

Aviation Safety Department
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Vehicle Engine Multifunction Display (VEMD) Summary for U.S. CBP AS350B3 S/N 3592

I. ACCIDENT INFORMATION

NTSB Accident #: CEN15TA017
Aircraft Model & S/N: AS350B3 S/N 3592
Aircraft Registration: N852BP
Operator: U.S. Customs Border Protection
Location: Lordsburg, New Mexico
Date: 18 October 2014

II. HISTORY OF FLIGHT (NTSB Preliminary Report)

On October 17, 2014, about 1245 mountain daylight time, an Airbus Helicopters AS350B3 helicopter, N852BP, rolled over on its right side during takeoff near Lordsburg, New Mexico. The pilot sustained minor injuries. The helicopter sustained substantial damage. The helicopter was registered and operated by the United States Customs and Border Protection (CBP) under the provisions of 14 Code of Federal Regulations Part 91 as a public use flight. Visual meteorological conditions prevailed at the time of the accident. The flight was originating at the time of the accident.

According to the CBP investigators, the pilot reported that during the takeoff he drifted backward and the aft right skid might have hit a rock embedded in the ground. The pilot did not report any mechanical malfunctions with the helicopter.

At 1256, the automated weather observation at the Bisbee Douglas International Airport, Douglas/Bisbee, Arizona, which was 38 miles west of the accident site, reported: calm wind, visibility 10 miles, clear sky, temperature 79° Fahrenheit (F), dew point 39° F, and altimeter setting 30.08 inches of mercury.

The helicopter has been retained for further examination.

III. OVERVIEW OF VEMD DATA CAPTURE

The aircraft's Vehicle Engine Multifunction Display (VEMD) and Digital Engine Control Unit (DECU) were sent to Airbus Helicopters Inc. (AHI) in Grand Prairie, TX for a VEMD data capture at AHI and DECU download at Turbomeca USA.



VEMD and DECU Boxes as received



Vehicle Engine Multifunction Display (VEMD)

The VEMD data capture was accomplished by installing the accident VEMD on a training bench and powering up the device to capture the maintenance data stored in its non-volatile memory. Following is an overview of the maintenance information captured:

IV. Flight Reports:

The last complete flight recorded by the VEMD was #3276 with a duration of 9 minutes. It should be noted that the VEMD “flight” begins when gas generator speed (NG) reaches 10% and ends when NG falls below 10% and NR (main rotor RPM) falls below 70. However, failures are recorded when the NG reaches 60% and ends when NG falls below 50%.

It should also be noted that if electrical power to the VEMD is cut before these end of flight conditions are met, the “Flight Report” for that respective flight will not be completed and displayed.

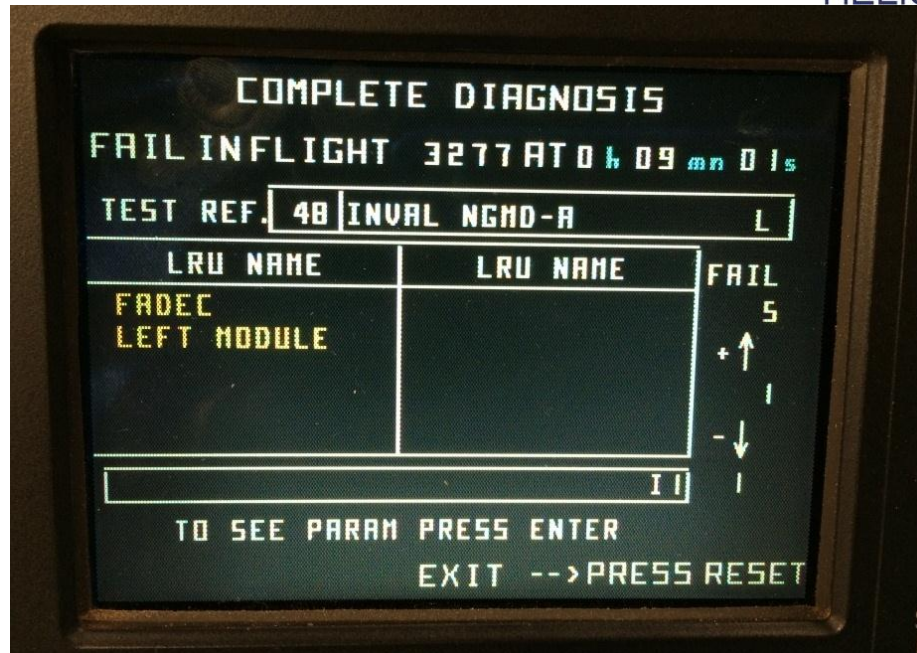


Most Recent Completed Flight Report (no failures)

V. Failures:

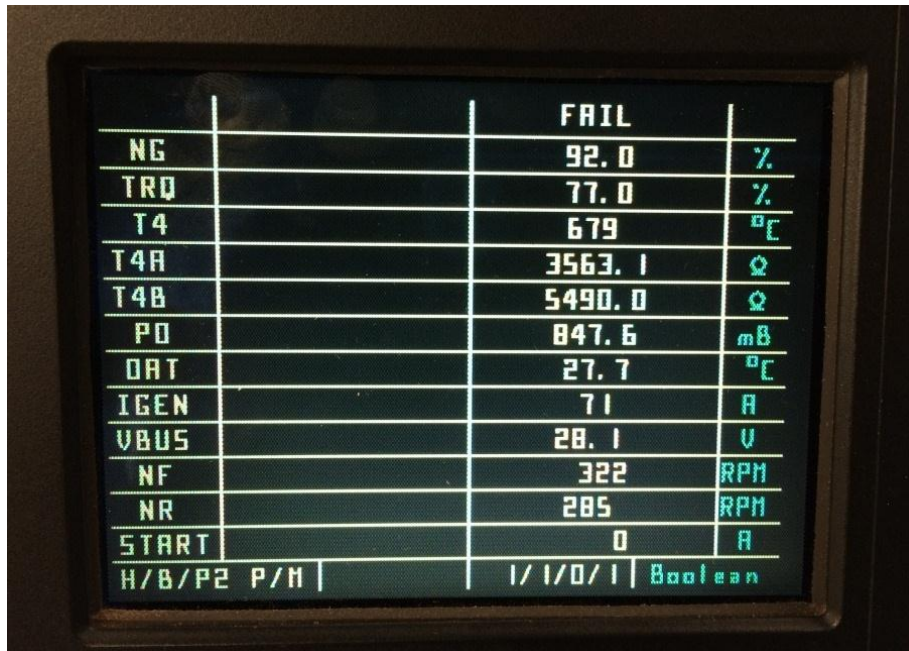
Five total VEMD system/interface failures were detected by the VEMD for flight # 3277 (the accident flight), which was not a “completed flight.” Of the five total failures, there were two pair of corresponding failures, so in reality, there were only three system/interface failures recorded (two recorded by both modules, and one recorded by the left module only). Following are the failures as observed on the VEMD with the corresponding parameters.





Test Reference 48 “INVAL NGMD – A” recorded on left module at 09 mn 01 s.

This failure code is raised when one of the NG values is declared invalid or is not available (the DECU of the B3 is a single channel).



	FAIL	
NG	92.0	%
TRQ	77.0	%
T4	679	°C
T4A	3563.1	°C
T4B	5490.0	°C
PO	847.6	mB
OAT	27.7	°C
IGEN	71	A
VBUS	28.1	V
NF	322	RPM
NR	285	RPM
START	0	A
H/B/P2 P/M	1/1/0/1	Boolean

Parameters associated with detected failure Test Reference 48 “INVAL NGMD – A”

The parameters above indicate that the free turbine speed (NF) was higher than the main rotor speed (NR) and lower than the nominal speed which is consistent with the failure of the engine / main gear box coupling consistent with the main rotor blade impact with the ground.



Test Reference 49 “INVAL NGMC – A” recorded on left module at 09 mn 01 s.

This failure code is raised when the second NG measurement is declared invalid or is not available.

	FAIL	
NG	92.3	%
TRQ	71.3	%
T4	684	°C
T4A	3563.1	°C
T4B	5490.0	°C
PD	847.6	mB
QAT	27.7	°C
IGEN	71	A
VBUS	28.1	V
NF	322	RPM
NR	261	RPM
START	0	A
H/B/P2 P/M	1/1/0/1	Boolean

Parameters associated with detected failure Test Reference 49 “INVAL NGMC – A”

The parameters above don't provide any additional information except that the torque (TRQ) and the main rotor speed (NR) decreased as a consequence of the main rotor blade impact with the ground.



Test Reference 122 "COLL PITCH POT" was recorded on left module at 09 mn 01 s.

This failure corresponds to a collective pitch potentiometer anticipator failure.

It triggers when:

- There is a problem with the potentiometer.
In this case, it is always possible to fly safely but the engine will take additional time to react the pilot input.
- The measurement of the relative position of the collective pitch potentiometer reaches its minimum (5 %) or maximum (95 %) thresholds or when its variation is above 350 % per second.
These thresholds can't be mechanically reached because of the collective pitch system design.

Airbus Helicopters has noted that this failure is usually one of the first failures recorded during a crash sequence due to the ground contact and resulting structural deformation or/and main rotor blade contact with the ground.

	FAIL	
NG	92.8	%
NG FR.	91.8	%
TRQ F.	5.3	%
T4	714	°C
T4 FR.	706	°C
NF	466	RPM
FAIL1	0010	HEX
FAIL2	0000	HEX
LOG 1	4204	HEX
LOG 2	4020	HEX

Parameters associated with detected failure Test Reference 122 “COLL PITCH POT”

These associated parameters indicate that the free turbine speed (NF) increased beyond its nominal value and the torque (TRQ) was very low and close to zero which is consistent with the failure of the engine / main gear box coupling compatible with the main rotor blade impact with the ground.

The following codes were also available in the associated parameters:

Label 350 – FAIL1_FADEC = 0010 Bit 18 => Collective pitch failure

Label 353 – LOG1_OUT = 4204 Bit 16 => Self-test ended

Bit 23 => Control mode = Flight

Bit 28 => Proportional mode

Label 354 – LOG2_OUT = 4020: Bit 19 => Degraded operation

Bit 28 => Mixed mode

These codes indicate that when the failure was recorded, the aircraft was in flight mode and that the twist grip was out of the flight detent.



Test Reference 72 “OUT OF RANGE T4-R” was recorded on left module at 04 mn 31 s.

	FAIL	
NG	0.0	%
TRQ	0.0	%
T4	0	°C
T4A	16129.9	°C
T4B	10937.7	°C
PO	0.0	mB
OAT	0.0	°C
IGEN	0	A
VBUS	0.0	V
NF	0	RPM
NR	0	RPM
START	0	A
H/B/P2 P/M	0/0/0/0	Boolean

Parameters associated with detected failure Test Reference 72 “OUT OF RANGE T4-R”

This fourth failure appears after the first ones but with a lower flight time.

Moreover, the associated parameters show an excessively high value of T4A and B (out of range) with all other parameters equal to zero. This indicates the failure was most likely recorded during the power up on the training bench.



Test Reference 72 “OUT OF RANGE T4-R” was recorded on right module at 00 mn 00 s.


The failure code is raised when the VEMD has detected that the T4 value cannot be measured or is out of tolerances.

For the reason explained in the previous recorded failure, this failure was most likely not recorded during the crash sequence but during the power up on the training bench.

Furthermore, this failure is the same as the previous one but on the other module of the VEMD.

The next most recent flight with recorded failures was # 3253 (FLI Loss).

VI. Over-limits:



OVER LIMIT 3277			
	TIME	LIMIT	MAX
TRQ	000 00	>TRQ TRA	000 %
	000 00	>TRQ MED	
	000 00	>TRQ EXT	
T4	000 00	>T4 LOU	0000 °C
	000 00	>T4 MED	0000 °C
	000 00	>T4 HI	
NG	000 00	>NG HNT	000.0 %
	000 00	>NG TRA	
NF	000 00	>NF TRA	466 RPM
	000 00	>NF EXT	
NR	000	000	000 RPM

An NF over-limit of 466 RPM was recorded during flight # 3277, however, there is no time, level, or duration associated with this value.

This over-limit is in accordance with the failures recorded during the accident flight and is consistent with the failure of the engine / main gear box coupling compatible with the main rotor blade impact with the ground.

VII. Power Checks:



ENGINE POWER CHECK RESULT			
NG	95.6 %	NF	392 RPM
T4	760 °C	Zp	4600 Ft
TRQ	70.0 %	QAT	+73 °F
T4 MARGIN		TRQ MARGIN	
-6.1 °C		+5.8 %	
GOOD		GOOD	
EXIT --> PRESS RESET			

The most recent power check conducted (unknown flight #) yielded “good” results.

VIII. Summary

All the first failures appear to be associated with the impact. Furthermore, the parameters associated with the failures and times of the failures do not indicate any pre-impact anomalies.