NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

ENGINE EXAMINATION

WPR16L019

This document contains one embedded photo.

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

Seth Buttner
Accident Investigation and Safety
Airbus Helicopters

Bryan Larimore
Accident Investigation and Safety
Turbomeca USA

C. SUMMARY

Examination of the engine and Digital Engine Control Unit (DECU) was conducted on December 1, 2015 at the facilities of Turbomeca USA, Grand Prairie, Texas.

D. DETAILS OF THE INVESTIGATION

1.0 Examination

Engine

The engine was removed from the crate, examined by the group, and no shipping damage was observed. The engine was then installed in a test cell, utilizing the test cell digital engine control unit (DECU).

The engine started normally, and preliminary acceptance tests revealed no anomalies.
The engine was warmed up, and ran to 106% torque. No exceedance limits were reached.
A vibration test was performed and, was within limits.

The engine was then set to idle, at an output shaft speed of 84%. The engine was then set to "flight" and achieved an output shaft speed of 103 % in about 6 seconds.

A "ramp" test was then performed in an effort to gauge the engines ability to accelerate under load. The engine was set from idle to flight, and a load of 84 % torque was applied over a period of 1 second as soon as the output shaft reached 103%. Maximum torque was achieved 6 seconds later.

The same test was again performed, but this time ramping up the load to 84% in 2 seconds. Maximum torque was achieved 4 seconds later.

A transient test was performed, which required accelerating and decelerating the engine from min load to 80 danM (approx 85%) torque in less than 1 second and ensuring there is no surge or stall of the engine. The engine passed.

Initial engine examination revealed that the neutral switch connector on the hydro mechanical unit (HMU) was three turns loose. In an effort to test the significance of this finding, the connector was manually moved back and forth while the engine was operating at flight power. No change was observed to engine performance during this period, and the test cell control panel did not indicate any faults. The socket was then loosened completely and again no faults were observed. The socket was then completely removed from the HMU and the test cell panel reported "damaged mode", which according to the Turbomeca representative was consistent with the "amber gov / degraded mode " light illuminated in the helicopter. A DECU neutral switch open fault was also triggered. No engine performance degradation was observed when the connector was disconnected, and another transient test was successfully performed. The connector was reattached, and the error remained in the DECU memory.

An EBCAU test was performed with normal results.

The engine was shut down and the fuel filter removed. No debris was observed.

DECU

The unit was visually examined, and all connector pins were intact with no damage observed to the case. The unit was then installed and tested on a DECU Loading and Test Bench, which had been configured for the 2B1 engine. A memory data download was performed (dump EPROM from channel A and B).

Examination of the downloaded data revealed that the DECU use counter was 25,367. Channel A was checked, and the most recent fault was at cycle 5,139. Eight faults had been logged in total; the last four faults were all recorded 9 seconds after the DECU was energized. All faults indicated N1 and N2 of 0%, which was consistent with post-accident system power up during initial investigation. As such, no faults were apparent for the accident flight.

The technical occurrences log was checked and the most recent error was for flight cycle 4,694. Channel B was checked and the most recent recorded error was 4,052 cycles, with 22,924 recorded on the total use counter. The fault indicated N1 and N2 of 0%, which was consistent

with post accident system power up during initial investigation. As such, no faults were apparent for the accident flight.

A self-test was then initiated, and the unit passed.

1.1 Examination Photos

Photo 1 - Engine Fuel Filter

Submitted by: Eliott Simpson