FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: 05-6-B30-1 -X

SUBSYSTEM NAME: DATA PROCESS & SOFTWARE
REVISION: 0 12/02/97

PART DATA

	PART NAME	**PART NUMBER**
	VENDOR NAME	**VENDOR NUMBER**
	: FWD AVIONICS BAY 1 & 2	
LRU	: BACKUP FLIGHT CONTROLLER AUTONETICS	MC615-0023-0004 13050-507-31

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
BACKUP FLIGHT CONTROLLER (BFC)

REFERENCE DESIGNATORS: 81V72A361
82V72A362
82V72A363

QUANTITY OF LIKE ITEMS: 3
THREE

FUNCTION:
PROVIDES THE NECESSARY LOGIC SIGNALS TO SWITCHOVER FROM THE PRIMARY TO THE BACKUP SYSTEM AND REVERSE. TO EFFECT SWITCHOVER, IT PROVIDES INTERFACING LOGIC TO ENABLE THE BACKUP SYSTEM COMPUTER, WHILE SIMULTANEOUSLY INHIBITING THE OUTPUTS OF THE FOUR PRIMARY SYSTEM COMPUTERS.

FAILURE MODES EFFECTS ANALYSIS FMEA – CIL FAILURE MODE
NUMBER: 05-5-B30-1-02

REVISION#: 8 06/25/97

SUBSYSTEM NAME: DATA PROCESSING SYSTEM (DPS)
LRU: BACKUP FLIGHT CONTROLLER
ITEM NAME: BACKUP FLIGHT CONTROLLER

CRITICALITY OF THIS FAILURE MODE: 1R2

FAILURE MODE:
ALL CREDIBLE MODES - LOSS OF OUTPUT, ERRONEOUS OUTPUT

MISSION PHASE:
LO LIFT-OFF
DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:
102 COLUMBIA
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:
PIECE PART FAILURE, VIBRATION, CONTAMINATION, TEMPERATURE STRESS, LIGHTNING, POWER CYCLING, ADJACENT PIN SHORT AND MANY PARTS IN MOST CIRCUITS ARE SINGLE FAILURE POINTS.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES
AOA ABORT ONCE AROUND
RTLS RETURN TO LAUNCH SITE
TAL TRANS-ATLANTIC LANDING

REDUNDANCY SCREEN
A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)

B)
FAILS SCREEN B BECAUSE UNABLE TO ISOLATE FAILURE TO A SPECIFIC LINE REPLACEABLE UNIT (LRU) AND PROPER ENGAGE DISCRETE OPERATION CAN NOT BE DETERMINED PRIOR TO ENGAGE.

C)

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- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF FUNCTION.

(B) INTERFACING SUBSYSTEM(S):
ERRONEOUS TERMINATE B OUTPUT (TRUE), ERRONEOUS ENGAGE OUTPUT (TRUE):

PRIMARY AVIONICS SOFTWARE SYSTEM (PASS): GPC CORRESPONDING TO FAILED BFC CHANNEL WILL BE UNABLE TO TRANSMIT ON ITS ASSIGNED FLIGHT CRITICAL BUSES. EQUIVALENT TO GPC LOSS OF OUTPUT.

BACKUP FLIGHT SYSTEM (BFS) (PRE-ENGAGE): NO EFFECT. ABILITY TO ENGAGE BFS IS LOST.

(C) MISSION:
PASS: LOSS OF FIRST GPC NO EFFECT. LOSS OF SECOND GPC RESULTS IN MINIMUM DURATION FLIGHT.

BFS (PRE-ENGAGE): NO DIRECT MISSION EFFECT.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
BFC FAILURE RESULTS IN INABILITY OF CORRESPONDING GPC TO TRANSMIT ON FLIGHT CRITICAL BUSES AND RESULTS IN CRITICALITY 1R2 BECAUSE OF THE FOLLOWING REASONS:

FOR ASCENT/ENTRY: THIS FAILURE COUPLED WITH AN UNDETECTED FLIGHT CONTROL SYSTEM (FCS) FAILURE IN THE NULL (ZERO OUTPUT) POSITION (E.G., IN THE AEROSURFACE AMPLIFIER (ASA) OR ASCENT THRUST VECTOR CONTROLLER (ATVC)), COULD RESULT IN THE TWO HEALTHY PATHS BEING VOTED OUT. THIS COULD RESULT IN A VOTING DILEMMA IN THE FCS (E.G., "FORCE FIGHT" IN THE SERVO ACTUATORS. REFERENCE FMEA 05-1-FC6042-1 AND 05-1-FC6542-1).

FOR ALL PHASES:
(1) LOSS OF PASS DUE TO A GENERIC FAILURE(S) REQUIRES BFS ENGAGE. INABILITY TO ENGAGE BFS DUE TO A BFC FAILURE CAUSES INABILITY TO CONTROL THE VEHICLE AND RESULTS IN LOSS OF CREW/VEHICLE.
(2) LOSS OF OUTPUT FROM ONE INERTIAL MEASUREMENT UNIT (IMU) OR A FLIGHT FORWARD (FF) MDM CHANNEL PROCESSING IMU DATA, FOLLOWED BY FAILURE OF ANOTHER IMU OR FF MDM WITH ERRONEOUS OUTPUT SUCH THAT THE AVERAGE OF THE TWO REMAINING CHANNELS IS CORRUPTED, WILL LEAD TO INCORPORATION OF FAULTY IMU DATA BY ALL COMPUTERS AND POSSIBLE LOSS OF VEHICLE/CREW.

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FOR ASCENT:
DURING INTACT ABORT (RTLS, TAL OR AOA), CRITICALITY 1 IF UNABLE TO PURGE AFT FUSELAGE COMPARTMENTS OF POST MECO GAS MIXTURE (BY OPENING HELIUM BLOW DOWN VALVE) RESULTING IN POSSIBLE FIRE/EXPLOSION AND MAY RESULT IN LOSS OF VEHICLE & CREW ((FLIGHT AFT) FA3 OR FA4 MULTIPLEXER DEMULTIPLEXER (MDM)).

-DISPOSITION RATIONALE-

(A) DESIGN:
DESIGN MARGINS ARE ADEQUATE AND PARTS ARE DERATED 25% TO ORBITER PROJECT PARTS LIST (OPPL) REQUIREMENTS. DESIGN ALSO INCORPORATES RELIABILITY, MAINTAINABILITY, ENVIRONMENTAL AND TRANSPORTABILITY REQUIREMENTS AND OTHER DESIGN AND CONSTRUCTION PER SPECIFICATION MC615-0023.

(B) TEST:
ACCEPTANCE TESTING, WHICH INCLUDES ACCEPTANCE TEST PROCEDURE (ATP) (C78-348/201), ACCEPTANCE THERMAL TESTING (ATT) (AL01215), ACCEPTANCE VIBRATION TESTING (AVT) (AL01216 AND AL01217), EXAMINATION OF PRODUCT, DIELECTRIC STRENGTH, RETURNS ISOLATION, INSULATION RESISTANCE AND FUNCTIONAL AND PERFORMANCE IS PERFORMED ON EACH UNIT.

QUALIFICATION TESTING, INCLUDING POWER TEST, ELECTROMAGNETIC COMPATIBILITY, BONDING, CABIN ATMOSPHERE, QUALIFICATION ACCEPTANCE VIBRATION TEST, QUALIFICATION ACCEPTANCE THERMAL TEST, PRESSURE TESTS, LIFE, SHOCK AND FLIGHT VIBRATION HAS BEEN SUCCESSFULLY COMPLETED. APPROXIMATELY 500 HOURS OF OPERATION AND 1000 CYCLES WERE ACCUMULATED DURING QUALIFICATION TESTING.

FUNCTIONAL TEST WERE MONITORED TO VERIFY LOGIC SIGNALS ARE WITHIN SPECIFIED LIMITS. INTEGRATED AND SUBSYSTEM VERIFICATION IS PERFORMED AT PALMDALE.

GROUND TURNAROUND TEST: ALL TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
RECEIVING INSPECTION
CERTIFICATION RECORDS/TEST REPORTS ARE MAINTAINED CERTIFYING MATERIAL AND PHYSICAL PROPERTIES.

CONTAMINATION CONTROL

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BFS CONTROLLER/SUB-ASSEMBLIES ARE ASSEMBLED IN CONTROLLED WORK AREAS WHEREIN AIR SAMPLES, TEMPERATURES, AND HUMIDITY ARE VERIFIED WEEKLY.

ASSEMBLY/INSTALLATION
BFS CONTROLLER/SUB-ASSEMBLIES ARE INSPECTED PER PRODUCT INSPECTION WORK INSTRUCTIONS. THESE WORK INSTRUCTIONS CONTAIN ACCEPT/REJECT CRITERIA FOR HEAT SINK INSTALLATION, CYLINDRICAL COMPONENT FILLETING, SOLDERING, INTERCONNECTING WIRES, FUSE INSTALLATION, CONNECTOR ENVIRONMENTAL SEALING. SUB-ASSEMBLIES/COMPONENTS ARE CONFORMALLY COATED AND INSPECTED PER DETAILED PRODUCT INSPECTION WORK INSTRUCTIONS.

CRITICAL PROCESSES
STRICT WORK STATION DISCIPLINES ARE ADHERED TO AS SPECIFIED BY MASTER PROCESS CONTROL ELEMENT LIST. AT LEAST ONE OBSERVATION BY QUALITY ASSURANCE (QA) IS MADE EACH DAY TO ENSURE COMPLIANCE.

TESTING
ATP IS OBSERVED AND VERIFIED BY QUALITY CONTROL, INCLUDING AVT AND ATT.

HANDLING/PACKAGING
ALL ASSEMBLY BENCHES ARE EQUIPPED WITH GROUNDING STRAPS AND COVERS FOR USE DURING HANDLING OF STATIC SENSITIVE DEVICES.

(D) FAILURE HISTORY:
CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE

(E) OPERATIONAL USE:
NONE.

- APPROVALS -

EDITORIALLY APPROVED	: RI	: Robert Stell 6/25/97
EDITORIALLY APPROVED	: JSC	: Tom Stacey 7/11/97
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: 97-CIL-033_05-5