

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-1E-002 -X

SUBSYSTEM NAME: LANDING DECELERATION - WHEEL, BRAKE & TIRE
REVISION: 1 02/24/95

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
	: CHASSIS ASSEMBLY MLG	MC194-0007
LRU	: MLG TIRES	
	MICHELIN AIRCRAFT TIRE	006-866

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
MAIN LANDING GEAR TIRES

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 4
TWO RIGHT
TWO LEFT

FUNCTION:
PROVIDE SUPPORT AND ROLLING CAPABILITY.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-1E-002-01

REVISION#: 2 01/05/99

SUBSYSTEM NAME: LANDING DECELERATION - WHEEL, BRAKE & TIRE

LRU: MLG TIRES

CRITICALITY OF THIS

ITEM NAME: MLG TIRES

FAILURE MODE: 1/1

FAILURE MODE:

RUPTURE - TIRE RUPTURES AT MLG TOUCHDOWN BEFORE NOSEGEAR TOUCHDOWN.

MISSION PHASE: DO DE-ORBIT

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

CAUSE:

EXCESSIVE LOADING, CUTS, POOR FABRICATION.

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:

LOSS OF ROLLING AND LOAD CARRYING CAPABILITY ON AFFECTED TIRE/WHEEL ASSEMBLY.

LOSS OF ADJACENT TIRE/WHEEL ASSEMBLY AND LOSS OF ALL BRAKING CAPABILITY ON AFFECTED STRUT. PROBABLE FAILURE OF AFFECTED MLG STRUT OR ITS ATTACHMENTS.

(B) INTERFACING SUBSYSTEM(S):

SAME AS A.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: 02-1E-002-01

(C) MISSION:

PROBABLE LOSS OF MISSION/CREW/VEHICLE DUE TO THE EXCESSIVE YAWING FORCES PRODUCED AND/OR LOSS OF 50 PERCENT OF BRAKING CAPABILITY CAUSING VEHICLE TO DEPART RUNWAY.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:

TIRE DESIGNED AND MANUFACTURED TO MEET MIL-T-5041F AND MIL-A-8862. MAXIMUM PRESSURE 370 (30 PSI OVERPRESSURE TO ALLOW FOR COLD TEMPERATURE LANDING AND PRESSURE LOSS DURING PAD STAY TIME), MINIMUM BURST PRESSURE 1020. THE TIRE COMPLIES WITH REQUIREMENTS OF MIL-T-5041 FOR EXTRA PRESSURE TUBELESS TIRES, WITH A MINIMUM STATIC RATED LOAD OF 65,700 POUNDS AND HAVE A VELOCITY RATING OF 225 KNOTS.

(B) TEST:

PERFORMED DELTA CERTIFICATION QUALIFICATION TESTS FOR -45° F TESTS CONSISTED OF:
2 WHEEL/TIRES CYCLE STATIC 14 DAY COLD SOAK -45°(+/-) F AT KSC
4 CYCLES DYNAMIC LANDING LOAD
TIRE INFLATION 363 PSI (70° F)
CHILL TIRE TO -45°(+/-) F MINIMUM OF 8 HOURS BEFORE START OF TEST
SUBJECT TIRE TO SIMULATED LANDING PROFILE W233MAN BASED ON:
233,000 LB. ORBITER WEIGHT,
1082.0 C.G.,
225 KNOTS AIRSPEED,
5.2 F/SEC SINK RATE,
195 KNOT DEROTATION INITIATION VELOCITY, AND
-1.0 DEG/SEC DEROTATION COMMAND INPUT OVER 1 SECOND.
THIS CYCLE FEATURED A PEAK RADIAL LOAD OF 113,000 LB AND LATERAL LOADING, DUE TO YAWED DYNAMIC ROLLING, OF UP TO 15,450 LB. FULL TREAD LOSS OCCURRED ON FIRST OF 4 LOAD CYCLES AND WAS SIMILAR TO THAT OBSERVED ON ORIGINAL ORBITER MAIN LANDING GEAR QTR, 84012-2-TL, THEREFORE WAS NOT CONSIDERED A TIRE FAILURE.

QUALIFICATION TESTS: BEAD INSULATION STOCK AND FABRIC ADHESION TESTING WAS CONDUCTED TO MEET THE REQUIREMENTS OF MIL-T-5041F. CERTIFIED TO A BURST

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: 02-1E-002- 01

PRESSURE OF 1020 PSI. THE TIRES MET A DYNAMIC TEST SPECTRUM OF 4 TO 6 SIMULATED MISSION CYCLES INCLUDING CROSSWIND AND TAXI TESTS. -

A DYNAMIC TEST TO SATISFY A MAX RADIAL LOAD OF 142.5 KIPS WAS PERFORMED: TEST CONDITIONS INCLUDED 20 KNOTS CROSSWIND, 225 KNOTS TOUCHDOWN VELOCITY, USING A 55/45 TIRE LOAD DISTRIBUTION (258.8 KLB STRUT LOAD).

DEFLECTION TEST WITH THE TIRE PRESSURE AT 340 PSIG, A RADIAL LOAD OF 65,500 LBS WAS APPLIED AND HELD FOR ONE MINUTE. TIRE DEFLECTION WAS 32% (28% TO 35% IS ALLOWED).

ACCEPTANCE/TURNAROUND (FOR ALL WHEEL/TIRE ASSEMBLIES) CONSISTS OF:

- (1) REINFLATE AND PERFORM 5 DAY COLD TEMP FOLLOWED BY 7 DAY AMBIENT TEMP LEAK TESTS.
- (2) STORAGE AT ROOM TEMP FOR 2 WEEKS.
- (3) INFLATION PRESSURE VERIFICATION.

OMRSD: FLIGHT TIRE DECAY RATE; THIS TEST DETERMINES THE DECAY RATE FOR EACH FLIGHT TIRE/WHEEL ASSEMBLY PER THE REQUIREMENTS OF THE ML0308-0142 SPECIFICATION.

FLIGHT TIRE PRESSURE CHECKS:
THIS CHECK VERIFIES THE TIRE PRESSURE FOR EACH FLIGHT TIRE/WHEEL ASSEMBLY, PER THE REQUIREMENTS OF THE ML0308-0143 SPECIFICATION, IF MORE THAN 30 DAYS HAVE ELAPSED SINCE THE LAST FLIGHT TIRE PRESSURE

TIRE PRESSURES FOR FLIGHT:
TIRE PRESSURES ARE VERIFIED FIVE DAYS BEFORE FINAL RETRACTION FOR FLIGHT. MLG TIRES FLIGHT PRESSURE REQUIREMENT IS 368 PSIG TO 370 PSIG.

MLG WHEEL/TIRE CERT:
VERIFIES MLG WHEEL/TIRE ASSEMBLY HAS BEEN BUILT UP AND TESTED PER THE VO70-510002 DRAWING, ML0308-0028 LANDING GEAR RIGGING SPECIFICATION AND ML0308-0142 MLG WHEEL/TIRE INSTALLATION AND INSPECTION SPECIFICATION.

FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIALS ARE VERIFIED ACCEPTABLE BY IN-HOUSE LABORATORY AT RECEIVING INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
BASIC COMPONENTS AND ASSEMBLIES ARE INSPECTED AND VERIFIED THROUGHOUT ASSEMBLY. GREEN TIRE VERIFIED CORRECT BY WEIGHT. CURED TIRE 100% VISUALLY INSPECTED.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: 02-1E-002-01

CRITICAL PROCESSES

CURING VERIFIED BY INSPECTION. CURING MOLD GAUGES AND INDICATORS ARE PERIODICALLY VERIFIED CORRECT.

TESTING

ATP IS VERIFIED BY INSPECTION.

PACKAGING/HANDLING

HANDLING, PACKAGING AND STORAGE REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

NONE.

(E) OPERATIONAL USE:

TIRE/WHEEL FAILURE BEFORE NLG TOUCHDOWN CREW WILL ATTEMPT TO USE AERO RUDDER AND BRAKING ON THE OPPOSITE SIDE IN AN ATTEMPT TO MAINTAIN DIRECTIONAL CONTROL.

TIRE/WHEEL FAILURE AFTER NLG TOUCHDOWN CREW WILL USE NWS, AERO RUDDER AND DIFFERENTIAL BRAKING TO MAINTAIN DIRECTIONAL CONTROL.

- APPROVALS -

SS & PAE MGR
SS & PAE ENGR
BNA SSM
NASA MOD
USA SAM
USA PROJ. MGR.

: D.F. MIKULA
: K. E. RYAN
: M.T. PORTER
for : J.P. JASON
: C. B. CLOKEY

: *D.F. Mikula* 10 JUN 99
: *K.E. Ryan*
: *M.T. Porter*
: *C.B. Clokey*
: *J.P. Jason*
Signature