PRINT DATE: 10/17/91

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

NUMBER: 04-2-CONTL6-IM-X

SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

REVISION : 3 10/16/91

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ LRU :	APU CONTROLLER	MC201-0001-1005
■	SUNDSTRAND	753831

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
LUBE OIL REPRESSURIZATION CIRCUIT.

■ QUANTITY OF LIKE ITEMS: 3
ONE PER APU

■ FUNCTION:
(1) PROVIDES SIGNAL TO OPEN NORMALLY CLOSED GN2 SOLENOID VALVE WHEN THE LUBE OIL CASE PRESSURE (V46P0151A) DROPS TO 5.35 +/- 0.90 PSIA AND CLOSE VALVE WHEN PRESSURE IS 8.77 +/- 0.45 PSIA.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE NUMBER: 04-2-CONTL6-IH-01

REVISION# 3 10/16/91 R

SUBSYSTEM: AUXILIARY POWER UNIT (APU)
LRU :APU CONTROLLER
ITEM NAME: APU CONTROLLER

CRITICALITY OF THIS FAILURE MODE:1R3

■ FAILURE MODE:
LOSS OF OUTPUT, ERRONEOUS OUTPUT.

MISSION PHASE:
OO ON-ORBIT
OO DE-ORBIT

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

■ CAUSE:
CONTROLLER INTERNAL PIECE PART FAILURE, OPEN OR SHORT CIRCUIT.

□ CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

■ REDUNDANCY SCREEN A) PASS
■ B) FAIL
■ C) PASS

PASS/FAIL RATIONALE:
■ A)

■ B) ERRONEOUS OUTPUT
NOT DETECTABLE IN FLIGHT UNLESS REPRESSURIZATION OF GEARBOX IS REQUIRED.

■ C)

- FAILURE EFFECTS -

■ (A) SUBSYSTEM:
NO EFFECT UNLESS ERRONEOUS GEARBOX PRESSURE HAS DECAYED BELOW 5.35 +/-0.90 PSIA. ~~LOSS OF OUTPUT~~ WOULD NOT BE DETECTABLE IN FLIGHT UNLESS REPRESSURIZATION OF THE GEARBOX WAS REQUIRED. ~~ERRONEOUS OUTPUT~~ IS DETECTABLE IN FLIGHT SINCE GEARBOX PRESSURE WOULD INCREASE. LOSS OF OUTPUT

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 04-2-CONTLS-IH-01

■ (B) INTERFACING SUBSYSTEM(S):
IF GEARBOX PRESSURE IS LOW, LOSS OF ONE HYDRAULIC SYSTEM FOR ENTRY.

■ (C) MISSION:
NONE.

■ (D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT UNTIL SECOND SYSTEM LOST.

■ (E) FUNCTIONAL CRITICALITY EFFECTS:
LOSS OF CREW/VEHICLE IF GEARBOX PRESSURE DECAYS BELOW 5.35 +/-0.90 PSIA, REPRESSURIZATION CIRCUIT FAILS, AND LOSS OF SECOND APU OCCURS.

- DISPOSITION RATIONALE -

■ (A) DESIGN:
THE LUBE OIL REPRESSURIZATION CIRCUIT IS A SINGLE SERIES CIRCUIT. ELECTRICAL COMPONENTS ARE REQUIRED TO BE QUALIFIED, PROPERLY DERATED, AND APPLIED PER MC201-0001, PARAGRAPH 3.3.2.2. ELECTRICAL PARTS SELECTED FROM MF0004-400 (OPPL) B PLUS.

CONFORMAL COATING PER SUNDSTRAND SPEC CP 17.32-01. CLEANLINESS PER MA0110-301. CONTROLLER VIBRATION DAMPED AT MOUNTING.

THE OPPL CALLS FOR GLASSIVATION FOR INTEGRATED CIRCUIT DIE, SINGLE SEAL FOR TANTALUM WET SLUG CAPACITORS, ETC. DERATING OF EEE PARTS IS EXPANDED BEYOND THE SIMPLISTIC (75% x RATED) REQUIREMENTS OF THE CONTRACT.

■ (B) TEST:
CONTROLLER IS FUNCTIONALLY TESTED DURING ATP. CONTROLLER IS SUBJECTED TO AVT. CONTROLLER IS THERMAL TESTED DURING ATP - RANGE 70 DEG F, 130 DEG F, 30 DEG F.

CONTROLLER IS QUALIFIED FOR QAVT, EMI, THERMAL VACUUM (-65 DEG F TO 165 DEG F, 80 K FT FOR 10 CYCLES), HUMIDITY AND FLIGHT VIBRATION.

ALL EEE PARTS ARE SUBJECTED TO SCREENING AND BOX LEVEL BURN-IN TESTS TO DETECT MARGINAL PARTS AND TO CAUSE INFANT MORTALITY FAILURES.

OMRSD: GEARBOX PRESSURIZATION CIRCUIT IS VERIFIED EVERY FIFTH FLIGHT DURING GROUND TURNAROUND USING CONTROLLER CHECKOUT UNIT.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 04-2-CONTL6-IM-01

SOSC/04 ATTACH PAGE 55

■ (C) INSPECTION:
RECEIVING INSPECTION:
VISUAL AND DIMENSIONAL INSPECTIONS ARE PERFORMED ON ALL INCOMING PARTS. MATERIAL AND PROCESSES CERTIFICATIONS ARE VERIFIED.

CONTAMINATION CONTROL:
CLEANLINESS IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION:
MANUFACTURING, ASSEMBLY, AND INSTALLATION REQUIREMENTS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES:
SOLDERING TO NHB 5300.4(3A) IS VERIFIED BY INSPECTION.

TESTING:
TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. ATP IS WITNESSED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING:
HANDLING, PACKAGING, STORAGE, AND SHIPPING PROCEDURES ARE VERIFIED BY INSPECTION.

■ (D) FAILURE HISTORY:
NONE.

■ (E) OPERATIONAL USE:
ATTEMPT TO START/RUN WITH LOW GEARBOX PRESSURE TO MAINTAIN TWO APU'S.

- APPROVALS -

RELIABILITY ENGINEERING	D. R. ATAPATTU	1/23/92
DESIGN ENGINEERING	D. J. ZWICK	
QUALITY ENGINEERING	W. R. HIGGINS	10/4/91
NASA RELIABILITY		11/27/91
NASA SUBSYSTEM MANAGER		1-24-92
NASA QUALITY ASSURANCE		12/3/91