

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE  
NUMBER: 02-2A-021109 -X**

**SUBSYSTEM NAME: FLIGHT CONTROL - RUDDER SPEED BRAKE  
REVISION: 0 02/02/88**

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**PART DATA**

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	<b>PART NAME VENDOR NAME</b>	<b>PART NUMBER VENDOR NUMBER</b>
ASSY	BODY FLAP ACTUATION	MC621-0056-0083
SRU	: HYDRAULIC MOTOR	

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
HYDRAULIC MOTOR**

**REFERENCE DESIGNATORS:**

**QUANTITY OF LIKE ITEMS: 3  
THREE**

**FUNCTION:  
THREE HYDRAULIC MOTORS PROVIDE RPM/TORQUE INPUTS INTO THE BODY FLAP  
SUMMER DIFFERENTIALS.**

## FAILURE MODES EFFECTS ANALYSIS FMEA - CIL FAILURE MODE

NUMBER: 02-2A-021109-02

REVISION#: 1 08/07/98

SUBSYSTEM NAME: FLIGHT CONTROL - RUDDER SPEED BRAKE

LRU:

CRITICALITY OF THIS

ITEM NAME: HYDRAULIC MOTOR

FAILURE MODE: 1/1

## FAILURE MODE:

NO RPM/TORQUE OUTPUT, OPEN DRIVELINE

MISSION PHASE: DO DE-ORBIT

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

## CAUSE:

SHEARED SHAFT/SPLINE, DAMAGED OR WORN CYLINDER BARREL/VALVE PLATE,  
CONTAMINATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN	A) N/A
	B) N/A
	C) N/A

## PASS/FAIL RATIONALE:

A)

B)

C)

## - FAILURE EFFECTS -

## (A) SUBSYSTEM:

REMAINING TWO HYDRAULIC MOTOR RPM/TORQUE OUTPUTS BACKDRIVE FAILED  
HYDRAULIC MOTOR, RESULTING IN LOSS OF BODY FLAP FUNCTION.

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**(B) INTERFACING SUBSYSTEM(S):**  
NONE.

**(C) MISSION:**  
LOSS OF MISSION, CREW/VEHICLE.

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
SAME AS (C)

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**

SHEAR SECTION ON HYDRAULIC MOTORS SIZED 3X OPERATING. SEQUENTIAL HYDRAULIC DEPRESSURATION 1,2-1,3-2,3 CHECKS ALL COMBINATIONS AND DETECTS FAILURE. VALVE PLATE AND CYLINDER BARREL SURFACES ARE SURFACE TREATED AND MICRO FINISHED TO NEAR OPTICAL FLATNESS TO MINIMIZE WEAR. CYLINDER BARREL SUPPORT BEARINGS DESIGNED TO STABILIZE BARREL IN OPERATION. DESIGNED TO MEET MIL-H-5440. HYDRAULIC MOTOR DESIGNED FOR 250 HRS VERSUS SHUTTLE USE OF 16 HOURS. 5 MICRON HYDRAULIC SYSTEM FILTRATION.

**(B) TEST:**

QUALIFICATION TESTS: QUALIFICATION TESTED OVER 250 HRS - BURST TEST 7,500 PSI. PERFORMANCE, OPERATING LIFE. ULTIMATE LOAD AND IMPULSE CYCLING. POWER DRIVE UNIT (PDU) QUALIFICATION TEST - THERMAL CYCLE -40 DEG F TO +275 DEG F.

ACCEPTANCE TESTS: SHAFT AND SPLINES STRENGTH VERIFIED 1.5 X OPERATING PRESSURE DURING MOTOR ACCEPTANCE TEST PROCEDURE (ATP). PROOF PRESSURE. PROOF LOW PRESSURE. QUIESCENT LEAKAGE, FAILURE MODE TEST AND FUNCTIONAL TEST.

**GROUND TURNAROUND TEST**

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(C) INSPECTION:**

RECEIVING INSPECTION

MATERIAL AND PROCESSES CERTIFICATIONS VERIFIED. CERTIFICATION OF HEAT TREAT HARDNESS IS VERIFIED BY INSPECTION.

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**CONTAMINATION CONTROL**

CONTAMINATION CONTROL PROCEDURE AND PRACTICES VERIFIED. CLEANLINESS OF WETTED SURFACES TO LEVEL 190 VERIFIED BY INSPECTION

**ASSEMBLY/INSTALLATION**

TORQUE VALUES VERIFIED AND RECORDED. ASSEMBLY AND INSTALLATION OPERATIONS VERIFIED BY SHOP TRAVELER MIPS. SHAFT AND SPLINE MATERIAL IS INSPECTED TO DRAWING. MICROFINISH OF VALVE PLATE AND CYCLINDER BARREL SURFACES IS VERIFIED BY INSPECTION. SURFACE TEMPER INSPECTION (NITAL ETCH TO VERIFY MICROSTRUCTURE) IS VERIFIED BY INSPECTION.

**NONDESTRUCTIVE EVALUATION**

MAGNETIC PARTICLE INSPECTION AND ULTRASONIC INSPECTION ARE VERIFIED

**CRITICAL PROCESSES**

HEAT TREAT, ELECTROLESS NICKEL PLATING, DRY FILM LUBRICANT, SHOT PEEN AND GRIT BLASTING ARE VERIFIED.

**TESTING**

CERTIFICATIONS OF ACCEPTANCE TESTS AND EXAMINATION OF PRODUCT VERIFIED

**HANDLING/PACKAGING**

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION

**(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 DATA BASE

**(E) OPERATIONAL USE:**

NONE.

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**- APPROVALS -**

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EDITORIALLY APPROVED  
TECHNICAL APPROVAL

. BNA  
. VIA APPROVAL FORM

J. Kimura 8-18-98  
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