

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE
NUMBER: 02-1E-071 -X

SUBSYSTEM NAME: LANDING DECELERATION - WHEEL, BRAKE & TIRE
REVISION: 2 08/10/91

PART DATA

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU : NLG WHEEL ASSEMBLY	MC621-0050

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
NOSE LANDING GEAR WHEEL

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:
CIRCULAR FRAME, SPLIT WHEEL TYPE, ON WHICH THE AIRCRAFT TIRE IS MOUNTED.

FAILURE MODES EFFECTS ANALYSIS FMEA - CIL FAILURE MODE

NUMBER: 02-1E-071-01

REVISION#: 1 08/03/97

SUBSYSTEM NAME: LANDING DECELERATION - WHEEL, BRAKE & TIRE

LRU: NLG WHEEL ASSEMBLY

CRITICALITY OF THIS

ITEM NAME: NLG WHEEL ASSEMBLY

FAILURE MODE: 1/1

FAILURE MODE:

STRUCTURAL FAILURE.

MISSION PHASE: LS LANDING/SAFING

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

CAUSE:

BEARING FAILURE, EXCESSIVE LOAD, DEFECTIVE PART/MATERIAL.

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 THE AFFECTED WHEEL/TIRE ASSEMBLY. IF FAILURE OCCURS AT OR SHORTLY AFTER NOSE WHEEL TOUCHDOWN, REMAINING WHEEL/TIRE ASSEMBLY WILL FAIL. PROBABLE FAILURE OF NLG STRUT OR ITS ATTACHMENTS.

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(B) INTERFACING SUBSYSTEM(S):
SAME AS A.

(C) MISSION:
PROBABLE LOSS OF MISSION/CREW/VEHICLE DUE TO NOSE LANDING GEAR COLLAPSE
(IF BOTH WHEEL/TIRE ASSEMBLIES FAIL).

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

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:
WHEEL DESIGNED PER MIL-W-5013 AND INCLUDES FRACTURE CONTROL PER MC999-0096. WHEEL DESIGN INCORPORATES PRESSURE/THERMAL RELIEF DEVICES TO PROTECT AGAINST EXPLOSIVE WHEEL FAILURE. DESIGNED TO WITHSTAND A SAWTOOTH SHOCK PULSE OF 40G PEAK AMPLITUDE FOR A PULSE DURATION OF 10 TO 12 MILLISECONDS WITHOUT DAMAGE. THE WHEEL IS ALSO DESIGNED TO PERFORM AFTER EXPOSURE TO A 20G VERTICAL AND LONGITUDINAL ACCELERATION. DESIGN MAXIMUM LANDING RADIAL LOAD, FOR A 65K PAYLOAD VEHICLE, IS 58,800 POUNDS. DESIGN MINIMUM SAFETY FACTOR IS 1.4.

(B) TEST:
QUALIFICATION TESTS: WHEEL ASSEMBLY WAS SUBJECTED TO VIBRATION, ACCELERATION, SHOCK, RADIAL LOAD TESTS, ULTIMATE STRUCTURAL TORQUE TEST AND BURST PRESSURE TEST.
THE WHEEL WAS ALSO SUBJECTED TO 1000 MILE ROLL TEST, YIELD COMBINED LOAD TESTS, STATIC LOAD TESTS AND PERFORMANCE TESTS.

YIELD COMBINED LOAD TEST: THE WHEEL WAS SUBJECTED TO TWO COMBINATIONS OF VERTICAL AND SIDE LOADS AS FOLLOWS:
ACTING INBD - 21,300 LBS VERTICAL LOAD AND 10,850 LBS SIDE LOAD.
ACTING OUTBD - 17,700 LBS VERTICAL LOAD AND 8,840 LBS SIDE LOAD.
THESE LOADS WERE APPLIED THROUGH THE TIRE CONSECUTIVELY AT THE ZERO DEGREE, 90 DEGREE, 180 DEGREE AND 270 DEGREE POSITIONS, WITH TWO MORE APPLICATIONS AT THE ZERO DEGREE POSITION. THERE WAS NO DAMAGE TO THE WHEEL.

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ULTIMATE COMBINED LOAD TEST:
THE WHEEL WAS ALSO SUBJECTED TO TWO COMBINATIONS OF ULTIMATE VERTICAL AND SIDE LOADS AS FOLLOWS;
ACTING INBD - 27,750 LBS VERTICAL LOAD AND 13,900 LBS SIDE LOAD.
ACTING OUTBD - 23,100 LBS VERTICAL LOAD AND 11,550 LBS SIDE LOAD.

ULTIMATE RADIAL LOAD TEST:
THE WHEEL/TIRE ASSEMBLY SUPPORTED A LOAD OF 88,200 LBS APPLIED AT THE ZERO DEGREE POSITION, FOR 10 SECONDS, WITHOUT DAMAGE TO THE WHEEL OR TIE BOLTS.

ACCEPTANCE TESTS INCLUDE WHEEL BALANCE AND RADIAL/LATERAL RUNOUT CHECKS. ACCEPTANCE TESTS ALSO INCLUDE DIMENSIONAL CHECKS, FINISH, CLEANLINESS AND THAT CERTIFIED MATERIALS AND PROCESSES HAVE BEEN USED.

GROUND TURNAROUND TEST
ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD. THE OMRSD DATA PROVIDED BELOW IS NO LONGER BEING KEPT UP-TO-DATE. IF THERE IS ANY DISCREPANCY BETWEEN THE GROUND TESTING DATA PROVIDED BELOW AND THE OMRSD, THE OMRSD IS THE MORE ACCURATE SOURCE OF THE DATA.

NLG WHEEL AND TIRE INSPECTION:
WHEELS ARE INSPECTED PER THE NLG WHEEL/TIRE ASSEMBLY AND INSPECTION SPECIFICATION ML0308-0143 WHICH STATES: "... VISUALLY INSPECT ALL COMPONENTS OF THE MAIN WHEEL ASSEMBLY FOR CRACKS, NICKS, CORROSION AND OTHER DAMAGE." THE WHEEL FLANGE SURFACES THAT CONTACT THE TIRE BEAD SEAT IS ALSO INSPECTED FOR CORROSION, NICKS, SCRATCHES AND OTHER DAMAGE. REPAIRS ARE PERFORMED PER THE MANUFACTURER'S RECOMMENDATIONS.

NLG WHEEL/TIRE CERT:
VERIFIES NLG WHEEL/TIRE ASSEMBLY HAS BEEN BUILT UP AND TESTED PER THE VO70-510502 DRAWING, ML0308-0028 NOSE LANDING GEAR RIGGING SPECIFICATION AND ML0308-0143 NLG WHEEL/TIRE INSTALLATION AND INSPECTION SPECIFICATION.

FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.

(C) INSPECTION:
RECEIVING INSPECTION
RECORDS AND TEST REPORTS ARE MAINTAINED CERTIFYING MATERIAL AND PHYSICAL PROPERTIES (RAW MATERIAL, FORGING).

CONTAMINATION CONTROL
CLEANLINESS AND CORROSION CONTROL REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MACHINED WHEEL INSPECTED VISUALLY AND DIMENSIONALLY DURING FABRICATION, PRIOR TO SHOT PEENING. FINAL INSPECTION IS VISUAL AND DIMENSIONAL. INSTALLATION OF O-RINGS, PLUGS AND VALVES ARE VERIFIED BY INSPECTION. BUSHINGS, SURFACE FINISHES AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION.

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CRITICAL PROCESSES

FORGING, HEAT TREATING AND SHOT PEENING ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

FORGINGS ARE ULTRASONICALLY INSPECTED.

TESTING

ONE FORGING PER LOT IS DESTRUCTIVELY TESTED AND ANALYZED CHEMICALLY AND FOR GRAIN FLOW. TEST BARS ARE TENSILE TESTED.

PACKAGING/HANDLING

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

NONE.

(E) OPERATIONAL USE:

WHEEL/TIRE FAILURE AT (OR SHORTLY AFTER) NLG TOUCHDOWN - CREW WILL USE AERO RUDDER AND DIFFERENTIAL BRAKING IN AN ATTEMPT TO MAINTAIN DIRECTIONAL CONTROL.

- APPROVALS -

EDITORIALLY APPROVED	: BNA	: <u>J. Kamusa 8/3/97</u>
EDITORIALLY APPROVED	: JSC	: <u>A. Stoney 9-12-98</u>
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: 96-CIL-071_02-1E