SHUTTLE CRITICAL ITEMS LIST - MSBLS GROUND STATION

SUBSYSTEM: GROUND STATION - MSBLS
ASSEMBLY : Azimuth/DME Shelter
P/N : 502174
:
QUANTITY : 1
:

FMEA NO.: 05-2GS-00005 REV: 11 JUL 89
ABORT: CRIT. FUNC: 1
CRIT. HDW: 1

VEHICLE	102	103	104	105
EFFECTIVITY:	X	X	X	X
PHASE(S) PL	LO	OO	DO X	LS

REDUNDANCY SCREEN: A- B- C-

PREPARED BY:	APPROVED BY:	APPROVED BY (NASA):
DES: George Dulmovits	DES:	DES:
REL:	REL:	REL:
QE:	QE:	QE:

ITEM: AZ/DME Shelter

FUNCTION: Provides Azimuth and DME guidance RF beams (either PRI or B/U) to Orbiter.

FAILURE MODE: No AZ and/or DME guidance RF is radiated to Orbiter from Shelter; both PRI and B/U beams are lost.

CAUSE(S): Piece part failure causes loss of both PRI and B/U RF output:

An SPF (Single Point Failure) causes loss of all AC power to the AZ/DME Shelter. (The non-redundant power input cable W23; connecters W23P1, W23P2, or Shelter J8; LRU 303 (502562, Power Entrance Panel); LRU 309 (502875, Filter Box Assy); and certain internal (to the Shelter) control wiring.) Some of these SPF's involve "burndown", wherein a primary failure (of a part) causes secondary failures in adjacent parts due to arcing, etc.

The UPS batteries (in the UPS, LRU 307, P/N 502157 or 510359) will take over in these cases. However, the UPS batteries will power the MSBLS AZ/DME Shelter only for a period of 15 to 40 minutes; the actual time depends on many variables, including temperature and battery state-of-charge. After battery charge is exhausted, the UPS output will transfer back to the AC power line, which is not providing power to either channel in the AZ/DME Shelter.

One (of the two) Air Conditioners (Unit 301, P/N 502156) or the Temperature Controls (Unit 302, P/N 503309) fails such that one of the A/C units no longer provides any cooling. If the Shelter requires maximum cooling load, the Shelter interior temperature will begin to rise. (Air temperature rise about 1.6 degree F per minute; Wavemeter Cavity temperature at a delayed and slower rate. The Wavemeter (Unit 245, P/N 502267) is temperature sensitive. When its cavity temperature has risen by 15 to 30 degrees F, this will cause a frequency alarm.

Said frequency alarm (in a given shelter) will cause the MSBLS to switch over from PRI to B/U channel. However, the Wavemeter for the B/U channel will also be undergoing the same temperature drift, and will also declare a frequency alarm, which will cause shutdown of the B/U channel.

Time to effect is not known at present. It is at least 30 minutes, and may be as much as 3 hours.

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

(A/B) All AZ/DME RF output from the Shelter ceases.

(C) No effect.

(D) Possible loss of Crew/Vehicle due to degradation of the terminal area approach and landing functions.

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-Eaton 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 were performed and witnessed by Eaton, NASA and AFPRO on all LRUs and again at system level.

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

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

(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.

(D) - FAILURE HISTORY

All field and flight failures were reviewed. The failures identified occurred in circuitry identical to the current hardware configuration. There have been four failures in the power entrance panel which have resulted in the loss of power to the shelter. The last such reported failure occurred in July, 1981. Three failures were attributed to shorts to ground and one to a circuit breaker problem. There have been thirteen air conditioner failures which have resulted in loss or potential loss of AZ/DME RF guidance from the Shelter. Historically, these type of failures are detected at system power up, none have occurred during system operation. Since the MSBLS Ground Stations 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, a loss of power failure would be detected and corrected before a Shuttle landing.

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(E) - OPERATIONAL USE

Flight rules permit deorbit when the ceiling is between 10,000 and 8,000 feet if the landing site is equipped with MSBLS and the Orbiter MSBLS is operational. 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 Northrup 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 Unit Display is monitored to determine the nature of the malfunction (hard failure, intermittent, or random) and advise the chain of command on the status and the estimated time to restore operation.