

ATTACHMENT 5

Moog Report Regarding Spoiler Control Unit Circuit Card Examination

MOOG

July 12, 2013

Mr. George Haralampopoulo
National Transportation Safety Board
Via: E-mail [REDACTED]@ntsb.gov)

Subject: Investigation of SCU 233700-109 S/N 0218 (HBC PN: 390-384011-0019)

Accident Description Provided:

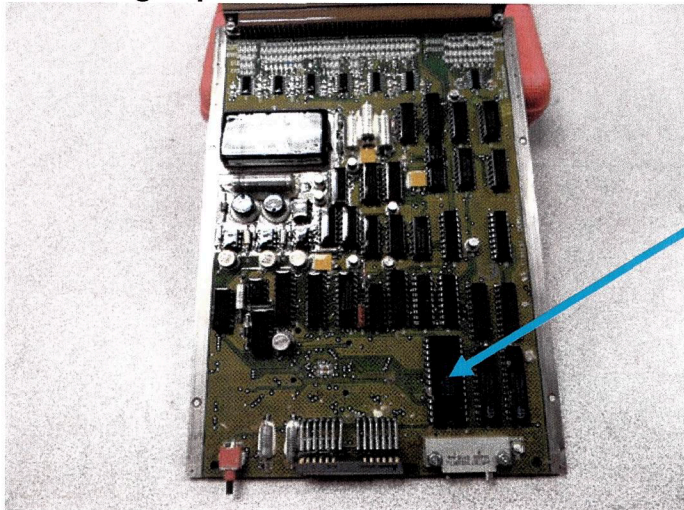
On March 17, 2013, a Hawker Beechcraft model 390 (Premier IA) business jet, registered N26DK, collided with residential structures at the South Bend Regional Airport (KSBN), South Bend, Indiana.

This report describes the information download from the Spoiler Control Unit (SCU) 233700-109 S/N 0218 NV RAM memory IC chip component that was involved in the accident and delivered to Moog Aircraft on June 10, 2013.

Information and Instructions Provided to Moog:

The NTSB contacted Moog and sent pictures of the BIT / Diagnostics board (PN: 233498-001) that they removed from the ECU unit, S/N 0218. Moog did not know they were going to open the unit and remove the cards. There appeared to be no damage to the board.

Following is picture taken of the board:



U3 – NV RAM
memory chip

BIT / Diagnostics Board PN: 233498-001 from SCU S/N: 0218

Actions Performed at Moog:

George Haralampopoulo arrived at Moog on 06/10/2013 with the NV RAM memory chip U3 mounted on the BIT / Diagnostics Board from SCU S/N: 0218. The whole SCU was not returned to Moog and no pictures were provided.

The BIT / Diagnostics board (PN: 233498-001) from SCU S/N: 0218 was installed in an engineering asset Premier SCU and using the NVRAM downloader per the AVO 003843 Rev. 2 procedure, the NV RAM codes were viewed.

Below is the screen capture taken from the "Premier 1 Viewer" used to view the last 250 fault codes recorded.

Note: The Premier 1 Viewer is an engineering test and development tool used as a troubleshooting and fault isolation aide and is not used during normal maintenance activity. This tool will display information not seen on the unit display.

S/N 0218 (last 20 codes are displayed

INDEX	DESCRIPTION	FLT CODE
1	MONITOR CCA NO 1	2
2	CONTROL CCA	1
3	AIRCRRAFT SOURCE POWER	V
4	MONITOR CCA NO 2	3
5	AIRCRRAFT SOURCE POWER	V
6	RIGHT WOW SWITCH	M
7	AIRCRRAFT SOURCE POWER	V
8	RIGHT WOW SWITCH	M
9	AIRCRRAFT SOURCE POWER	V
10	POWER & DRIVER CCA	4
11	RIGHT WOW SWITCH	M
12	AIRCRRAFT SOURCE POWER	V
13	RIGHT WOW SWITCH	M
14	AIRCRRAFT SOURCE POWER	V
15	RIGHT WOW SWITCH	M
16	AIRCRRAFT SOURCE POWER	V
17	RIGHT WOW SWITCH	M
18	AIRCRRAFT SOURCE POWER	V
19	RIGHT WOW SWITCH	M
20	AIRCRRAFT SOURCE POWER	V

The remaining 250 codes were repeats of M and V in the same pattern.

Fault codes are recorded in descending order. The most recent recorded fault is number 1. It is not clear when these events occurred. The SCU does not receive or supply time and date information, therefore it is uncertain if these events were logged before, during or after the accident.

Fault data are displayed as a single digit code that identifies the faulty LRU. The single digit code is identified in Table below. Diagnostics is capable of isolating a fault to any one of the components listed in Table below. If more than one fault exists, fault codes will be displayed as a series string of up to eight codes.

FAULT CODE	LRU
A	Control Wheel RVDT B. This means that the pilot's control wheel sensor, rigging or wiring may be faulty.
B	Control Wheel RVDT A. This means that the copilot's control wheel sensor or wiring may be faulty.
C	Right Midboard Panel LVDT. The right midboard panel wiring, LVDT (sensor) or rigging may be faulty.
D	Left Midboard Panel LVDT. The left midboard panel wiring, LVDT (sensor) or rigging may be faulty.
E	Right Roll Actuator. This fault indicates a problem with the actuator. It could be the LVDT (sensor) that is internal to the actuator or some other wiring problem.
F	Left Roll Actuator. This fault indicates a problem with the actuator. It could be the LVDT (sensor) that is internal to the actuator or some other wiring problem.
G	Right Pull-down/Hold-down Actuator. This fault indicates a possible fault in the down-and-lock switch, wiring, or the down-and-lock actuator itself.
H	Left Pull-down/Hold-down Actuator. This fault indicates a possible fault in the down-and-lock switch, wiring or the down-and-lock actuator itself.
I	Hydraulic Control Unit. This fault could be caused by many malfunctions but indicates something is wrong with the hydraulic control unit, a signal going into the unit, or a portion of the wiring is faulty or disconnected.
J	Right Pneumatic Pressure Out-of-Limits. This fault indicates over or under-charged pneumatic pressure in the blowdown actuator, a faulty pressure sensor, or faulty wiring. There may also be a leak in the actuator assembly if pneumatic pressure continues to bleed off.

FAULT CODE	LRU
K	Left Pneumatic Pressure Out-of-Limits. This fault indicates over or under-charged pneumatic pressure in the blowdown actuator, a faulty pressure sensor, or faulty wiring. There may also be a leak in the actuator assembly if pneumatic pressure continues to bleed off.
L	Flap Position Indicator. This is a signal from the flap control system and indicates flap position. Faulty wiring or potentially a fault in the flap control system is the likely causes of this fault.
M	Right Weight on Wheels (WOW) Switch. This fault can be caused by faulty rigging, wiring or a defective switch.
N	Left WOW Switch. Faulty rigging, wiring or a defective switch can cause this fault.
O	Right Throttle at Idle Switch. Faulty wiring or a defective switch can cause this fault.
P	Left Throttle at Idle Switch. Faulty wiring or a defective switch can cause this fault.
Q	Right Throttle at Power Switch. Faulty wiring or a defective switch can cause this fault.
R	Left Throttle at Power Switch. Faulty wiring or a defective switch can cause this fault.
S	Speed Brake Switch. Faulty wiring or a defective switch can cause this fault.
T	Right Inboard Panel Stow Switch. Faulty wiring, rigging or a defective switch can cause this fault.
U	Left Inboard Panel Stow Switch. Faulty wiring, rigging or a defective switch can cause this fault.
V	Aircraft Power. This fault indicates an aircraft low or high voltage situation. This can be caused by a low battery condition and may occur during engine starts. If a problem exists with aircraft's power system, this fault will likely occur.
1	Control CCA. This fault indicates a potentially faulty Control CCA in the SCU. All other potential faults should be ruled out before SCU replacement is attempted.
2	Monitor CCA No. 1. This fault indicates a potentially faulty Monitor 1 CCA in the SCU. All other potential faults should be ruled out before SCU replacement is attempted.

FAULT CODE	LRU
3	Monitor CCA No. 2. This fault indicates a potentially faulty Monitor 2 CCA in the SCU. All other potential faults should be ruled out before SCU replacement is attempted.
4	Power and Driver CCA. This fault indicates a potentially faulty power and driver CCA in the SCU. All other potential faults should be ruled out before SCU replacement is attempted.
5	BIT and Diagnostics CCA. This fault indicates a faulty condition in the BIT and diagnostics card. It is likely that if the cycling power on the SCU does not clear the problem, it is faulty.
9	Unknown Monitor Fault. No specific cause of the monitor fault could be isolated. If there are no system anomalies, this may be a spurious fault with no action needed.

Conclusions:

Based on the codes reported, it is difficult to determine sequence of events before and during the accident.

See Appendix A attached, for the AVO 003843 Rev. 2 procedure used.

The original New Build Record and previous maintenance history for SCU (S/N 0270 is available from Moog upon request.

John Pioli
Moog Sr. Quality Engineer

CC: Brian Webber, HBC

Appendix A
AVO 003843 Rev. 2

AVO #:AVO003843

DATE: April 29, 2013

Revision: 2

AVO
*Avoid
Verbal
Orders*
MOOG Inc.

FROM: Michael Voigt
TO: Dept 143, Premier
SUBJECT: 233700 NV RAM Download
REFERENCE: MRM12494 Software User's Manual

PURPOSE: Procedure for NV RAM downloads

SCOPE: OEM and Aftermarket NV RAM download

1.0Download requires a CA21072-001 test stand(See figure 1), Test Set Assembly, and Load Assembly (See figure 2). While in proximity to the test equipment, remove the front cover on the unit for NV RAM Download and connect the communications cable to the RS232 port in the SCU.

Figure 1 – Premier Test Stand
CA21072-001

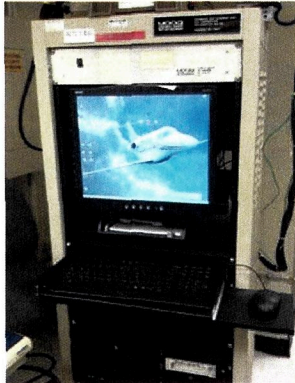
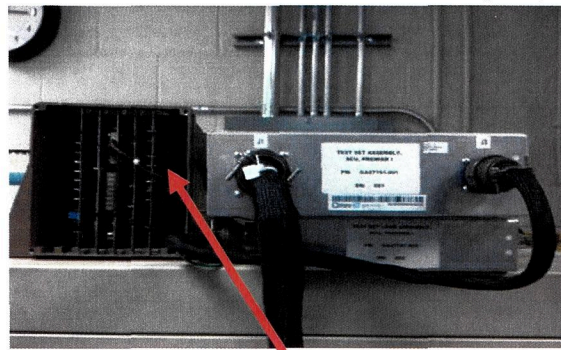


Figure 2 – Test Set Assembly (top right) CA27781-001
Test Set Load (bottom right) CA27787-001
Premier SCU 233700 unit under test (Left)



Communications Cable

2.0 On the Premier test stand. Open the Premier 1 Viewer program by selecting the icon shown in Figure 5. Once open select the fault listing tab on the bottom as shown in Figure 6. Prior to proceeding to step 4.0 assure that the “Freeze Data” button says “Freeze Data”. If it does not toggle the status of the button to “Freeze Data”.



Figure 3

Freeze Data Button

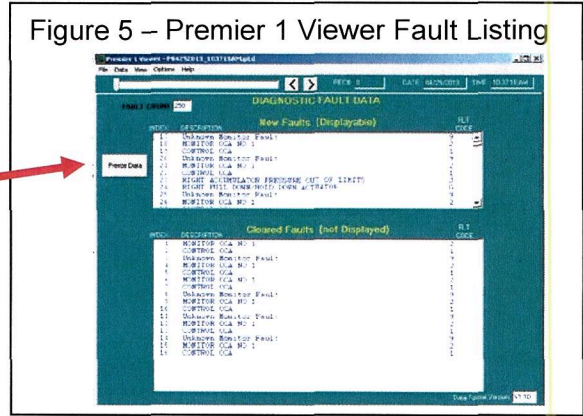


Figure 5 – Premier 1 Viewer Fault Listing

3.0 On the Premier test stand. Open the Premier 1 test system.exe program by selecting the icon shown in Figure 3. There is no password and when in the sequence. Select and run the manual sequence.

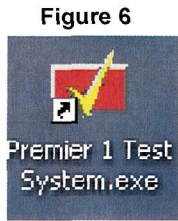


Figure 6

CMD and Mon power switches (step 4)

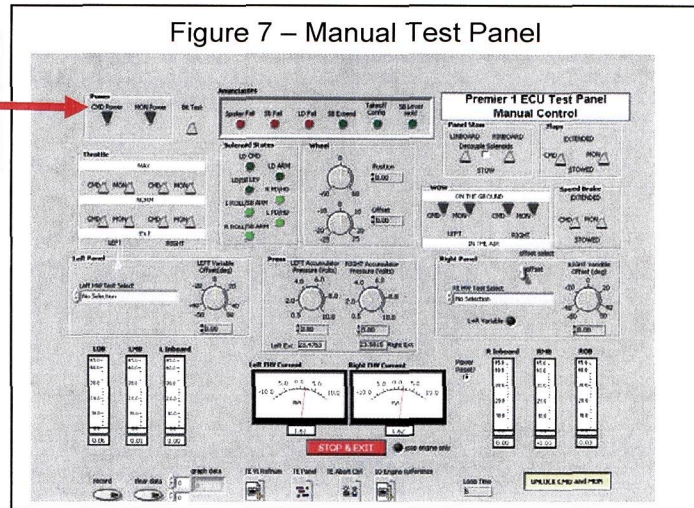
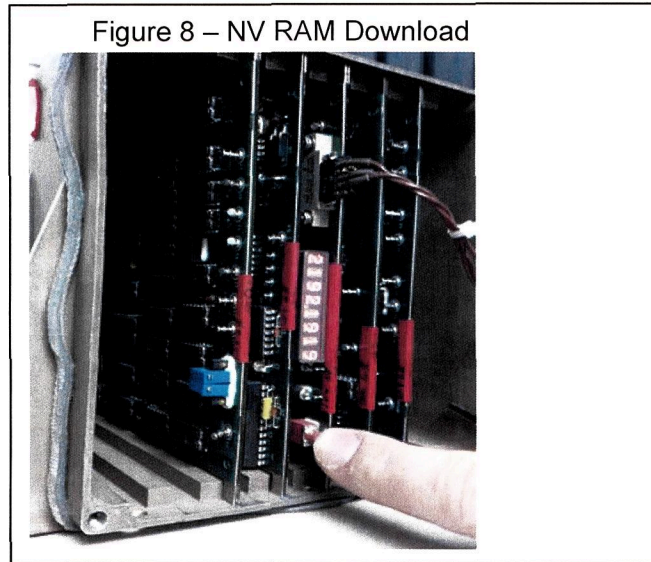


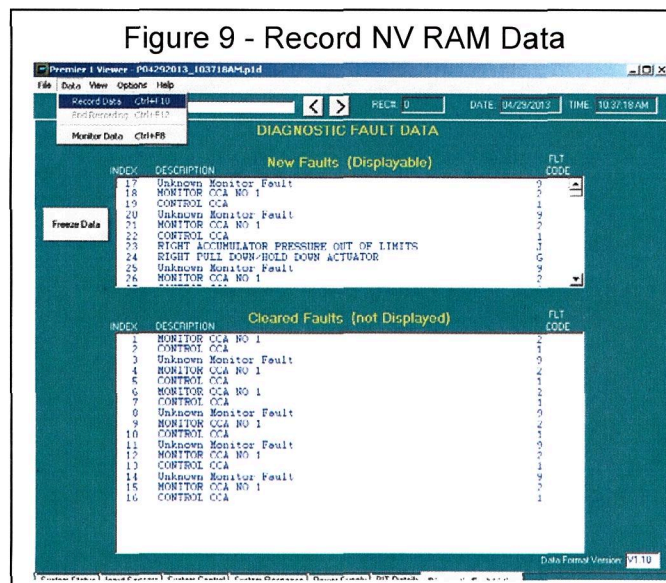
Figure 7 – Manual Test Panel

4.0 On the manual test panel assert the CMD Power and Mon Power switches up as shown in Figure 7.

5.0 Press and hold the toggle switch on the SCU as shown in Figure 8 to dump the NV RAM data. Hold this button till the NV RAM records in the Premier fault viewer (Figure 5) meets or exceeds 250 records. This can take several minutes.



6.0 Once the NV RAM fails have completed downloading (250+ records). Record the data by selecting the data drop down and select "Record Data". Wait 10 seconds and select the data drop down again and select "End Recording".



7.0 The NV Ram download can be loaded back into the Premier 1 Viewer by selecting the file drop down and selecting open log.