NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		103FM06		
UPPER ARM RESTRAINT AND BLADDER ASSEMBLY, ITEM 103 (1) LEFT (1) RIGHT ---------- 0103-89953-04 (2)	2/1R	Loss of primary axial restraint webbing. Defective Material: Worn thread or webbing.	END ITEM: Loss of primary axial load restraining capability. GFE INTERFACE: Axial load will be transferred to secondary restraint. MISSION: None. CREW/VEHICLE: None with single failure. Loss of crewman with loss of secondary restraint. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: Days. TIME REQUIRED: Days. REDUNDANCY SCREENS: A-PASS B-N/A C-PASS	A. Design - The upper arm assembly axial restraints are fabricated from 1/2 in. wide Spectra 1000 webbing. Size "F" and "FF" polyester thread conforming to V-T-285D type II, Class I is used to fabricate the primary axial restraints with type 301 lock stitching conforming to FED-STD-751A. Seams are terminated by backtack and searing of thread ends. Worn thread is precluded by design as a function of the abrasion protection afforded the axial retraints by the TMG. Worn webbing is precluded by using a swivelling bracket to attach the primry webbing to the scye bearing. This prevents wear by limiting relative movement between webbing and the bracket. Axial restraints pulled to destruction during design verification testing exhibited an ultimate strength of 1397 lbs. At 4.4 psid (normal operating pressure) the S/AD limit lad is 288 lbs., giving the restraint a safety factor of 4.9 for ultimate. At 5.5 psid (max failure pressure) and at 8.8 psid (max BTA operating pressure(, the restraints exhibit ultimate safety factors of 4.8 and 4.7 respectively. The S/AD minimum safety factor for softgoods at 4.4 psid is 2.0 for ultimate. At both 5.5 psid and 8.8 psid, the S/AD minimum ultimate safety factor for softgoods is 1.5. B. Test - Acceptance: The upper arm primary and secondary axial restraints are subjected to S/AD limit load of 288 pounds during fabrication of each upper arm restraint. PDA: The following test is conducted at the shoulder level in accordance with ILC Document 0111-710112: 1. Proof pressure test at 8.0 + 0.2 - 0.0 psig for a minimum of 5 minutes conducted with the TMG removed. Certification: The upper arm axial restraint was successfully tested (manned) during SSA certification to duplicate 458 hours operational usage (Ref. ILC Report 0111-711330). The following usage, reflecting requirements of significance to the upper arm restraints, was documented during certification: Primary Axial Restraint Requirement / S/AD / Actual Add/Abd: 8484 / 18000 Lateral/Medial: 4092 / 10000 Flex Extensions: 7430 / 16000 Don/Doff Cycles: 98 / 400 Pressure Hours: 458 / 916 The upper arm axial restraints were successfully subjected to an ultimate pressure of 13.2 psid during SSA certification testing (Ref. ILC Report 0111-711330). This is 1.5 times maximum BTA operating pressure of 8.8 psid.

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C. Inspection -
Components and material manufactured to ILC requirements at an approved supplier are documented from procurement through shipping by the supplier. ILC incoming receiving inspection verifies that the materials received are as identified in the procurement documents, that no damage has occurred during shipment and that supplier certifications have been received which provides traceability information.

The following MIP's are performed during the arm assembly manufacturing process to assure that the failure causes are precluded from the fabricated item:
The restraints stitching and brackets are visually inspected upon completion of the primary restraint webbing pull test for signs of defective threads and material. During PDA, the following inspection points are performed at the Arm Assembly level in accordance with ILC Document 0111-710112:
1. Visual inspection for damage or material degradation.
2. Visual inspection for damage following proof-pressure test.

D. Failure History -
B-EMU-103-A048 (10/15/99) -
Tracked by J-EMU-103--016.

J-EMU-103--016 (6/4/99) -
Primary axial restraint damaged at arm-bearing end near the primary restraint bracket. Anomaly is consistent with damage incurred by localized heat exposure. Primary restraint webbing is trimmed with a hot knife during manufacture. The tip of the hot knife may have inadvertently contacted the restraint webbing loop during trimming. ECO 992-0387 and 992-0388 incorporates a Teflon shield to protect the loops of the primary and secondary restraint lines. Additionally, Pre-flight visual inspections per FEMU-R-001 exist to identify such anomalies.

B-EMU-103-T005 (8/14/99)
During CL III 40-hr maintenance, the secondary restraint webbing was found frayed at the scye bearing. Technician pinched webbing during assembly. No CA required. Pre-flight inspections provide adequate screening.

E. Ground Turnaround -
None for every component which is within its limited life requirements.

Also, every 4 years or 229 hours of manned pressurized time the arm restraint and bladder assemblies are removed from the arm assembly and subjected to a complete visual inspection (interior and exterior surfaces) for material damage and degradation.

F. Operational Use -
Crew Response -
Pre EVA: No response. Single failure is not likely to be detected. If problem detected tactually or audibly, trouble shoot. If no success, consider 3rd EMU if available. Otherwise, terminate EVA prep.
EVA : No response. Single failure not detectable.
Training -
No training specifically covers this failure mode.
Operational Considerations - Not applicable.

EXTRAVEHICULAR MOBILITY UNIT

SYSTEMS SAFETY REVIEW PANEL REVIEW

FOR THE

I-103 ARM ASSEMBLY

CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: _____
HS - Project Engineering

Approved by: _____
NASA - SSA/SSM

_____
HS - Reliability

_____
NASA - EMU/SSM

_____ 4/24/02
HS - Engineering Manager

_____ 6/26/02
NASA - S&MA

_____ 6/27/02
NASA - MOD

_____ 7/1/02
NASA - Crew

_____ 7-1-02
NASA - Program Manager