



MSFC ER24/Propulsion Research & Technology Branch



Cryogenic Propellant Storage and Transfer (CPST) Engineering Development Unit (EDU) Multilayer Insulation (MLI) Blanket Fabrication Process Summary and Status

Erin Kimberlin, Kelley Vann-Johns, Sam England (ER24 / Yetispace)
Hoss Burtt, Lee Foster, Jessica Wood (ER24 / Yetispace)
Juan Valenzuela (ER24)
Noah O. Rhys (ER24 / Yetispace)



- Design of the MLI blanket
 - Approach: Traditional Multilayer Insulation (tMLI) assembled at MSFC by onsite staff
 - Layers: 60
 - Density:
 - 10 layers/cm: 20 layers closest to tank
 - 20 layers/cm: 40 layers farthest from tank
 - Seams: overlapped, interleaved seams, taped at ~4" intervals
- All work completed in Marshall Space Flight Center's Propulsion Research Development Laboratory (MSFC PRDL) MLI Fabrication Lab (Building 4205, Lab 109C)





MLI Fabrication Lab Set Up

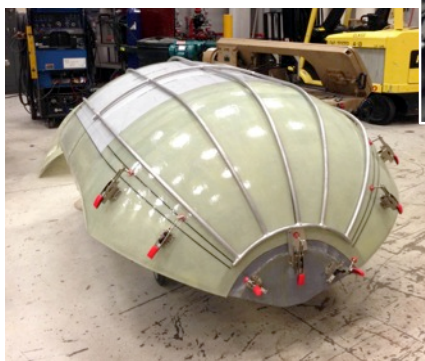
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Material Rack: Materials specified and purchased per the MSFC MLI Materials Guideline and EDU Thermal Working Group.



Reflector Layers: Mylar and Kapton cut into rectangles for the blanket cylinder and gore sections for the blanket domes.



Fabrication Table: Fiberglass shell built to the EDU Spray-on Foam Insulation (SOFI) Outer Mold Line (OML) for MLI layer assembly.

The MLI Fabrication Lab is in Building 4205, Room 109C. EDU MLI blanket material preparation and layer assembly took place in this CWA per JPR 5322.1G.



Controlled Work Area (CWA): Cleanliness standards maintained to minimize blanket contamination during the layer assembly process.





Blanket Materials



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- Reflector Layers: Double-aluminized, 0.25-mil polyester (Mylar) film coated with 1000Å of aluminum, 0.059" perforations for a total open area of 1%
- Separator Layers: B4A polyester (Dacron®) netting (Apex Mills), 0.2 oz/yd²
- Bumper Strips: Folded layers of B2A Dacron netting (Apex Mills), 0.4 oz/yd²
- Outer Covers: Nomex® reinforced, double-aluminized, 2 mil polyimide (Kapton®) film, aluminized on both sides, perforated with ~120 needle perforations per square inch
- Inner Covers: Double-aluminized, 2 mil Kapton, 0.059" perforations for a total open area of 1%

Acronyms: Double-Aluminized Mylar (DAM) and Double-Aluminized Kapton (DAK)



Low-Density Blanket Fabrication



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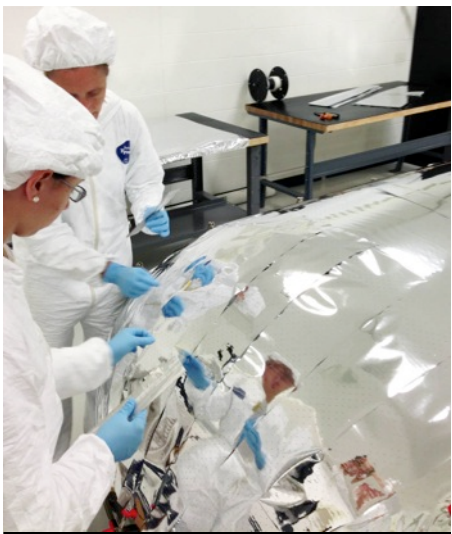
- Cover Layer:
 - Cylinder cover layer section is centered on fabrication table and fixed in place with table clamps
 - 9 cover layer gore sections are placed on each dome and pinned in place with ~0.5" pieces of 1" tape at ~4" intervals
 - All seams are closed out with continuous 2" tape for stability
- Netting:
 - Continuous layer of B4A Dacron netting is placed over reflector layer and fixed in place by table clamps
 - 3 lateral, 6-ply, B2A Dacron bumper strips are positioned and fixed in place by blanket clips
 - 3 longitudinal, 6-ply, B2A Dacron bumper strips are positioned and fixed in place by blanket clips and table clamps
 - Bumper strips are sewn together at intersections to maintain proper spacing and placement within the layer
- Reflector Layer:
 - Cylinder DAM layer section is centered on fabrication table and fixed in place with table clamps
 - 5 gore DAM layer sections are placed on each dome and pinned in place with ~0.5" pieces of 1" tape at ~4" intervals



Low-Density Blanket Fabrication



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Cover Layer Assembly →



B4A Netting Placement →



B2A Bumper Strips →



Bumper Strip Sewing →

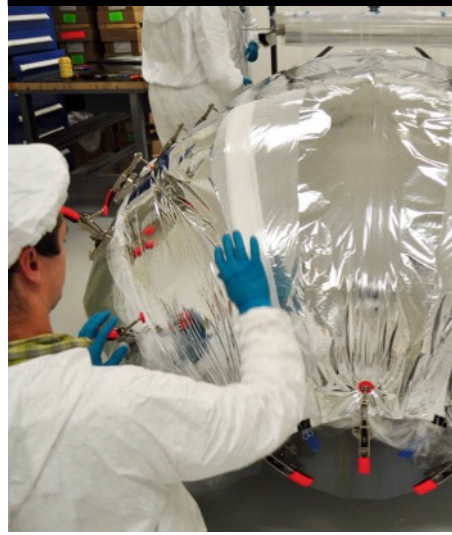
DAM Cylinder Section →



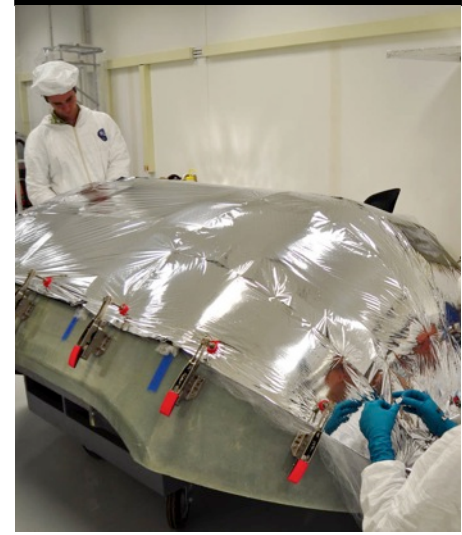
DAM Placement on Table →



DAM Gore Sections →



Completed DAM Layer





Standard-Density Blanket Fabrication



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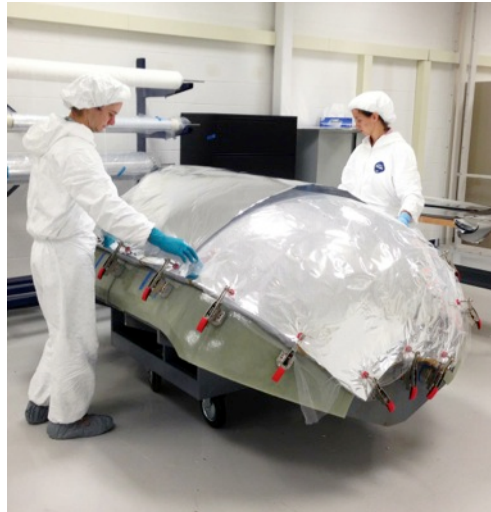
- Cover Layer:
 - Cylinder cover layer section is centered on fabrication table and fixed in place with table clamps
 - 9 cover layer gore sections are placed on each dome and pinned in place with ~0.5" pieces of 1" tape at ~4" intervals
 - All seams are closed out with continuous 2" tape for stability
- Netting:
 - Continuous layer of B4A Dacron netting is placed over reflector layer and fixed in place by table clamps
- Reflector Layer:
 - Cylinder DAM layer section is centered on fabrication table and fixed in place with table clamps
 - 5 DAM layer gore sections are placed on each dome and pinned in place with ~0.5" pieces of 1" tape at ~4" intervals



Standard-Density Blanket Fabrication

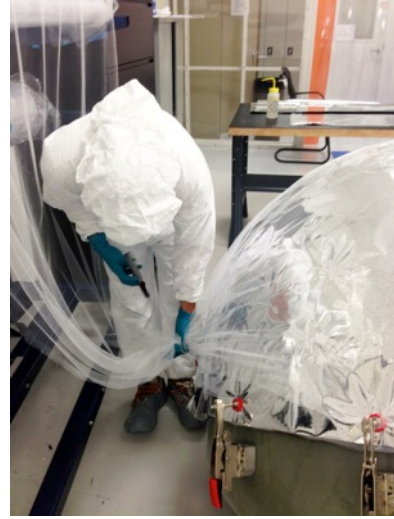


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↑ Double Aluminized Mylar Layer

B4A Dacron Netting Layer ↓





EDU MLI Status, Fall 2013



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- The EDU tank MLI blanket assembly was completed on Wednesday, September 18, 2013.
- Blankets were bagged and stored for installation on the EDU tank in December 2013.
- MLI design and fabrication for EDU struts, plumbing, and components occurred based on guidance from the EDU thermal team.