FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: MO-AA4-405-X

SUBSYSTEM NAME: STABILIZED PAYLOAD DEPLOYMENT SYSTEM
REVISION : 2 07/31/90

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ SRU :	DAMPER - PEDESTAL ASSEMBLY	V790-544080

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

■ QUANTITY OF LIKE ITEMS: 2
ONE PER PEDESTAL ASSEMBLY

■ FUNCTION:
THE PURPOSE OF THE DAMPER IS TO REDUCE OSCILLATIONS THAT MAY BE INTRODUCED INTO THE PAYLOAD BY SHUTTLE POINTING MANEUVERS AND OTHER ACTIONS. THE DAMPER ASSEMBLY APPLIES A 220 +30/-20 INCH-POUND PRELOAD OF "RUNNING TORQUE" TO THE DISCONNECT ASSEMBLY DRIVE SHAFT IN BOTH PEDESTALS. IN THE PREFERRED USE CONFIGURATION, THIS PRELOAD IS MOST EFFECTIVE WITH THE SECONDARY PEDESTAL. THE DAMPER IN THE PRIMARY PEDESTAL IS LESS EFFECTIVE BECAUSE THE DISCONNECT ASSEMBLY DRIVE SHAFT IS COUPLED TO THE ACTUATOR GEAR TRAIN. WHEN THE ACTUATOR HAS COMPLETED ITS DEPLOYMENT CYCLE, ITS DRIVE MOTORS ARE DEACTIVATED AND THE MOTOR BRAKES ARE APPLIED. THESE BRAKES TEND TO HOLD THE MOTOR DRIVE SHAFT AND THE ACTUATOR GEAR TRAIN IN A STATIONARY POSITION.

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SUBSYSTEM: STABILIZED PAYLOAD DEPLOYMENT SYSTEM REVISION# 2 07/31/90 R

ITEM NAME: DAMPER - PEDESTAL ASSEMBLY CRITICALITY OF THIS FAILURE MODE:2/2

■ FAILURE MODE:
ERRATIC OPERATION

MISSION PHASE:
OO ON-ORBIT

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

■ CAUSE:
PIECE-PART STRUCTURAL FAILURE, CONTAMINATION.

■ CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:
■ A)
NO METHOD OF MEASURE AT INSTALLATION

■ B)
NO PANEL INDICATION

■ C)
SEPARATE DAMPER INSTALLATIONS, ONE ON EACH PEDESTAL.

- FAILURE EFFECTS -

■ (A) SUBSYSTEM:
THE FAILURE WOULD APPEAR AS AN ERRATIC, UNSTABLE DEPLOYMENT OF THE PAYLOAD. THE PAYLOAD ROTATION RATE COULD BE REDUCED BY INTENTIONALLY DISABLING THE SYSTEM TO DRIVE ON A SINGLE MOTOR; THIS WOULD REDUCE PAYLOAD OSCILLATION DURING DEPLOYMENT.

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- (B) INTERFACING SUBSYSTEM(S):
  THE FAILURE WOULD APPEAR AS AN ERRATIC, UNSTABLE DEPLOYMENT OF THE PAYLOAD. THE PAYLOAD ROTATION RATE COULD BE REDUCED BY INTENTIONALLY DISABLING THE SYSTEM TO DRIVE ON A SINGLE MOTOR.

- (C) MISSION:
  SECOND FAILURE RESULTS IN POSSIBLE MISSION ABORT.

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

- (E) FUNCTIONAL CRITICALITY EFFECTS:
  LOSS OF FUNCTION COULD RESULT IN THE ABOVE EFFECTS.

- DISPOSITION RATIONALE -

- (A) DESIGN:
  THE DAMPER IS MADE OF HIGH STRENGTH CORROSION RESISTANT MATERIAL FOR SPACE ENVIRONMENT USE.

- (B) TEST:
  QUALIFICATION TESTS PER DTP4779-801 WERE SUCCESSFULLY COMPLETED JANUARY 5, 1990 AND WILL BE DOCUMENTED IN TEST REPORT STS90D0115. TESTS IN ACCORDANCE WITH TEST REQUEST NUMBER S 144026 FOR 34 CYCLES IN BOTH DIRECTIONS, WERE SUCCESSFULLY COMPLETED. DETAIL EXAMINATION OF THESE DATA ARE IN PROCESS FOR VALUES NOT INITIALLY REQUESTED.

  OMRSD: GROUND TURNAROUND
  FREQUENCY OF CHECKOUT IS MISSION DEPENDENT. PEDESTAL DEPLOY/REBERTH VERIFICATION S0790A.010-A, -B, -C, -D, -E, -F, -G, -H, -I, -J.

- (C) INSPECTION:
  ALL DIMENSIONAL CHARACTERISTICS ARE VERIFIED BY INSPECTION. PROCESSES ARE VERIFIED BY INSPECTION EITHER AT ROCKWELL OR AT SUPPLIER FACILITIES. THE CLEANLINESS AND MATERIAL CERTIFICATION ARE VERIFIED BY INSPECTION.

- (D) FAILURE HISTORY:
  ** AD5693.- V790-544002-002 S/N P18771. DURING ATP A CLICKING NOISE WAS HEARD WHILE OPERATING THE FIRST MOTOR OPERATION OF THE "DEPLOY" RUN. SUSPECT THE DAMPER (V790-544080) STEEL DISKS DO NOT MEET THE 16-FINISH REQUIREMENT; TRANSFER TO QUALITY. CLOSED IM 890612.

  ** AD6133.- V790-544002-002 P18773. DURING POST AVT OPERATION A 'THUMPING' NOISE COULD BE HEARD. TORQUE OF THE DAMPER (V790-544080) WAS MEASURED AT 600 INLB SB 220 +30, -20 INLB. DISASSEMBLY AND INSPECTION

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REVEALED BERYLLIUM COPPER DEPOSITS ON THE DISKS. NOISE IS SUSPECTED AS BEING THE RESULT OF 'STICKING-RELEASE' ACTION CAUSED BY THESE DEPOSITS. DAMPER WAS CLEANED AND REASSEMBLED WITH A DIFFERENT HOUSING (V790-544087). PLATES HAVING NEW FINISH CONDITION (EO V790-544091 A 04), AND WITH CORRECT TORQUE SETTINGS. PEDESTAL ASSEMBLY OPERATED CORRECTLY AND WITH NO NOISE. SINGLE FLIGHT RESTRICTION APPLIES. CLOSED IM 891005.

** AD6160.- V790-544002-002 S/N P18773. SIMILAR TO AD6133, CLICKING NOISE HEARD DURING MOTOR OPERATION. TORQUE OF THE DAMPER (V790-544080) WAS MEASURED AT 600 INLB SB 220 +30, -20 INLB. DISASSEMBLY AND INSPECTION REVEALED BERYLLIUM COPPER DEPOSITS ON THE DISKS. NOISE IS SUSPECTED AS BEING THE RESULT OF 'STICKING-RELEASE' ACTION CAUSED BY THESE DEPOSITS. DAMPER WAS CLEANED AND REASSEMBLED WITH A DIFFERENCT HOUSING (V790-54487), PLATES HAVING NEW FINISH CONDITION (EO V790-544091 A 04), AND WITH CORRECT TORQUE SETTINGS. PEDESTAL ASSEMBLY OPERTED CORRECTLY AND WITH NO NOISE. SINGLE FLIGHT RESTRICTION APPLIES. CLOSED IM 891005.

** AD6174.- V790-544002-002 S/N P18773. EXCESSIVE TORQUE; DAMPER (V790-544080) TORQUE MEASURED AT 265 INLB S/B 220 +30,-20 INLB. DISSASSEMBLY AND INSPECTION REVEALED BERYLLIUM COPPER DEPOSITS ON THE DISKS. DAMPER WAS CLEANED AND REASSEMBLED WITH A DIFFERENT HOUSING (V790-544087), PLATES HAVING NEW FINISH CONDITION (EO V790-544091 A 04), AND WITH CORRECT TORQUE SETTINGS. PEDESTAL OPERATED CORRECTLY AND WITH NO NOISE. SINGLE FLIGHT RESTRICTION APPLIES. CLOSED IM 891005.

** AD6181.- V790-544002-001 S/N P18729. EXCESSIVE TORQUE; DAMPER (V790-544080) TORQUE MEASURED AT 370 INLB S/B 220 +30, -20 INLB. DISSASSEMBLY AND INSPECTION REVEALED BERYLLIUM COPPER DEPOSITS ON THE DISKS. DAMPER WAS CLEANED AND REASSEMBLED WITH A DIFFERENT HOUSING (V790-544087), PLATES HAVING NEW FINISH CONDITION (EO V790-544091 A 04), AND WITH CORRECT TORQUE SETTINGS. PEDESTAL OPERATED CORRECTLY. SINGLE FLIGHT RESTRICTION APPLIES. CLOSED IM 891005.

** AD6224.- V790-544002-002 S/N P18771. EXCESSIVE TORQUE; TESTING WAS STOPPED WHEN DAMPER TORQUE REACHED 315 INLB S/B 220 +30, -20 INLB. THE MALFUNCTIONING DAMPER ASSEMBLY (V790-544080) IS PART OF DEVELOPMENT OPERATIONAL TEST HARDWARE NOT SCHEDULED FOR FLIGHT USE. THE DAMPER WAS REMOVED, DISASSEMBLED, AND INSPECTED. COPPER HAD MIGRATED FROM THE V790-544091 PLATES AND BUILT-UP ON THE V790-544092 DISCS DEVELOPING INTO AN EXCESSIVE FRICTION CONDITION. THE PLATES AND DISCS WERE CLEANED AND REFINISHED; THE V790-544092-004 DISCS WERE REPLACED. THE DAMPER WAS REASSEMBLED, REINSTALLED, AND TESTED SUCCESSFULLY PER ML0108-0019. CLOSED IM 891005.

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■ (E) OPERATIONAL USE:
NONE.

- APPROVALS -

RELIABILITY ENGINEERING	W. R. MARLOWE	8/6/90
DESIGN ENGINEERING	G. CAMPBELL	
QUALITY ENGINEERING	M. F. MERGEN	9/3/90
NASA RELIABILITY	G-E	9/12/90
NASA SUBSYSTEM MANAGER		9/25/90
NASA QUALITY ASSURANCE		9/4/90