control spring was in-place, and the idle mixture screw was located towards the lean position. Following partial removal of the data plate, a number engraved on the body of the fuel servo "AV22748481" did not match the S/N engraved on the data plate¹. The regulator hex plug was stamped with "G" indicating compliance with Precision Airmotive LLC Service Information Letter (SIL) RS-88. The gasket beneath the regulator hex plug was identified as part number 2577258.

The fuel servo was placed on the test bench as received with a flexible fuel hose with attached fuel flow meter attached to the outlet fitting. The throttle plate was set at 0.036 inch (production units are set to 0.026 inch). The fuel servo manufacture representative indicated that the throttle plate is field adjustable. The fuel servo was flowed onto white paper (Figure 2). No contaminants or water was noted during the first fluid coming from the unit. The unit was subjected to production bench test limits (calibration limits), which consisted of 5 test points². The unit flowed within calibration limits at 3 of the 4 test points (Test Points 3, 4, and 5), but flowed 3.0 pounds-per-hour (PPH) high at Test Point 1 when compared to the production (calibration) limits and 1.95 PPH high when compared with allowed service limits³. At Test Point 2, which is a check of idle cut-off, 1 drop in 30 seconds was noted, which calculated to be 2.0 drops in 1 minute (maximum allowed 100 drops in 1 minute). The travel check, pressure and hysteresis checks were satisfactory. The idle fuel flow was recorded to be 17 PPH with the throttle plate set at 0.026 inch, which was 2.0 PPH greater than specified. The bench test results were documented in Attachment 1 to this report.

¹ The manufacturer representative indicated that both S/N's should have matched. The S/N engraved on the body was associated with a fuel flow divider.

² The Test Points were determined to be an indicator as to the operational status of the fuel servo.

³ Avstar Fuel System Service Bulletin AFS-SB12, issued July 1, 2014, provides Service Limits for minimum and maximum flow meter limits.

The outlet fuel hose with attached fuel flow meter was removed and the fuel servo was subjected to the same production bench test limits (calibration limits). At Test Point 1 the fuel servo flowed 2.0 PPH greater than the calibration limits and .95 PPH greater than the service limits. At Test Points 3, 4, and 5, the unit flowed 69.0, 103.0, and 145.0 PPH, respectively, which all were within the production (calibration) limits. The fuel servo was removed from the test bench for a disassembly inspection.

Disassembly examination of the fuel servo revealed the regulator lock nut was in-place (Figure 3). The fuel servo body regulator section exhibited very light contamination. The center body air side had white powder from the impact tubes (Figure 5). The fuel diaphragm stem was intact. The center body and air diaphragm had white contamination and a line consistent with water submersion (Figure 6). The air diaphragm and regulator cover (low pressure area) had residue (Figure 7). The air venturi was clean (Figure 8). The idle valve and mixture valves were satisfactory (Figures 9 and 10), and the valve train area was satisfactory. The unit was loosely reassembled.

Examination of the separate device shipped with the fuel servo (Figure 11) revealed the thin paper type data plate found around the hexagon shaped sensor portion of the device was damaged but the remains of "Wasco" was readable. The attached electrical lead was covered with black shrink wrap which was marked with "D745-1 Rev F" and "197915".

PARTS DISTRIBUTION

The fuel injection servo was retained by NTSB following the operational testing and examination. It will be shipped as instructed by the NTSB investigator-in-charge.



Figure 1: View of the fuel flow meter installed onto the outlet flexible fuel hose

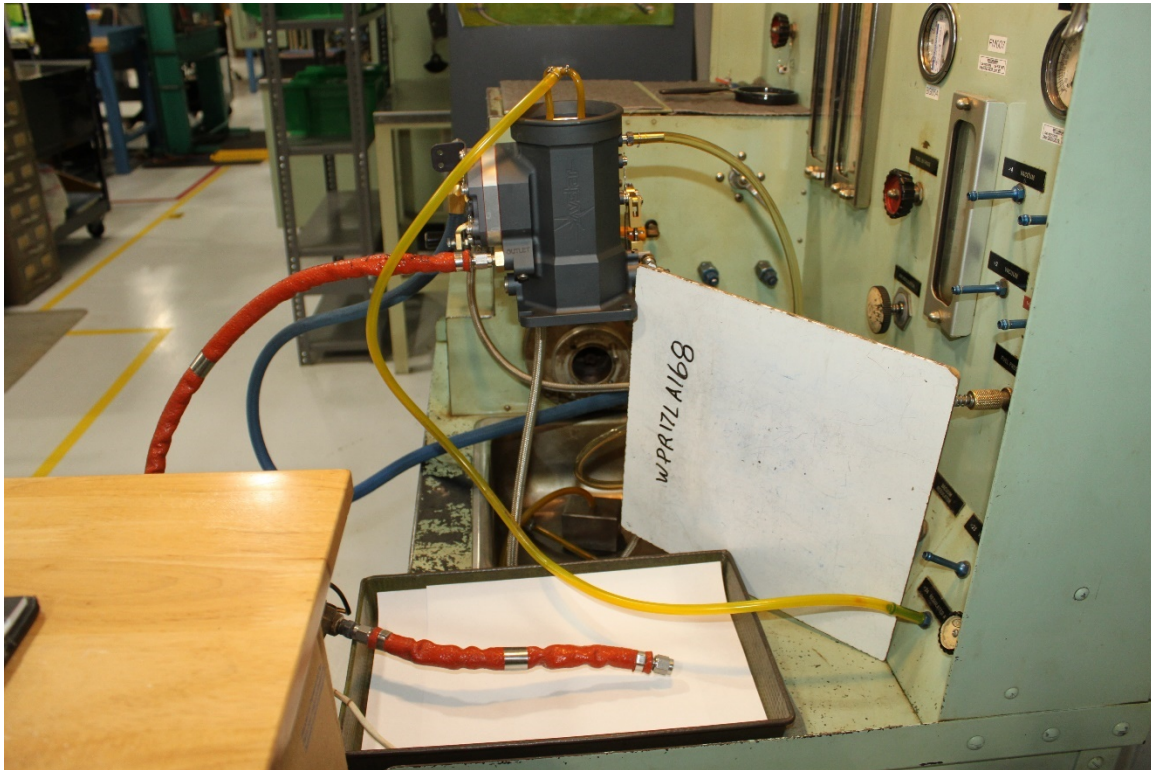


Figure 2: View of the fuel servo on the test bench before testing. Note the outlet flexible fuel hose in a pan with white paper.

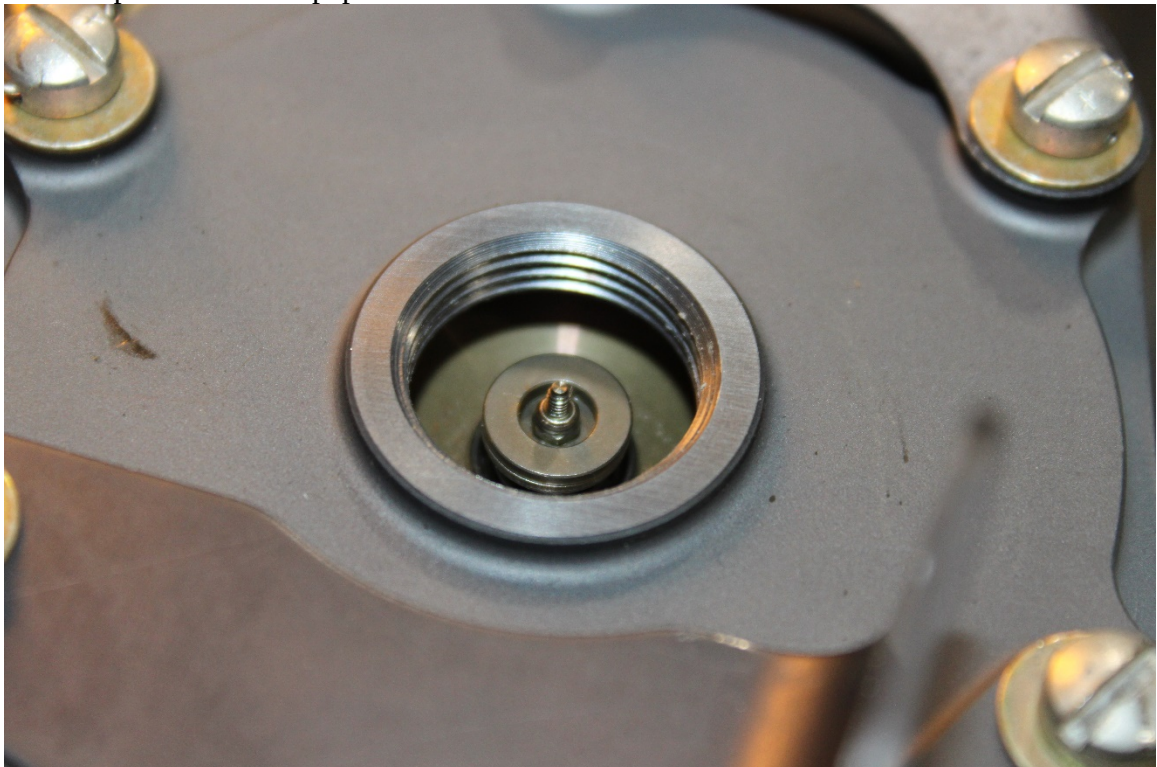


Figure 3: View of the Regulator Nut in Place



Figure 4: Fuel of the Fuel Diaphragm and Fuel Side of the Center Body

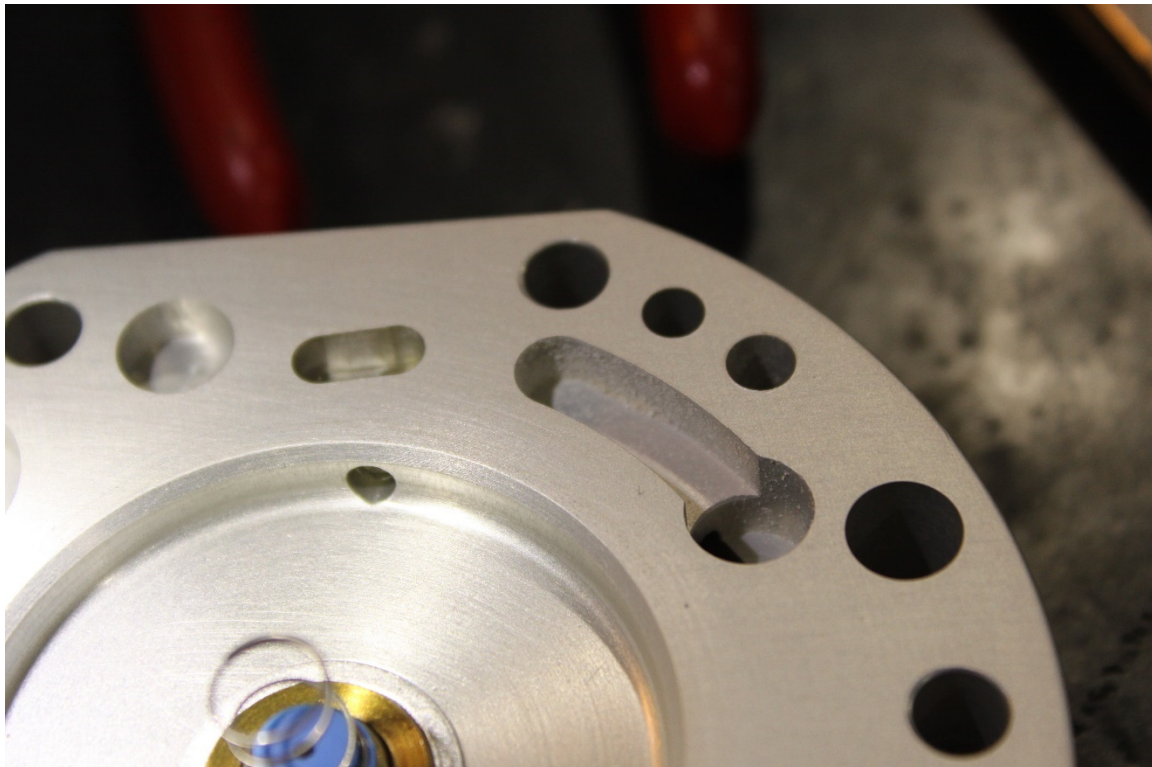


Figure 5: View Showing the White Residue in the Air Side of the Center Body



Figure 6: Air Diaphragm and Air Side of the Center Body Showing Contamination and Line.



Figure 7: View Showing the Slight Contamination in the Regulator Cover and Air

Diaphragm.



Figure 8: Air Venturi



Figure 9: Idle Valve



Figure 10: Mixture Valve



Figure 11: View of the Wasco Pressure Switch and attached Electrical Lead