SHUTTLE CRITICAL ITEMS LIST - MSBLS GROUND STATION

SUBSYSTEM: GROUND STATION - MSBLS
ASSEMBLY : B/U Shelter
P/N : 517070
:
QUANTITY : 1
:

FMEA NO.: 05-2SW-00009 Rev: 9 April 90
ABORT: CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE	102	103	104	105
EFFECTIVITY:	X	X	X	X

PHASE(S) PL LO OO DO X LS
REDUNDANCY SCREEN: A-pass B-fail C-pass

PREPARED BY:
DES:
REL:
QE:

APPROVED BY:
DES:
REL:
QE:

APPROVED BY (NASA):
DES:
REL:
QE:

ITEM: B/U Shelter

FUNCTION: Provides Azimuth guidance RF beam into dummy load at Shelter.

FAILURE MODE: Erroneous AZ guidance RF is generated at Shelter.

CAUSE(S): A Shelter LRU (AZ subsystem) fails due to piece part electrical failure. The LRU's which can cause this failure mode (05-2SW-00009) are listed below, with LRU Designator No., LRU P/N, and LRU Name:

LRU No.:	LRU P/N:	LRU Name:
140	501808	Transmitter, Azimuth/DME
160	501825	Power Supply
322	517076	Panel, Entrance, Signal
324	517079	Cables, Interconn, Interior (inside Shelter)
325	517081	Harness, Rack
430	517082	Control Monitor
519	513479	Digital Unit, Azimuth
521	511219	Antenna, Azimuth
550	502332	Field Monitor Circuits, Azimuth/DME
630	501771	Scanner, Azimuth
640	502541	Assy, Waveguide (Az)
707	513888	Radome, Azimuth
710	517080	Cables, Interconn, External (to/from Shelter)
863	513455	Panel, Entrance, Power
864	513456	Assy, Filter Box
920	518007	Assy, RF (Switching)

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EFFECT(S): (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A/B) Some (or all) B/U Shelter RF generation is erroneous, but RF guidance output from the PRI Shelter continues. However, redundancy has been lost, and the next failure (if in PRI Shelter) will cause loss of good RF guidance.

(C) Not applicable.

(D) No effect on AZ RF guidance signals at the Orbiter. Possible loss of crew/vehicle after second failure (loss of PRI and B/U) due to loss of good AZ RF guidance signals at the Orbiter.

DISPOSITION AND RATIONALE:
(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

(A) - DESIGN
The MSBLS design was structured from existing/proven ground-based landing systems and upgraded to meet MIL-E-4158, MIL-STD-454 and all subsidiary specifications in effect at the time of manufacture. Military and standard NASA approved parts, materials and processes were used.

The design evolved from a timely and in-depth internal design review process culminating in an optimum reliability/maintainability/performance end-item product. The design review process included studies such as FMEA, electrical and thermal analysis, sneak circuit analysis, worst case studies, tolerance analysis, etc. which resulted in direct impact of the design.

The design was approved via the formal NASA-CSD PDR, CDR, PCA, FCA and certification process.

(B) - TEST
The MSBLS program consists of an equipment confidence build-up approach starting from 100% screening of components (burn-in and environmental test). Environmental testing of SRU's and 100% temperature/vibration tests at the LRU and equipment rack-level.

In plant ATP for functional performance verification and workmanship will be performed and witnessed by CSD, NASA and DCAS on all LRUs and again at system level.

Site testing and certification will be performed on each system after installation. Annual flight tests are conducted to demonstrate continued system compatibility.

Ground Turnaround Test - Verify operation of the MSBLS Ground Station prior to each Orbiter landing.

This failure mode can be detected by performing Forced PRI and Forced B/U during Ground Turnaround.

(C) - INSPECTION

Receiving Inspection

Receiving inspection verifies all incoming parts and materials, including the performance of visual and dimensional examinations. All electrical, mechanical and raw material records that certify materials and physical properties per drawing/specification requirements are retained by receiving inspection as required by contract.

Assembly/Installation

All detailed inspections are planned out by the methodization department for all new builds, spares and repairs for the MSBLS Programs. Inspection points are designated to permit inspection before the applicable portions of the assembly become inaccessible and prior to the next assembly operation.

Critical Processes

All processes and certifications are monitored and verified by inspection. The critical processes are soldering, conformal coating, torquing and boresiting, application of adhesives/sealants and application of chemical film.

Testing

All parts of the ATP are observed and verified by QA.

Handling/Packaging

All parts and assemblies are protected from damage or contamination from the point of receiving inspection to final shipment, through methods detailed in a documented procedure. This handling procedure is in effect for all newly built hardware as well as for repair units. QA audits conformance to this procedure in accordance with its internal audit schedule, and all areas are considered under continuous audit by QA with respect to material handling. The maintenance of electrostatic discharge prevention methods is verified by QA through periodic audits. All hardware items are packaged and protected according to contract requirements and are verified by inspection. Evidence of inspection of packaging is recorded on the applicable shipping document.

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(D) - Failure History
All field and flight failure were reviewed. The failures identified occurred in circuitry identical to the current hardware configuration; MSBLS-GS and MSBLS-JR are included. There have been 7 failures which resulted in erroneous output. There were 3 transmitter failures, 1 intermittent waveguide switch problem, 1 waveguide which had RF leakage, and 2 out of sync/out of balance antenna problems. Erroneous output failures typically are detected at system power up, and generally do not occur during system operation. Since the MSBLS Ground Station at all Shuttle landing sites are powered up daily beginning 4 or 5 days prior to a mission, and again 4 hours before a landing, an erroneous output failure most likely would be detected and corrected before a Shuttle landing.

(E) - OPERATIONAL USE
For lower ceilings (8,000 to 10,000 feet) or night operations, redundant MSBLS (single fault tolerance) is required for night landing on a concrete runway. MSBLS is also mandatory for daylight landings on the lakebed with reduced ceilings, but is not required to be redundant. Deorbit is not attempted if the ceiling is less than 8,000 feet to ensure good visibility at low altitude. If radar tracking data (available at Edwards, KSC, and Northrop only) and ground communications are available, the MCC can attempt to resolve a MSBLS dilemma. Remote control operators are trained to evaluate system health and recognize probable failure modes from the Remote Control Unit Display. The Remote Control Operators will verify the back-up switching transition has occurred properly or take action to force the system into back-up. The Remote Control Unit Display is monitored to determine a malfunction and advise the chain of command on the status.