



CAL Document Change Notification

DCN No.
7650-DCN-0035

CHANGE TITLE: Change Connector Marking Text Height Requirement

Internal External

ORIGINATOR: Jim Ampe

DATE: 19-Mar-04

NEXT ASSY:

DOC or DWG NUMBER	TITLE	AFFECTED REV.	NEW REV.
LAT-DS-01496-02	Calorimeter Afee 'Y' Cable Fabrication Specification	01	02

CHANGE DESCRIPTION:

Change connector marking text height requirement, paragraph 6.7

REASON FOR CHANGE:

Manufacturer was not able to mark assemblies with original text marking height specified.

DISPOSITION OF HARDWARE:

No hardware affected

Serial numbers affected:

Effective date:

	Use as is	Retest	Rework	Scrap	Other/Comment
Raw material					
Parts in process					
Assemblies					

APPROVALS	DATE	OTHER APPROVALS (specify):	DATE
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	Prepared by(s) N. Virmani J. Ampe	Supersedes None
	Subsystem/Office Calorimeter Subsystem	
Document Title GLAST AFEE “Y” Cable Fabrication Specification		

Gamma-ray Large Area Space Telescope (GLAST)
Large Area Telescope (LAT)
Calorimeter AFEE ‘Y’ Cable Fabrication Specification

DOCUMENT APPROVAL

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1 PURPOSE

This document specifies the GLAST Calorimeter AFEE Board to TEM cable, referred to as the AFEE-“Y” cable.

2 SCOPE

This specification establishes the requirements for the connector cable assembly between the Calorimeter (CAL) and Tower Electronics Module (TEM), for use in high reliability space applications. Many referenced figures in this specification are in Appendix A of this document.

3 DEFINITIONS

3.1 Acronyms

GLAST – Gamma-ray Large Area Space Telescope

LAT – Large Area Telescope

CAL – Calorimeter Detector

TEM – Tower Electronics Module

NRL – Naval Research Lab

4 APPLICABLE DOCUMENTS

4.1 Requirement Documents

ASME Y 14.5	Dimensioning and Tolerancing
LAT-MD-00228-03	CAL, TKR, DAQ Contamination Control Requirements
NASA-SN-C-0005	Contamination Control Requirements
NASA-STD-8739.3	Soldering Electrical Connections
NASA-STD-9739.4	Crimping, Interconnecting Cables, Harnesses, and Wiring

5 REQUIREMENTS

5.1 General requirements for cable fabrication.

1. Unless otherwise specified, all solder terminations shall be in accordance with NASA-STD-8739.3.
2. Interpretation of drawing terms and tolerances shall be per ASME Y14.5 or as specified by program.
3. If a conflict exists between hardware referenced on the Wire Connection List and the Assembly Drawing or Parts List, the Parts List or Assembly Drawing shall take precedence.
4. Harness Fabrication Planning — The following items shall be recorded in each planning package and shall be a permanent part of the manufacturing and quality control of harness documentation.
 - 4.1. Wire reel and vendor log number of each wire used in harness;
 - 4.2. Serial number of each crimp tool and calibration due date when applicable;
 - 4.3. Potting material, lot number, serial number and cure times per the process spec, where applicable;
 - 4.4. Weight of completed harness.
5. Spare wires shall be defined in the Wire Connection List. Unless otherwise noted, all spare wires shall be at least 2.0 inches in length. All spare wires shall be capped with heat shrink tubing or wire caps. Heat shrink sleeving shall cover the exposed conductor by $.25 \pm .125$ inches.

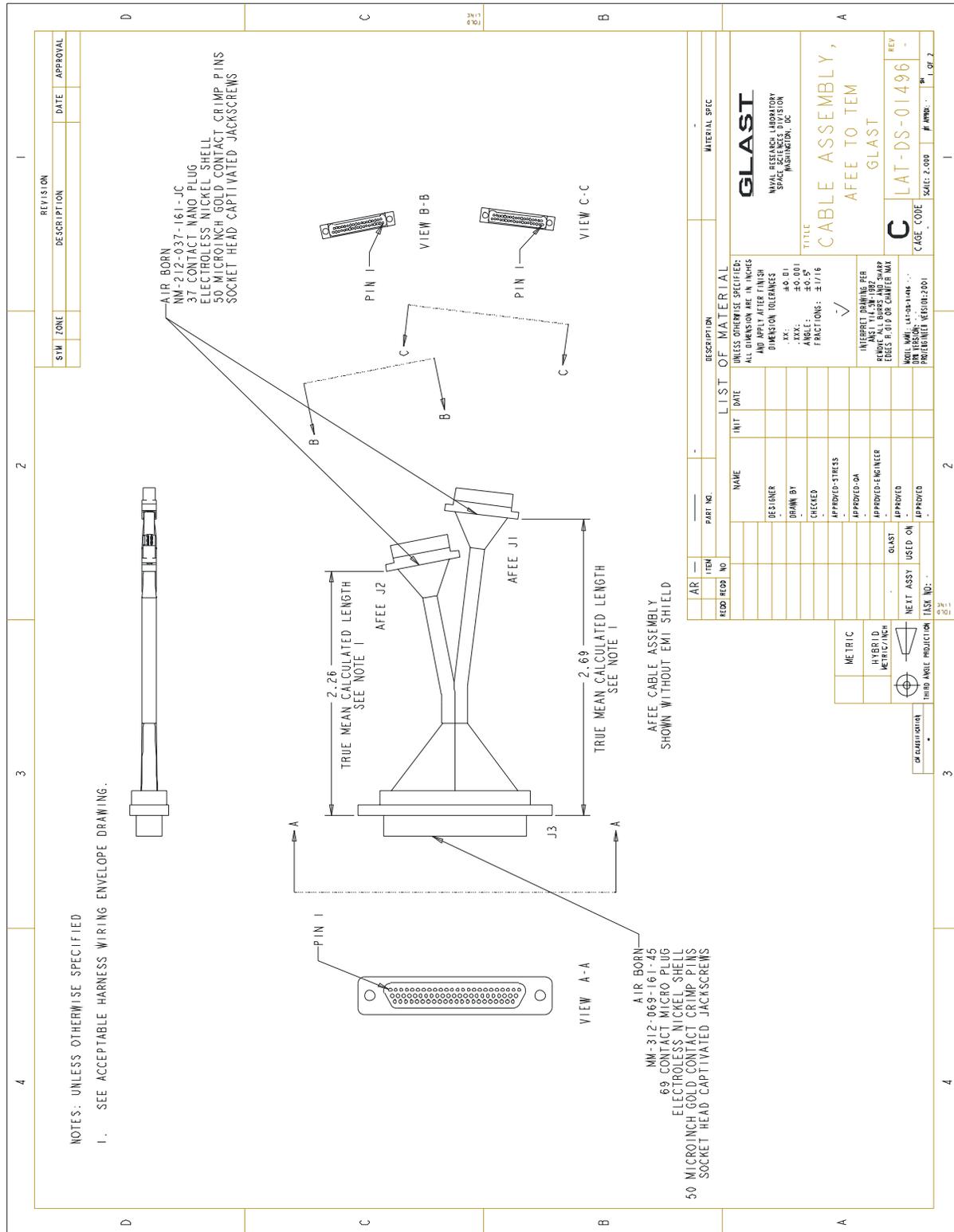
6. All parts used for Flight Harness Fabrication shall be ordered from the NASA approved part lists or as specified in the harness drawing.
7. On harness documentation, chassis ground, structure ground and subsystem ground are used interchangeably and define the connection of a wire from a connector and/or shield to primary structure. Shield tie wire refers to the wire exiting from a solder sleeve that is to be terminated, as specified to such things as a connector contact, the connector shell, structure ground, etc. Shield jumper wire refers to the wires that connect solder sleeves together on shielded wires.
8. When rework is performed on a harness requiring an existing wire to be cut and capped as a spare, then both sides of cut wire shall be cut and capped and identified with from/to destination using approved sleeving material.
9. A pigtail lead is a wire, which is terminated at one end and coiled and stowed at the other end for termination at a higher assembly. Pigtail leads shall be identified as specified in the Wire Connection List. Cap each wire (see section 3.1.6) to ensure freedom from contamination prior to termination.
10. Unless otherwise specified on the approved Wire Connection List, jumper wires within a connector are NOT allowed.
11. Unless otherwise specified by drawing, all wire being removed from spools for wire Harness Assembly shall be cleaned using a lint free cloth dampened with isopropyl alcohol.
12. Clean residual adhesive from wire after removing temporary tags using a lint free cloth and isopropyl alcohol, unless temporary tag is removed when wire is cut to proper length.
13. Extreme care must be taken when handling 26 AWG and higher wire due to its low tensile strength.
14. Contact with bare fingers shall be avoided for wires that will subsequently be terminated, i.e., spliced, soldered or crimped. However, if contact has been made, the wire shall be cleaned with isopropyl alcohol prior to further processing.
15. Harness and cables shall be protected during assembly as follows:
 - 15.1. Protect all cable and harness assemblies not on a harness board or peg board by placing them in a sealed plastic bag.
 - 15.2. Protect harnesses under assembly with a large plastic sheet as appropriate.
 - 15.3. Harness boards shall be clean at all times during harness fabrication.
 - 15.4. ESD dust caps shall be installed on all connectors at all times except for contact insertion or test of a connector.

6 Cable Specification

6.1 Harness Dimension

The flattened AFEE-"Y" cable in Figure 1 shows connector orientation and calculated mean wiring lengths.

Figure 1. AFEE-Y Cable connector orientation.



6.3 Harness Connection List

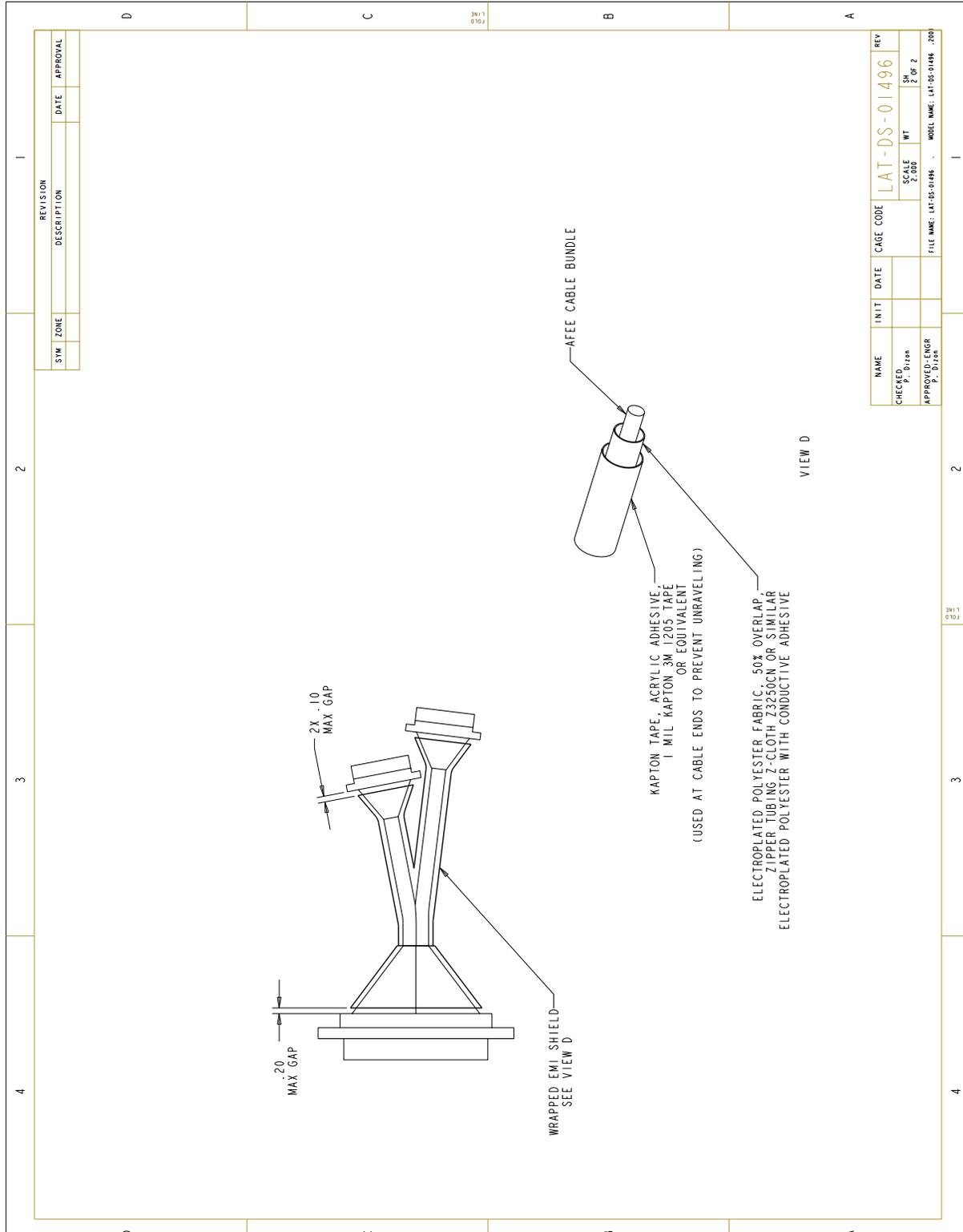
Table 1. AFEE-"Y" Cable Harness Connection List.

Airborn Nano AFEE End Conn-Pin	Airborn Micro D TEM End Conn-Pin	Signal	Twist Pair Number
J1-1	J3-47	* DIG RET (4)	
J1-2	J3-69	* BIAS RET (3)	
J1-3	J3-23	* 3.3V DIGITAL (3)	
J1-4	J3-68	* BIAS VOLTAGE (3)	
J1-5	J3-67	BIAS VOLTAGE (2)	
J1-6	J3-66	BIAS VOLTAGE (1)	
J1-7	J3-65	BIAS RET (2)	
J1-8	J3-64	BIAS RET (1)	
J1-9	J3-19	CAL_NTREQHE1M	TP1
J1-10	J3-18	CAL_NTREQHE1P	TP1
J1-11	J3-63	CAL_THERM1M	TP2
J1-12	J3-62	CAL_THERM1P	TP2
J1-13	J3-39	CAL_NTREQLE3M	TP3
J1-14	J3-38	CAL_NTREQLE3P	TP3
J1-15	J3-61	DIG RET (2)	
J1-16	J3-60	DIG RET (1)	
J1-17	J3-59	3.3V DIGITAL (2)	
J1-18	J3-58	3.3V DIGITAL (1)	
J1-19	#N/A	Shield Chassis Gnd	
J1-20	J3-24	* 3.3V DIGITAL (4)	
J1-21	J3-46	* DIG RET (3)	
J1-22	J3-45	CAL_NDATA1_3M	TP4
J1-23	J3-44	CAL_NDATA1_3P	TP4
J1-24	J3-21	CAL_NDATA0_1M	TP5
J1-25	J3-20	CAL_NDATA0_1P	TP5
J1-26	J3-43	CAL_NDATA0_3M	TP6
J1-27	J3-42	CAL_NDATA0_3P	TP6
J1-28	J3-41	CAL_NTREQHE3M	TP7
J1-29	J3-40	CAL_NTREQHE3P	TP7
J1-30	#N/A	Unused	
J1-31	J3-17	CAL_NTREQLE1M	TP8
J1-32	J3-16	CAL_NTREQLE1P	TP8
J1-33	J3-15	CAL_NDATA1_0M	TP9
J1-34	J3-14	CAL_NDATA1_0P	TP9
J1-35	J3-37	CAL_NDATA1_2M	TP10
J1-36	J3-36	CAL_NDATA1_2P	TP10
J1-37	#N/A	Shield Chassis Gnd	
J2-1	J3-13	CAL_NDATA0_0M	TP11
J2-2	J3-12	CAL_NDATA0_0P	TP11
J2-3	J3-35	CAL_NDATA0_2M	TP12
J2-4	J3-34	CAL_NDATA0_2P	TP12
J2-5	#N/A	Unused	
J2-6	J3-33	CAL_NTREQHE2M	TP13
J2-7	J3-32	CAL_NTREQHE2P	TP13
J2-8	J3-31	CAL_NTREQLE2M	TP14
J2-9	J3-30	CAL_NTREQLE2P	TP14
J2-10	J3-7	CAL_CLKM	TP15
J2-11	J3-6	CAL_CLKP	TP15
J2-12	#N/A	Unused	
J2-13	#N/A	Unused	
J2-14	#N/A	Unused	
J2-15	J3-5	CAL_NCMDM	TP16
J2-16	J3-4	CAL_NCMDP	TP16
J2-17	J3-3	CAL_NRESETM	TP17
J2-18	J3-2	CAL_NRESETP	TP17
J2-19	#N/A	Shield Chassis Gnd	
J2-20	J3-57	CAL_THERM0M	TP18
J2-21	J3-56	CAL_THERM0P	TP18
J2-22	J3-11	CAL_NTREQHE0M	TP19
J2-23	J3-10	CAL_NTREQHE0P	TP19
J2-24	J3-55	ANA RET (2)	
J2-25	J3-54	ANA RET (1)	
J2-26	J3-9	CAL_NTREQLE0M	TP20
J2-27	J3-8	CAL_NTREQLE0P	TP20
J2-28	J3-53	3.3V ANALOG (2)	
J2-29	J3-52	3.3V ANALOG (1)	
J2-30	J3-29	CAL_NDATA1_1M	TP21
J2-31	J3-28	CAL_NDATA1_1P	TP21
J2-32	J3-51	CAL_RIGHT_RET	TP22
J2-33	J3-50	CAL_RIGHT_FIRST	TP22
J2-34	J3-27	* ANA RET (3)	
J2-35	J3-49	* 3.3V ANALOG (3)	
J2-36	#N/A	Unused	
J2-37	#N/A	Shield Chassis Gnd	

6.4 Cable Shield.

The AFEE-"Y" cable shall be dressed and shielded. The shield wrapping is shown in Figure 3. The cable shield is electrically terminated at each nano connector using two cable shield pins specified in Table 1. The shield termination pins are crimped to buss wire, and the buss wire is then wrapped tightly around the EMI cloth. Ends of the wrapped EMI fabric will be over-wrapped with Kapton tape to prevent unraveling.

Figure 3. AFEE-"Y" Cable Shield Drawing.



6.5 Wires

Mil-W-22759/33, AWG 30, 7x38 strands of high strength copper alloy will be used to fabricate the harness. Insulation is crosslinked ETFE, copper wire is silver-coated with 600V rating and 200 degrees celcius temperature rating. Connector pins will be crimped at both ends. No insulation color scheme is specified.

Wires designated as twisted pairs in Table 1 will have 1-2 twists per inch.

6.6 Shield Terminations

Shield chassis ground wires shall be short with a small loop for strain relief and shall not exceed 0.5 inch in length.

6.7 Wire/Harness/Connector Identification

- 1) Connector identification text will be marked on the connector body and be of sufficient size to be readable by the un-aided eye or as specified on the drawing or installed near connector on a connector identification plate.
- 2) Unless otherwise specified, mark main identification tag with Harness number and Serial number. Marking shall be at least 1/8 inch high letters on identification tag.

6.8 Connector Potting

When specified on the applicable harness assembly drawing, the potting compound shall be used to provide mechanical support for the junction of the wires and connector. Potting should be done as soon as possible after electrical testing.

- 1) Wires extending through the potting material shall be straight. To ensure that the potting compound surrounds each wire individually, wires shall be equally spaced in potting cup prior to encapsulating.
- 2) The first tie adjacent to the potted connector shall be left untied until the potting compound has completely cured to avoid stressing the connections prior to solidification of the compound.
- 3) The potting shall be within 1/16 inch of the top of the potting form (either above or below). This restriction does not apply to the fillet of potting around the wires, or around the potting form.
- 4) Connectors are to have mating connectors in place during potting operation.
- 5) Unless otherwise specified, bubbles and/or voids shall be acceptable if controlled within the following limitations:
 - a. No bubbles or voids adjacent to a soldered connection.
 - b. One bubble or void connecting two (2) or more adjacent uninsulated wires or terminals shall not be acceptable — (This restriction shall not apply to surface bubbles).
 - c. Bubbles or voids exceeding 1/16 inch in diameter shall not be acceptable.

7 Fabrication Practices

7.1 Connector Cleaning

Each connector shall be cleaned as follows:

Note: The operator must wear gloves (nylon type preferred) while performing the cleaning operation.

- 1) Preferred Cleaning Method: Ultrasonic Cleaning with Isopropyl Alcohol
 - a. Position the portable ultrasonic cleaner close to cable or harness assembly which has connectors requiring cleaning.
 - b. Pour enough of solvent into cleaning tank to submerge one or more connectors.
 - c. Submerge connectors and allow approximately 10 minutes to degas solvent, i.e., eliminate gas bubbles. (This is required each time fresh solvent is added to tank.)
 - d. Allow 2 to 3 minutes ultrasonic action to clean after solvent degassed.
 - e. Immediately upon removal of connector, rinse in fresh solvent for approximately 1 minute.
 - f. Repeat above rinse with fresh solvent for the second time.
 - g. Allow to drain out immediately, wipe with lint free cloth or blow dry using cold setting of shrink blower gun, or dry nitrogen.
 - h. Inspect the connector face and contacts, including the inside barrel of the socket type contacts, under proper illumination and 10 X magnification. In addition, for potted connectors, inspect connector face and contacts under ultraviolet light for evidence of solder flux or potting/primer residue indicated by yellow or blue color under the light.
 - i. Repeat cleaning Steps 1 to 8 if there is any evidence of flux or any foreign particles visible during examination. Do not attempt to manually remove particles or contamination from the sockets.
 - j. Discard solvent from tank at end of each day or after use. Wipe out tank and leave clean for next use.
 - k. The internal surfaces of dust covers and connect covers shall be cleaned by solvent-brushing or isopropyl moistened lint free cloth and fitted onto cleaned connectors.
- 2) Alternate Cleaning Method: Brush Scrub Clean with Isopropyl Alcohol
 - a. Hold connector with front face pointing down (as practical) and brush front face and shell with a semi-firm nylon bristle brush moistened in isopropyl alcohol. On pin type contact connectors, brush down and around the contacts. On socket type contacts, brush face but do not insert bristles into sockets.
 - b. Rinse out with fresh solvent.
 - c. Allow to drain out immediately, wipe with lint free cloth or blow dry using cold setting of shrink blower gun, or dry nitrogen.
 - d. Inspect the connector face and contacts, including the inside barrel of the socket type contacts, under proper illumination and 10 X magnification. In addition, for potted connectors, inspect connector face and contacts under ultraviolet light for evidence of solder flux or potting/primer residue indicated by yellow or blue color under the light.
 - e. Repeat cleaning Steps 3.10.2.1 to 3.10.2.4 if there is any evidence of flux or any foreign particles visible during examination. Do not attempt to manually remove particles or contamination from the sockets.

7.2 Bent Pins

There shall be no bent pins. The definition of a bent pin is one, which gives excess mating force with its mating connector. Determination of bent pins may be either by the use of a mating connector or by a measurement technique which guarantees that the misalignment of any pin will not be greater than one-half pin diameter at the mating end.

7.3 Connector Mate/Demate Log

The connector mate/demate log shall be maintained throughout the rework/retest cycle.

Connector Mate/Demate Control

- 1) All mates/demates of cables, harnesses and external connectors to AFEE PWB assemblies must be recorded on a mate/demate log sheet (TBD).
- 2) The applicable harness/cable/AFEE PWB Assembly designation, serial number or job number shall be included in the log sheet. The body of the log sheet shall contain the connector designation, mating connector designation, mated by, mating inspected by, mating date, demated by, demating inspected by, demating date, and other pertinent remarks pertaining to contamination, wear or damage.

Subsystem / System Test

- 1) A log book continuing mate/demate log sheets will be generated at initial installation of the harness/cable/assemblies on the CAL subsystem. The log book shall remain with the subassemblies and/or CAL subsystem through the sequence of installation, test and final acceptance.
- 2) Inspection at each mate/demate shall consist of a visual examination of each connector and harness plus inspection for any contact contamination or any contact damage.
- 3) When a defect is found during these inspections, a PR (Problem Report) will be written and the PR number will be noted on the mate/demate log.
- 4) A complete history of mating/demating for each harness, cable and component will be maintained.
- 5) All mates/demates must be performed and witnessed by the designated area representative and entry recorded on a mate/demate log sheet. This requirement applies to harnesses that are completed and have been final accepted.
- 6) Only designated personnel will mate and demate connectors.
- 7) After reaching 75 mates/demate cycles, both sides of the connector shall be replaced.

8 Cable Test Requirements

When testing, the harness connector interface shall be mating pins and socket contacts of the size used in the connector. Test probes, paper clips or other type of probe devices are not to be used for flight connector testing.

Harness assemblies will be tested for the following requirements:

- 1) Continuity check.
- 2) Insulation resistance test.
- 3) High potential test.
- 4) Wire Resistance Test.
- 5) Contact Retention Inspection Test
 - a. Following installation of contacts in removable contact connectors, each pin and socket contact shall be subjected to a contact retention test.
 - b. At the front insert face of the connector, the applicable force TBD, shall be applied along the longitudinal axis of individual contacts in the direction tending to displace the contacts to the rear.
 - c. Contacts shall not be displaced after application of force.
- 6) Contact Separation Force Test
 - a. Contact separation force test shall be performed per NASA-STD-8739.4. The minimum separation force is TBD. The test pin shall have no sharp edges or burrs that can damage the contact plating.

9 Quality Assurance Provisions

This section describes quality requirements for harness fabrication and inspection.

9.1 General

- 1) Workmanship — Harness will be constructed and inspected in accordance with all applicable specifications, drawings and planning documents. Parts shall be free of burrs and sharp edges. Connectors shall be protected from damage by use of dust covers that have been solvent cleaned before installation.
- 2) Personnel Certification — Persons performing or inspecting special processes, such as a mate/demate, soldering, inspection, or assembly of harnesses and connectors shall be trained and certified to assure personal proficiency. Periodic evaluation and recertification shall be performed and records of those actions maintained.
- 3) Calibration — Prior to use, all calibrated tools and equipment shall be checked to assure unbroken seals and operation within calibration interval. Any item found out of date shall be tagged with an out—of—service tag and removed from the area if possible. The area supervisor and calibration laboratory shall be notified of out-of-date items.
- 4) Limited Shelf Life Materials — Life limited materials shall be marked with the following information:
 - a. Purchase order/lot report number
 - b. Lab report number if applicable
 - c. Specification number
 - d. Shelf life expiration date
- 5) Each person using life-limited material is responsible for determining that the material has not exceeded its shelf life expiration date.

9.2 Soldering Criteria

Solder Quality Acceptance Criteria

- 1) The appearance of the solder joint surface shall be smooth, nonporous, undisturbed and shall have a finish that may vary from satin to bright, depending on the type of solder used.
- 2) Solder shall wet all elements of the connection. The solder shall fillet between connection elements over the complete periphery of the connection.
- 3) Stress relief shall be present in leads or conductors to provide freedom of motion between point of constraint.

Solder Quality Rejection Criteria

- 1) Nicks, cuts and crushing or charring of insulation. Slight discoloration from thermal stripping is acceptable.
- 2) Improper insulation clearance.
- 3) Separation of wire strands (birdcaging).
- 4) Part damage.
- 5) Flux residue or other contamination.
- 6) Improper wrap or stress relief.
- 7) Terminals (solder cups) or wires modified to fit.
- 8) Solder connection defects:
 - 9) cold solder connection
 - 10) overheated solder connection
 - 11) fractured or disturbed solder connection
 - 12) poor wetting

- 13) blowholes, pinholes or voids
- 14) excessive solder
- 15) insufficient solder
- 16) splattering of flux or solder on adjacent areas
- 17) contamination
- 18) dewetting
- 19) insulation in solder connection
- 20) solder peaks or icicles or bridging of conductors.

9.3 Insulation Stripping Criteria

- 1) Insulation Damage
 - a. After removal of the insulation, the remaining conductor insulation shall not exhibit any damage such as nicks, cuts, crushing or charring. Conductors with damaged insulation shall not be used. Slight discoloration from thermal stripping is acceptable.
- 2) Conductor Damage
 - a. After removal of conductor insulation, the conductor shall not be nicked, cut, scraped or otherwise damaged. Damaged wires shall not be used.
- 3) Wire Lay
 - a. If disturbed, the lay of wire strands shall be restored as nearly as possible to the original lay. Contact with bare fingers shall be avoided for wires that will subsequently be soldered. However, if contact has been made, the wire shall be cleaned with an approved solvent prior to further processing.

9.4 Cable Shielding and Shield Terminations Criteria

Acceptance Criteria

- 1) No loose strands
- 2) No projecting strands
- 3) Wire insulation and a jacket free of punctures, cuts, nicks and deformations.
- 4) Solder connections with bright or satin surface showing evidence of proper flow and filleting to grounding wire.

Rejection Criteria

- 1) Loose or projecting strands
- 2) Wire insulation with cuts, punctures or crushing
- 3) Cracked, charred or split insulation sleeving
- 4) Cracked or fractured solder
- 5) Insufficient solder or poor wetting
- 6) Excessive number of nicked braid strands

9.5 Crimped Connections Criteria

Acceptance Criteria

- 1) Contact deformed only by tool indentations
- 2) Crimp indents located in the correct area of the contact
- 3) Wire strands visible in inspection hole of barrel
- 4) Shield termination free of loose strands or projecting strands
- 5) Wire insulation and jacket free of punctures, cuts, nicks and deformations
- 6) Metal ferrules tightly and symmetrically crimped
- 7) Insulation sleeving uniformly shrunk, providing proper covering and securing the wires in place
- 8) Wire strands not broken, nicked or cut. Burnishing is permissible provided the base metal is not exposed
- 9) Shield strands shall be clean, with nicks not exceeding 10% of total number of strands.

Rejection Criteria

- 1) Loose or projecting strands on shield terminations
- 2) Wire insulation having cuts, punctures or crushing
- 3) Metal ferrules crimped with improper alignment
- 4) Cracked, charred or split insulation sleeving
- 5) Excessive number of nicked braid strands
- 6) Improper sleeving coverage
- 7) Cracks in crimp barrel
- 8) Birdcaging of conductor
- 9) Wire strands not visible in inspection hole
- 10) Wire strands protruding from inspection hole
- 11) Peeling or flaking of plating on contact
- 12) Damaged or deformed crimp contact
- 13) Damaged insulation in excess of slight discoloration from thermal stripping
- 14) Damaged strands; burnishing is permissible if base metal is not exposed
- 15) Reduction of conductor cross-sectional area
- 16) Crimp indents not located in correct area on contacts
- 17) Tarnished, corroded or contaminated crimp contacts
- 18) Improper insulation clearance
- 19) Insulation that extends into the crimp barrel

10 Documentation

10.1 Production Documentation

Documentation used for fabrication shall be of the correct revision identified by the PIOS TPLQ screen. Current drawings, parts lists and shop MSIs shall be printed on yellow paper. Planning sheets and ECNs will be printed on white paper. Superseded revisions and uncontrolled (white paper) copies of yellow paper documents shall not be used for fabrication and shall be reported to area production control if found in the shop.

10.2 In-process Maintenance and Review of Production Documents

As appropriate during the fabrication process, Quality Control shall verify the correctness and completeness of data recorded in production documentation, including:

Cover Sheet — Heading information including drawing number, group ECN revisions, job/lot serial number, item nomenclature, and program QCE name. Verify configuration status using PIOS TPLQ screen. Verify ECN revision initialed/stamped by QCE and operations. Verify ADRs, D—stamps and closeout of same as applicable.

Bill of Materials — Verify all line items except air materials stamped in proper column, conditional release numbers recorded. Verify job/lot numbers legibly recorded, ECN revisions recorded for items accepted on BOM/CTh.

Planning/Work Instructions — Verify BOM accepted by inspection, all operator operations legibly signed/stamped, inspections legibly signed/stamped/dated. Verify mix record sheets and numbers recorded. Verify legible recording of cures, dates, start and stop times in military notation. Verify legible ADR and D—stamp recording and closeout, all entries in ink. When applicable, changes/revisions signed by originator and approved by QCE. Verify all DPRO mandatory inspections are stamped and dated. DPRO is to be given advance notice of readiness for mandatory inspections, in accordance with applicable agreements. Scan the ADR screen to assure that all ADRs are listed on the work instruction and travel card if applicable, and are properly closed or dispositioned to continue to NHA.

Travel Card — When a travel card is used, verify that all travel card information agrees with the planning cover sheet, ADRs and D—stamps properly annotated and all entries in ink.

Mate/Demate Log — A mate/demate log shall be maintained for all prime electrical connectors during assembly and test. Each person performing a mate/demate operation is responsible for completing the line entry less inspection signature and ADR number, if applicable. Heading must be complete with level of assembly, drawing number, job or serial number, program vehicle number. Each line entry shall include date, time, prime connector designation, indication of whether operation is a mate or demate, indication of what is being mated/demated to the prime connector, and operator signature. By signature, Quality Control shall verify inspection and that the mate/demate operation was performed by a qualified operator. Any defect noted during mate/demate shall be D—stamped, recorded in accordance with NCM procedures, and shall be noted also in the mate/demate log.

10.3 Reference Documentation

Reference documentation may be retained and used by support personnel for non—production activities such as troubleshooting and problem investigation. Reference documentation shall not be printed on yellow paper and shall not be used to manufacture, test or inspect prime hardware.

11 Handling and Storage

11.1 General

Packaging and handling of harness assemblies shall be in accordance with the highest workmanship standards to preclude possibility of impairment of reliability.

11.2 Materials

Materials shall be maintained to at least the same cleanliness levels as required for harness fabrication.

11.3 Operator

The operator must be familiar with and proficient in harnesses, heat sealing techniques and basic principles of good packaging. No special training or certification required

11.4 Equipment

Heat sealer capable of providing consistent, air tight seals of unlimited length on unsupported heat sealable thermoplastics up to 6 mils thickness. A heat gun may be used in lieu of heat sealer. Heat guns will only be used under

quality assurance surveillance and should be avoided if possible due to possibility of damage to flight harness. Kapton tape may be used as a substitute provided that all seams are completely sealed by the tape so that no openings exist between the wrap (use on large harnesses where heat sealing is impractical).

11.5 Tools and Stands

- 1) Heat guns will only be used under quality assurance surveillance and should be avoided if possible due to possibility of damage to flight harness.
- 2) Ty-Raps/Lacing cord or equivalent
- 3) Blister sheet, polyethylene or equivalent film with several air blisters sealed in this surface. (Bubble pak, clear)
- 4) Polyethylene Film (clear)—medium or low. Bags or sheet material.
- 5) Desiccant bag, humidity card

Area in which harnesses are packaged or where packages are to be opened must be of equal environmental conditions to those for harness fabrication.

11.6 Packaging Requirements — Preliminary Preparation

Clean harness fabrication boards and other hardware with an alcohol dampened cloth prior to attaching harness assembly.

Make certain plastic film and blister sheet are cleaned free of obvious contamination. DO NOT wipe plastic films, sheets, etc. unless absolutely necessary as wiping produces high static electric charges, which attract foreign particles.

Only clean polyethylene film material is allowed to touch cleaned harness surfaces.

11.7 Workmanship

Distorting or stressing of the harness must be avoided during positioning and securing to the handling/storage board.

CAUTION: Do not alter harness configuration.

Positioning of harness should approximate the designed configuration as closely as possible.

CAUTION: Do not alter harness configuration. Install and secure harness in a relaxed position.

Connectors of harness assembly shall be cleaned per 7.1 of this document. Harness shall be wiped down with isopropyl alcohol using a lint-free cloth.

11.8 Processing Requirements

- 1) Completed handling/storage assemblies shall be rigid and capable of protecting the harness from accidental contact with foreign objects.
- 2) Three dimensional harnesses should be positioned and secured as described below.
 - a. NOTE: A harness shall be considered three dimensional when the assembly cannot be placed on a harness/peg board without having a portion leave the harness plane of reference in such a manner that any external force would distort the harness configuration.
- 3) Harness shall be firmly fastened to the harness fabrication board or storage peg board so that no appreciable movements exist.
 - a. CAUTION: Fastenings will not be so tight as to bend, crimp or otherwise damage the harness.
- 4) All connectors and harnesses shall be cleaned as specified in the Connector Cleaning Requirements 7.1 and General Requirements 5.1, All connectors shall have ESD dust caps installed before the harness is packaged. Ensure that harness board or peg board are clean as well, as described in this section.
- 5) Perform packaging of harness by individually storing harness in ESD bag with dust caps installed and transport with other individually wrapped flight harnesses in approved tote boxes. The flight harnesses shall be cushioned and protected from damage inside the tote boxes.

- 6) The completed handling/storage assembly shall be wrapped with polyethylene film or equivalent containing one (1) each humidity indicator and desiccant bag. Insert and secure at minimum 0.5 units of desiccant within harness package. Secure a humidity indicator inside the package with the indicator facing outward. Wrap assembly with at least 2 ½ layers of film. Paperwork (Travel Tag and Doc Folder) shall be secured to the top side of assembly and covered by the last ½ layer. Fold film at ends and seal all seams using Kapton tape so that no openings exist between wrap. Use heat sealer for smaller assemblies as required. Write harness identification onto package using permanent marker.
 - a. Note: This is only required for harness storage in an environmentally uncontrolled area. Not required for in-process harness flow.

11.9 Product Assurance Requirements

- 1) Assure harness is securely attached to harness/peg board and that connections are sufficiently restricted from movement to prevent damage during handling.
- 2) Assure all connectors, harness and board are free of dirt and contamination.
- 3) Assure all connectors have dust caps and are protected individually with bubble pack or equivalent clean cushioning material.
- 4) Assure ties and wood on 3D harnesses are properly placed to ensure the shape of the harness is not distorted.
- 5) Assure outer and inner coverings are sufficiently sealed to prevent entry of dirt and contamination.
- 6) Harness identification must be written on package and be clearly visible.
- 7) Assure planning and travel cards are properly filled out, with all mandatory control points stamped off, and attached to handling/storage board.
- 8) Check for overall damage to harness resulting from handling and packaging.

11.10 Handling and Storage

- 1) Transportation of packaged harnesses shall be by Production Control Personnel or Authorized Movers only except for movement within the shop area.
- 2) Production Control shall provide dollies or hand trucks of sufficient size to provide maximum protection during transportation.
- 3) Harnesses delivered to the Final Assembly Area shall have the outer layer of film opened to remove paperwork at time of delivery. Inner layer shall not be removed until harness is to be installed.
- 4) Stock Storage facilities shall be provided to protect packaged harnesses from mechanical and chemical damage.
- 5) Harnesses shall not be stored in hallways, work area, dispatch areas, traffic areas, etc., at any time. Harnesses shall be stored in a controlled area.

12 Shipping to Customer

12.1 Delivery Acceptance

- 1) NRL Personnel will witness continuity testing and dimensional envelope check of each cable prior to delivery to NRL.

12.2 Shipping

- 1) Each cable will undergo bakeout prior to shipping
- 2) ESD Dust caps will be installed over each connector.
- 3) Each connector is to be separately wrapped and placed in a cushioned-packed shipping container which maintains the flight harness shape specified in Figure 2.

- 4) Proper documentation will be shipped with the respective connectors.
- 5) Each shipping container will have identified on the lid the harness drawing number and the serial numbers of the harnesses contained.

