

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE
NUMBER:05-1-12200B -X

SUBSYSTEM NAME: GUIDANCE, NAVIGATION, AND CONTROL

REVISION: 0 06/18/01

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
	:FLT DK AVNS INSTL AREA	
LRU	:DEVICE DRIVER UNIT AEROSPACE AVIONICS INC.	MC454-0154-0001 715305-1

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
 DEVICE DRIVER UNIT (DDU) - PILOT STATION

REFERENCE DESIGNATORS: 30V73A2

QUANTITY OF LIKE ITEMS: 1
 1 PILOT SIDE

FUNCTION:
 PROVIDES POWER TO THE ROTATION HAND CONTROL (RHC), NOSE WHEEL STEERING (NWS) STEERING POSITION TRANSDUCER (SPT) AND STEERING POSITION AMPLIFIER (SPA), RUDDER PEDAL TRANSDUCER ASSEMBLY (RPTA), SPEEDBRAKE THRUST CONTROL (SBTC), AND BACKUP FLIGHT CONTROL (BFC).

REFERENCE DOCUMENTS: MCR 19029 - DEVICE DRIVER UNIT (DDU), REV 2 (11/24/99)

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SUBSYSTEM NAME: GUIDANCE, NAVIGATION, AND CONTROL

LRU: DEVICE DRIVER UNIT

ITEM NAME: DEVICE DRIVER UNIT

CRITICALITY OF THIS

FAILURE MODE: 1R3

FUNCTIONAL CRITICALITY/

REQUIRED FAULT TOLERANCE/ACHIEVED FAULT TOLERANCE:1R/2/2

FAILURE MODE:

LOSS OF DEVICE DRIVER UNIT (DDU) FLIGHT CONTROL POWER SUPPLIES (A,B,C). LOSS OF POWER OUTPUT FROM ONE, TWO, OR THREE POWER SUPPLIES.

MISSION PHASE:

- PL PRE-LAUNCH
- LO LIFT-OFF
- OO ON-ORBIT
- DO DE-ORBIT
- LS LANDING/SAFING

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

- 102 COLUMBIA
- 103 DISCOVERY
- 104 ATLANTIS
- 105 ENDEAVOUR

APPLIES TO VEHICLES THAT HAVE MEDS AND NEW DDU INSTALLED ONLY

CAUSE:

CONTAMINATION, VIBRATION, SHOCK, PIECE PART FAILURE, TEMPERATURE, LOSS OF INPUT POWER

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO

REDUNDANCY SCREEN

- A) PASS
- B) PASS
- C) PASS

PASS/FAIL RATIONALE:

A)

B)

C)

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MASTER MEAS. LIST NUMBERS: V73X3011X
V73X3012X
V73X3013X
V73X3051X

CORRECTING ACTION: MANUAL

CORRECTING ACTION DESCRIPTION:

THE FLIGHT CONTROL FUNCTION AND BFC ENGAGE FUNCTION MAY BE TRANSFERRED TO THE COMMANDER'S STATION.

REMARKS/RECOMMENDATIONS:

THE DEVICE DRIVER UNIT COOLING IS CONVECTIVE TO SURROUNDING MEDIA AND CONDUCTIVE THROUGH THE MOUNTING PROVISION. IT IS NOT AIR-COOLED. HENCE, IT DOES NOT HAVE CO-LOCATION PROBLEM AS WOULD THE OLD DDU'S, WHICH LOSS OF ONE COMMON AIR DUCT COULD CAUSE LOSS OF BOTH DDU'S DUE TO OVERTEMPERATURE.

NOTE: THERE IS NO SINGLE POINT FAILURE THAT CAN CAUSE LOSS OF ALL THREE POWER SUPPLY OUTPUTS. IT REQUIRES AT LEAST TWO INTERNAL FAILURES TO CAUSE LOSS OF ALL THREE POWER SUPPLY OUTPUTS.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF ONE OF THREE DDU FLIGHT CONTROL POWER SUPPLIES AT THE PILOT STATION.

(B) INTERFACING SUBSYSTEM(S):

LOSS OF ONE POWER SUPPLY WILL CAUSE POTENTIAL LOSS OF BFS ENGAGE CAPABILITY. BFS WILL ENGAGE ON ONLY WITH A 3 OF 3 VOTE FROM RHC BFS MODE BUTTON.

AFTER LOSS ONE OF THREE REDUNDANT CHANNELS FOR THE RHC, SBTC, AND RPTA, RM SOFTWARE CAN SWITCH FROM 3 CHANNEL MID-VALUE SELECT TO 2 CHANNEL AVERAGING FOR THESE CONTROLLERS. LOSS OF ANOTHER REDUNDANT POWER SUPPLY WILL CAUSE LOSS OF POWER FOR TWO OF THREE REDUNDANT CHANNELS FOR THE RHC, SBTC, AND RPTA, WHICH WILL CAUSE THE SOFTWARE TO DISABLE THE CONTROLLER FUNCTION AT THE PILOT'S STATION. THE PILOT CAN RESELECT THAT FUNCTION ON ORBIT, IF DESIRED. ALSO, THE NWS CLOSED LOOP OPERATION WILL BE LOST TO BOTH NWS GPC MODES.

LOSS OF ALL THREE POWER SUPPLIES WILL CAUSE COMPLETE LOSS OF POWER TO RHC, SBTC, AND RPTA AT PILOT STATION AND TO THE NWS SPT/SPA.

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AFTER LOSS OF FIRST NWS POSITION, RM SOFTWARE WILL SWITCH FROM MVS TO AVERAGING. AFTER LOSS OF SECOND NWS POSITION, RM WILL USE THE SINGLE OUTPUT. AFTER LOSS OF ALL NWS POSITION, RM WILL USE THE LAST GOOD VALUE.

(C) MISSION:
FIRST FAILURE - NO EFFECT.

(D) CREW, VEHICLE, AND ELEMENT(S):
FIRST FAILURE - NO EFFECT

- (E) FUNCTIONAL CRITICALITY EFFECTS:**
- 1) POSSIBLE LOSS OF CREW/VEHICLE IF UNABLE TO UTILIZE BFS WHEN REQUIRED DUE TO INABILITY TO ENGAGE BFS. REQUIRES THREE FAILURES (LOSS OF ONE POWER SUPPLY FROM COMMANDER'S STATION, LOSS OF ONE POWER SUPPLY FROM PILOT'S STATION, AND PASS GENERIC SOFTWARE PROBLEM).
 - 2) POSSIBLE LOSS OF CREW/VEHICLE DURING CRITICAL FLIGHT PHASES DUE TO LOSS OF ABILITY TO CONTROL VEHICLE USING CONTROL STICK STEERING (CSS). REQUIRES FOUR FAILURES (LOSS TWO OF THREE POWER SUPPLIES FROM COMMANDER'S STATION, AND LOSS OF TWO OF THREE POWER SUPPLIES FROM PILOT'S STATION).
 - 3) POSSIBLE LOSS OF CREW/VEHICLE DURING ROLLOUT DUE TO LOSS OF VEHICLE LATERAL CONTROL. REQUIRES FOUR FAILURES (LOSS OF THREE PILOT DDU POWER SUPPLIES AND LOSS OF DIFFERENTIAL BRAKING).

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: MINUTES

- APPROVALS -

S&R ENGINEER	: T. T. AI	:/S/ T. AI_____
DDU SSM	: R. D. SMITH	:/S/ R. D. SMITH_____
FC HAND CONTROLLERS SSM	: D. HEIDMANN	:/S/ D. HEIDMANN_____