NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

SYSTEMS EXAMINATION

WPR16L019

This document contains six embedded photos.

A. ACCIDENT

Location:	Folsom, California
Date:	October 24, 2015
Aircraft:	Eurocopter AS-350 B3, N911WL, Serial #: 4587
NTSB IIC:	Eliott Simpson

B. EXAMINATION PARTICIPANTS:

Eliott Simpson
Senior Aviation Accident Investigator
National Transportation Safety Board

C. SUMMARY

Examination of the throttle twist grip electrical wiring was conducted on December 10, 2015 at the facilities of Advanced Helicopters, Woodland, California.

D. DETAILS OF THE INVESTIGATION

1.0 Examination

The digital engine control unit (DECU) connector 55K.P2 was utilized (with the DECU removed) to test the electrical logic inputs to the DECU at the IDLE, FLIGHT, and COM pins. (Photo 1)

Two ohmmeters were configured to read the resistance between the COM (pin 37) and FLIGHT (pin 39) pins, and the COM and IDLE (pin 45) pins. The helicopters battery power was then turned on, and the engine start switch set to ON.

The audible "click" of the three micro switches located below the left collective control was documented. It was noted that a "click" could be heard just as the twist grip was moved out of the IDLE position, with a second "click" heard after an additional 1 mm of rotation, with the third "click" heard as the twist grip moved into the FLIGHT detent. The TWST GRP light on the annunciator panel extinguished coincident with the third "click".

With the twist grip in the IDLE position, the resistance between IDLE and COM pins was 1.5 ohms, with the resistance between the FLIGHT and COM pins exceeding the ohmmeters range, indicating an open circuit. (Photo 2)

The twist grip was then rotated just out of the IDLE detent until the first microswitch "click" was heard. At that time, the resistance between FLIGHT and COM pins changed to 1.7 ohms, with the resistance between the COM and IDLE pins exceeding the ohmmeters range, indicating an open circuit. The resistance values remained unchanged as the twist grip was rotated through to the FLIGHT position. (Photo 3)

The twist grip was then cycled between IDLE and FLIGHT 50 times on the left twist grip and 50 times on the right in an effort to gauge the repeatability of the microswitches. For each rotation the values were repeatable, irrespective of the speed the twist grip was rotated.

Twist Grip Service Bulletins

Airframe maintenance records were examined, and an entry stated that Alert Service Bulletin AS350-80.00.09 Revision 1 (MOD 74263) "Improving twist grip logic" was accomplished on January 31, 2014. Additionally, an entry dated August 16, 2013 indicated that the Emergency Alert Service Bulletin AS350-05.00.61 Revision 2 "Functional check and installation of a protection for microswitches 53Ka and 53Kb and 65K", was accomplished.

The electrical system was visually examined to confirm the completion of AS350-80.00.09 Revision 2 (Post Revision 1). Specifically, it was confirmed that the cathode of Diode 3, pins 3K and 3J (66K block), had been disconnected in accordance with the bulletin (Photo 4). According to the technician who performed the bulletin, the cable (1KK44E) which was connected to the diode, was removed from the airframe rather than terminated, in an effort to eliminate unnecessary cabling. This was confirmed by airframe examination, and specifically cable 1KK44E was determined to no longer be connected to the 54K relay, pin A1 (Photo 5)

Oil was observed on the microswitch protective cover (Photo 6), and according to the technician this was a common occurrence, and explained by a breakdown of the grease within the twist grip rotary mechanism.

The microswitches were examined for compliance with AS350-05.00.61. All microswitch pins appeared clean, with no indication of corrosion. According to the technician, AS350-05.00.61 was accomplished by visual inspection as required at the time of its release.

1.1 Examination Photos

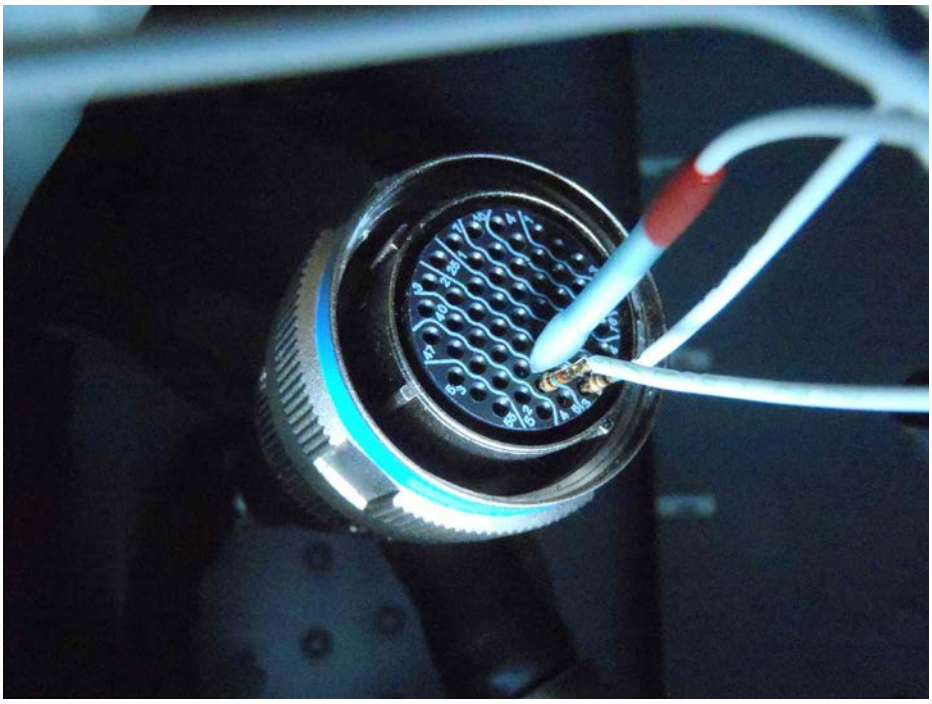

Photo 1 - The DECU connector 55K.P2

Photo 2 - Resistance at IDLE

Photo 3 - Resistance at FLIGHT

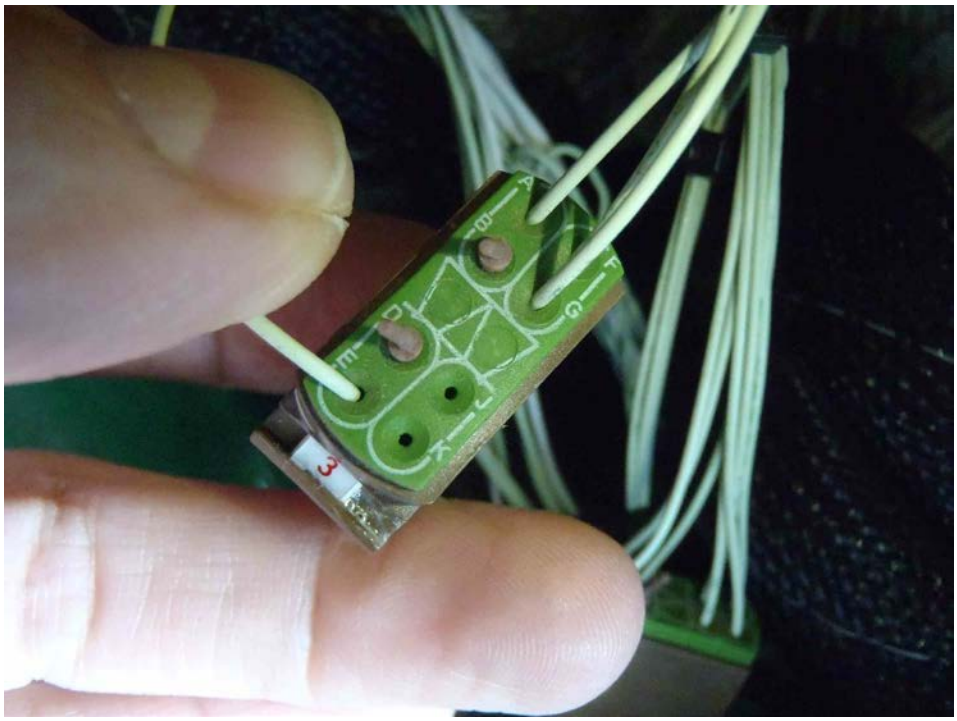

Photo 4 - Diode 3 on 66K Block

Photo 5 - 54K Relay

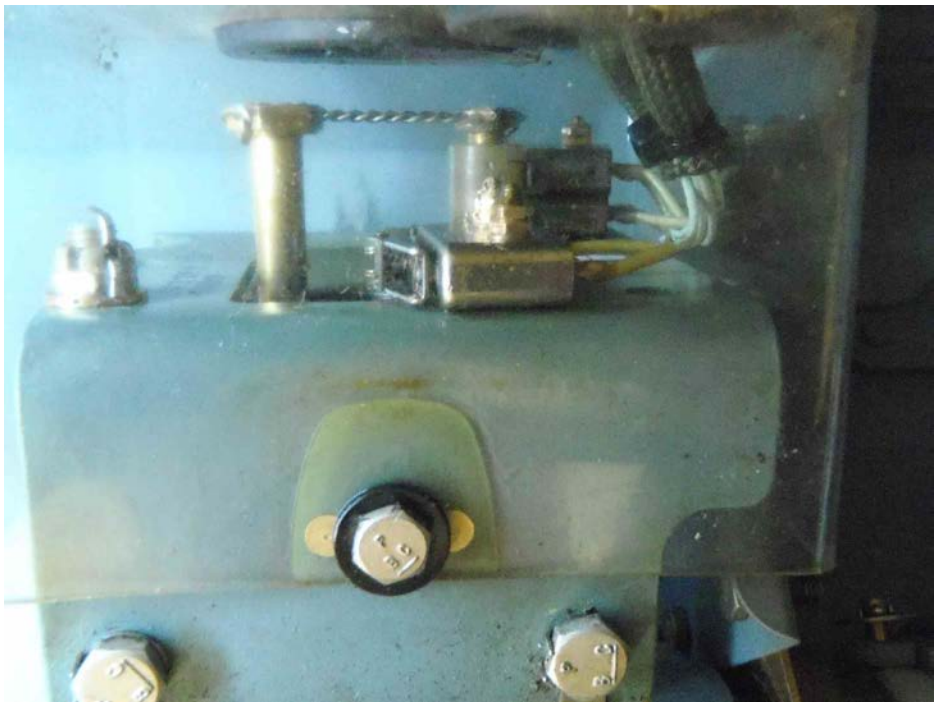

Photo 6 - Twist Grip Microswitches

Submitted by: Eliott Simpson