

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE  
 NUMBER:05-1-FC6042 -X

SUBSYSTEM NAME: GUIDANCE, NAVIGATION, & CONTROL

REVISION: 0 04/11/94

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	ASA HONEYWELL INC	MC621-0043-8046

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
 AEROSURFACE SERVO AMPLIFIER (ASA), NO'S 1, 2, 3, 4.

REFERENCE DESIGNATORS: 54V79A4  
 55V79A5  
 56V79A6  
 56V79A7

QUANTITY OF LIKE ITEMS:

FUNCTION:

PROVIDES ACTUATOR POSITION LOOP CLOSURE AND PRESSURE COMPENSATION FOR ONE OF FOUR REDUNDANT CHANNELS OF THE SECONDARY ACTUATORS FOR EACH OF SIX AEROSURFACE ACTUATOR ASSEMBLIES. PROVIDES AUTONOMOUS MONITORING OF SECONDARY DELTA PRESSURE, EQUALIZATION, AND ISOLATION DRIVE FOR SIX SECONDARY ACTUATORS. PROVIDES MOTOR CONTROL VALVE DRIVE TO THE BODY FLAP ACTUATOR.

## FAILURE MODES EFFECTS ANALYSIS FMEA - CIL FAILURE MODE

NUMBER: 05-1-FC6042-01

REVISION#: 1 01/22/96

SUBSYSTEM NAME: GUIDANCE, NAVIGATION, &amp; CONTROL

LRU: ASA

ITEM NAME: ASA

CRITICALITY OF THIS  
FAILURE MODE: 1R2FAILURE MODE:  
LOSS OF OUTPUTMISSION PHASE: LO LIFT-OFF  
DO DE-ORBITVEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA  
103 DISCOVERY  
104 ATLANTIS  
105 ENDEAVOUR

## CAUSE:

VIBRATION, TEMPERATURE, PIECE-PART FAILURE, MISHANDLING/ABUSE,  
CONTAMINATION, THERMAL SHOCK AND MECHANICAL SHOCK

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS  
B) FAIL  
C) PASS

## PASS/FAIL RATIONALE:

A)

B)

FAILS B SCREEN BECAUSE LOSS OF OUTPUT (NULL FAILURES) WILL NOT GENERATE  
SUFFICIENT PRESSURE TO USE THE FAULT DETECTION AND ISOLATION CAPABILITY.

C)

## - FAILURE EFFECTS -

## (A) SUBSYSTEM:

NO EFFECT FOR FIRST FAILURE, REMAINING 3 CHANNELS ARE UTILIZED FOR FLIGHT  
CONTROL.

## (B) INTERFACING SUBSYSTEM(S):

NO EFFECT FOR FIRST FAILURE, LOSS OF ONE OF FOUR ASA'S.

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(C) MISSION:

NO EFFECT FOR FIRST FAILURE.

(D) CREW, VEHICLE, AND ELEMENT(S):

NO EFFECT FOR FIRST FAILURE. VEHICLE LOSS AFTER A SECOND UNDETECTED FAILURE DUE TO A TWO ON TWO FORCE FIGHT CONDITION.

(E) FUNCTIONAL CRITICALITY EFFECTS:

CRITICALITY 1R BECAUSE LOSS OF AEROSURFACE CONTROL DURING ATMOSPHERIC FLIGHT MAY CAUSE LOSS OF VEHICLE.

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-DISPOSITION RATIONALE-

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(A) DESIGN:

ALL ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) PIECE PARTS WHICH MAKE UP THE ASA ARE CONTROLLED TO THE ORBITER PROJECT PARTS LIST (OPPL) REQUIREMENTS OF MF0004-400. PASSIVE EEE PARTS AND ELECTRICAL CONNECTORS ARE MILITARY QUALIFIED AND 100% SCREENED TO OPPL REQUIREMENTS. MICRO-CIRCUITS ARE QUALIFIED TO MIL-M-38510 AND SCREENED TO MIL-S-883, LEVEL B. SEMICONDUCTOR DEVICES ARE JANTXV LEVEL. CIRCUIT DESIGN LIMITS WORST CASE JUNCTION TEMPERATURES TO 95 DEGREES C AND ELECTRICAL STRESSES TO 50% OF RATED CAPABILITY FOR ALL PARTS. THE ASA AS AN ASSEMBLY HAS A CERTIFIED LIFE OF 10,000 HOURS (100 MISSIONS) EQUIVALENT TO TEN YEARS.

THE ASA IS DESIGNED AS A HERMETICALLY SEALED UNIT TO PREVENT OR ELIMINATE THE ENVIRONMENTAL EFFECTS OF RAIN, SAND, DUST, AS WELL AS MOISTURE. INTERNAL COMPONENTS ARE CONFORMAL COATED TO ELIMINATE THE ADVERSE EFFECTS OF MOISTURE, PRESSURE, AND/OR TEMPERATURE VARIATIONS IN ADDITION TO SHORT CIRCUIT PROTECTION. THE ASA ALSO INCORPORATES A FAULT DETECTION CIRCUIT TO ISOLATE DRIVER OF FAILED DETECTED CHANNEL, THEREBY ELIMINATING ITS EFFECT ON THE SYSTEM.

(B) TEST:

ACCEPTANCE TESTING, WHICH INCLUDES ACCEPTANCE THERMAL TESTING (ATT) AND ACCEPTANCE VIBRATION TESTING (AVT), IS PERFORMED ON EACH UNIT. QUALIFICATION TESTING, INCLUDING VIBRATION, SHOCK, TEMPERATURE, HAS BEEN SUCCESSFULLY COMPLETED TO CERTIFY THE DESIGN. INTEGRATED/SUBSYSTEM VERIFICATION IS PERFORMED DURING TURNAROUND. FUNCTIONAL TEST OF AEROSURFACES IS MONITORED TO VERIFY THAT AEROSURFACES OPERATE WITHIN SPECIFICATION.

(C) INSPECTION:

RECEIVING INSPECTION  
INCOMING MATERIAL IS VERIFIED BY RECEIVING INSPECTION.

CONTAMINATION CONTROL  
FINAL ASSEMBLY AND REWORK PERFORMED IN A CLEAN ROOM.

ASSEMBLY/INSTALLATION

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QUALITY PLANNING ENSURES ALL DRAWING AND PROCUREMENT REQUIREMENTS ARE PUT INTO IN-PROCESS WORK TICKETS. TORQUING VERIFICATION BY INSPECTION.

NONDESTRUCTIVE EVALUATION  
RADIOGRAPHIC ANALYSIS, ULTRASONIC TESTING, DYE PENETRANT AND MAGNETIC PARTICLE ANALYSIS VERIFIED BY INSPECTION.

CRITICAL PROCESSES  
POTTING, BONDING, FUSION WELDING, SOLDERING AND MATERIAL CLEANING VERIFIED BY INSPECTION.

TESTING  
ENVIRONMENTAL ACCEPTANCE TESTING IS OBSERVED AND VERIFIED BY QUALITY CONTROL.

HANDLING/PACKAGING  
THE PACKING AND PACKAGING REQUIREMENTS ARE SATISFIED BY USE OF SPECIAL QUALIFIED CONTAINERS FOR IN-PLANT TRANSPORTATION AND SHIPPING. RETURNED AND ACCEPTED GOODS ARE STORED IN A BONDED AREA.

(D) FAILURE HISTORY:  
THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

(E) OPERATIONAL USE:  
NONE

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- APPROVALS -

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EDITORIALLY APPROVED	: RI	: <u>Jim De 1/25/96</u>
EDITORIALLY APPROVED	: JSC	: <u>Ann Savary 2-1-96</u>
TECHNICAL APPROVAL	: APPROVAL FORM	: 95-CIL-004-RI