LAT Environmental Test Sequence

DRAFT 4

Draft 4, 4/29/2005: updated sequence to match Env Test PDR sequence. Specifically: EMI test does not include Radiators; added Radiator install to after EMI test; removed superfluous T-Vac cycle (now have 4); changed LAT test names to be consistent with Perf and Ops Test Plan;

Draft 3, 2/25/04: re-started work on this; updated sequence to match current thinking; updated functional testing; updated author list to include test directors

Draft 2: updated Purpose, Scope, Acronym List, Applicable Documents, and Overview sections. Updated all sections to consistent level of detail. Document sent out for review and comment to integration working group.

Draft 1: spun off this document from LAT-MD-00676, “LAT Integration Sequence” document.

1. Change History Log

<table>
<thead>
<tr>
<th>Revision</th>
<th>Effective Date</th>
<th>Description of Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29 Apr 2005</td>
<td>Sequence synchronized with LAT Env Test PDR plans</td>
</tr>
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3. **Purpose**
This document describes the sequence of environmental and functional testing of the LAT. It includes sufficient detail to establish the precise ordering of the tests and the handling and operations processes between tests. This is intended to provide the directives from which detailed work orders and procedures are made.

4. **Scope**
This document covers the environmental test sequence for the LAT from receipt of the LAT at NRL through all environmental and functional tests and associated handling and assembly/disassembly operations, until the LAT is shipped out from NRL following completion of all tests. It delineates the sequence of handling and test activities, and the basic steps to be used for those activities. This is not intended to serve as a work instruction or to define test requirements, but to provide suitable detail to provide clear direction for developing procedures and instructions for use in handling flight hardware.

This is one of three documents that details the LAT integration and test sequence. These three are:

- LAT-MD-00676, “LAT Integration Sequence”
- LAT-MD-02717, “LAT Environmental Test Sequence”
- LAT-MD-06560, “Plan for Integrating and Testing the LAT on the Observatory”

Note that this document does not replace the individual Test Plan documents, but puts them in the context of the other tests and handling. There may be some overlap in the details of the testing between this document and a test plan. If that occurs, then this document takes precedence.

5. **Acronyms**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ACD</td>
<td>Anticoincidence Detector</td>
</tr>
<tr>
<td>CCC</td>
<td>Comment for Capturing Concerns</td>
</tr>
<tr>
<td>CG</td>
<td>Center of Gravity</td>
</tr>
<tr>
<td>CPT</td>
<td>Comprehensive Performance Test</td>
</tr>
<tr>
<td>DAQ</td>
<td>Data Acquisition system</td>
</tr>
<tr>
<td>DSHP</td>
<td>Down Spout Heat Pipe</td>
</tr>
<tr>
<td>EGSE</td>
<td>Electrical Ground Support Equipment</td>
</tr>
<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
</tr>
<tr>
<td>EPU</td>
<td>Event Processor Unit</td>
</tr>
<tr>
<td>GASU</td>
<td>Global electronic, ACD, and Signal distribution Unit</td>
</tr>
<tr>
<td>GN2</td>
<td>Gaseous Nitrogen</td>
</tr>
<tr>
<td>GPR</td>
<td>Grid Perimeter Ring</td>
</tr>
<tr>
<td>GSE</td>
<td>Ground Support Equipment</td>
</tr>
<tr>
<td>HIB</td>
<td>Harness Interface Box</td>
</tr>
<tr>
<td>I&amp;T</td>
<td>Integration and Test</td>
</tr>
<tr>
<td>LAT</td>
<td>Large Area Telescope</td>
</tr>
<tr>
<td>LCS</td>
<td>LAT Coordinate System</td>
</tr>
</tbody>
</table>

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6. **Applicable Documents**

Plan-level documents relevant to the LAT Assembly Sequence:

[1]: LAT-TD-00035, “LAT Coordinate and Numbering System”

[2]:

[3]: LAT-MD-02717, “LAT Environmental Test Sequence”

[4]: LAT-MD-06560, “Plan for Integrating and Testing the LAT on the Observatory”

[5]: LAT-MD-00408: “LAT Instrument Performance Verification Plan”

[6]:

[7]: LAT-DS-TBD, “LAT Cable Flow Layout”

[8]: LAT-SS-00895, “LAT Instrument Survey Plan”

[9]: LAT-MD-01196, “LAT Dynamics Test Plan”

[10]: LAT-MD-01600, “LAT Thermal Test Plan”


7. **Overview**

7.1. **Document Description**

This document describes the sequence used for the environmental testing of the Large Area Telescope (LAT), including assembly and disassembly of flight hardware onto and off of the LAT:
Section 8: receipt and incoming inspection of the LAT.

Section 9: environmental test sequence and associated handling and assembly processes.

Section 10: preparation for and shipping of the LAT.

Each of these sections describes the handling, assembly and test sequence of flight hardware, and the Ground Support Equipment (GSE) needed. All hardware that is GSE is labeled as such; otherwise the hardware described is flight hardware. The Table of Contents provides the best overview of the order of testing and the basic steps in the process.

7.2. LAT Orientation

The following diagram shows the bay numbering scheme used to define bay locations in the Grid. The numbering system is identical to that described in Ref [1], and is repeated here for convenience. The labels refer to the data acquisition (DAQ) boxes mounted in the Grid bays on the underside of the Grid.

The horizontal bars represent the location of the Radiators.

The coordinate axis shown represents the LAT Coordinate System (LCS)—also defined in Ref [1]. The +Z direction is perpendicular to the plane of the Grid and points from the Grid to the top/front of the Tracker (TKR). The ground orientation of the LAT assembly is described as follows: “upright” or “right-side up” means TKR modules are pointing upwards (i.e., in a direction opposite to the gravity vector), “upside-down” means TKR modules are pointing downwards (i.e., in the same direction as the gravity vector), “sideways” means TKR modules are pointing in a direction parallel to the ground (i.e., in a direction perpendicular to the gravity vector).
8. **Receiving and Incoming Inspection**

8.1. **Description of LAT Shipping Configuration**

The Large Area Telescope (LAT) is sitting on Spacecraft (SC) Flexures, on the Test Interface Plate (TIP). This interface has been shimmed and match-drilled and reamed, with the Flexures pinned and bolted to the TIP such that they match up cleanly with the Grid interface. The LAT on the TIP is mounted inside the LAT Transport Container.

The Grid Perimeter Ring (GPR) is detached and shipped separately.

MLI: Anticoincidence Detector (ACD) to Cross-LAT Plate (X-LAT) multi-layer insulation (MLI) blankets are removed but Blanket Bars remain attached.

MGSE: chill bars are mounted to the LAT but hoses are disconnected.

8.2. **Receiving and LAT Preparation**

Move LAT Transport Container and ancillary shipping containers to Naval Research Lab (NRL) Bldg A-59 high-bay.

Inspect and clean boxes.

Remove and inspect GPR, 4x4 Lift Fixture, and Test Stand from their shipping containers.

Set up Test Stand in high bay.

Remove cover of Transport Container and visually inspect LAT.

Remove environmental and acceleration monitors and download data for review.

Mount Grid Perimeter Ring (GPR) to LAT.

Lift LAT with Test Interface Plate (TIP) and set on Test Stand, using the 4x4 Lift Fixture. Mount LAT to Test Stand and break rigging off of GPR (GPR remains connected to Grid).

Move clean tent over the LAT.

Remove ESD bagging from around LAT and inspect.

8.3. **Incoming Baseline Testing**

Connect E-GSE cabling to LAT.

Connect Grid Chill Bars and X-LAT cooling to chiller by way of flexible hose connections. Turn on chiller and stabilize LAT temperatures.

Run **Aliveness** test.

Run LAT **LPT** test.

Run LAT **CPT** test.
9. **Environmental Testing Sequence**

9.1. **Test Preparation**

Prep EGSE cabling and EGSE crates for move to vibration facility, by strain-relieving it to GPR (cabling remains connected to LAT).

Verify all external cable tie-downs.

Mount dust tent over LAT and set down on the GPR.

Plumb temporary GN2 purge lines under tent and turn on GN2.

Move clean tent away from around LAT

Configure Test Stand for rolling by adding casters. Jack feet off floor and onto casters.

Set 4x4 Lift Fixture on MGSE Cart.

9.2. **Sine Vibration Test**

9.2.1. **Transport to Vibe Test**

Move EGSE crates and cabling to vibe facility. Set up and check out.

Roll 4x4 Lift Fixture into vibration facility room.

Rig up 4x4 Lift Fixture, lift off MGSE Cart, and remove Cart from room. Set 4x4 Lift Fixture on floor.

Roll LAT on Test Stand into vibration facility room.

Rig 4x4 Lift Fixture to LAT and lift LAT+TIP off Test Stand with GPR. Set LAT on expander head on shaker. Bolt TIP to expander head.

Re-dress EGSE cabling from GPR to cable supports in the vibe facility.

Hand-lift dust tent off GPR and set down around expander head. Move GN2 purge lines off GPR and re-mount to base. Note: none of tent is supported on the expander head or any part of the LAT that will move during vibe testing.

Disconnect GPR from RMB’s.

Remove GPR from LAT using 4x4 Lift Fixture. Set GPR and Lift Fixture down in the vibration facility.

9.2.2. **Vibe Test Preparation**

Mount test and fly-away accelerometers to test data acquisition system (DAQ). Test DAQ to verify all is functioning.

Secure thermal fly-away instrumentation for vibration.
Re-connect cooling hoses to Chill Bars and X-LAT auxiliary cooling line on LAT.
Run LAT LPT test to establish pre-vibe baseline.
Disconnect LAT EGSE cabling and pull back from LAT.
Disconnect cooling hoses from Chill Bars and X-LAT auxiliary cooling line.

9.2.3. **Vibe Testing**
Vibe test LAT in Z-axis.
Reconnect LAT EGSE cabling and cooling hoses.
Run LAT LPT.
Disconnect LAT EGSE cabling and cooling hoses.
Pick 4x4 Lift Fixture with crane, pick up GPR, and mount GPR to LAT at RMB’s.
Break LAT configuration from vibe table, lift LAT on TIP (with dust tent), and set down on Test Stand.
Re-configure vibe table for lateral vibration.
Lift LAT off Test Stand and set down on vibe slip table. Connect to slip table, set dust tent down on table base, and move GN2 purge lines.
Disconnect and remove GPR from LAT.
Vibe test LAT in X-axis.
Reconnect LAT EGSE cabling and cooling hoses.
Run LAT LPT.
Disconnect LAT EGSE cabling and cooling hoses.
Pick 4x4 Lift Fixture with crane, pick up GPR, and mount GPR to LAT at RMB’s.
Break LAT configuration from vibe slip table, lift LAT on TIP (with dust tent), and rotate LAT 90 degrees.
Set LAT back down on vibe slip table. Re-connect to table, re-set dust tent and GN2 purge lines.
Disconnect and remove GPR from LAT.
Vibe test LAT on Y-axis.
Reconnect LAT EGSE cabling and cooling hoses.
Run LAT LPT.

9.2.4. **Transport from Vibe Test**
Disconnect LAT EGSE cabling and cooling hoses.
Pick 4x4 Lift Fixture with crane, pick up GPR, and mount GPR to LAT at RMB’s.
Hand-lift dust tent off vibe table base and onto GPR. Move GN2 purge lines and re-mount to GPR.
Lift LAT off vibe table and set down on Test Stand. Disconnect and remove GPR from LAT.
Set 4x4 Lift Fixture and GPR down on MGSE Cart, break rigging, and roll Cart out of vibration facility and back into High Bay.
Roll LAT on Test Stand out of vibration facility room and back into High Bay.

9.3. EMI Test

9.3.1. Transport to EMI Test Chamber
Install EGSE crates and run test cabling through anechoic chamber penetrations and check out.
Move LAT on its Test Stand to into Electro-Magnetic Interference (EMI) test anechoic chamber.

9.3.2. EMI Test Preparation
Re-plumb GN2 purge lines from under tent through penetration in the chamber to GN2 source outside chamber. Turn on GN2.
Position auxiliary cooling chiller outside anechoic chamber and plumb hoses through chamber penetrations. Connect hoses to LAT auxiliary cooling lines, test. Turn on.
Connect fly-away and SC thermal instrumentation from LAT to EGSE.
Re-connect EGSE cabling to LAT.
Turn on LAT, run Aliveness test, then LAT LPT test.

9.3.3. EMI Testing
Run EMI tests.
Run LAT LPT following final EMI test.

9.3.4. Transport from EMI Test
Disconnect EGSE cabling from LAT.
Remove EGSE cabling and crates from anechoic chamber and support room.
Disconnect fly-away and SC thermal instrumentation from LAT.
Disconnect auxiliary cooling hoses at the LAT.
Swap GN2 lines from remote to a nearby GN2 source in preparation for moving.
Roll LAT on Test Stand out of anechoic chamber and back to High Bay.
9.4. LAT Re-Configuration

Lift dust tent LAT so it allows clear access to the heat pipe three-way joint.
Remove heat pipe restraint plates from all 12 XLHP/DSHP joints.
Clean Radiator transport box, remove top, and inspect Radiators.
Rig and lift Radiator out of box.
Dry-mount Radiator to LAT at RMB’s and check fit of variable-conductance heat pipes (VCHP’s) to downspout heat pipes (DSHP’s) and X-LAT heat pipes (XLHP’s).
Remove Radiator and re-mount using flight-design materials and processes. Mount MGSE Radiator Struts to Test Base.
Verify thermal joint.
Repeat Radiator mounting for second Radiator.
Re-install MLI Blanket Bars on X-sides of LAT.
Survey location of Radiators with respect to the LAT
Electrically integrate Radiators to LAT.
Reconnect cooling hoses to Grid Chill Bars and X-LAT auxiliary cooling line. Turn on.
Reconnect LAT EGSE cabling.
Run Radiator Aliveness test.
Move clean tent over LAT on Test Stand.
Run Radiator CPT test.
Run LAT LPT test.
Disconnect LAT EGSE cabling and cooling hoses.
Prepare EGSE cabling and EGSE crates for move to acoustic test facility.
Lower dust tent over LAT and set down on the Test Stand.

9.5. Acoustic Test

9.5.1. Transport to Acoustic Test Cell
Install EGSE crates and run cabling through acoustic test cell penetrations and check out.
Move LAT on its Test Stand into acoustic test cell.

9.5.2. Acoustic Test Preparation
Re-route and secure GN2 purge lines from under tent to GN2 source inside chamber. Leave GN2 on.
Mount test accelerometers and microphones on LAT, MGSE, and within test cell. Check out.
Connect fly-away accelerometers to test cell DAQ and check out.

Install ACD-XLAT and ACD-Radiator multi-layer insulation (MLI) blankets. Install X-LAT MLI blanket.

Lay down white tarp under LAT and secure to floor.

9.5.3. **Acoustic Testing**

Run acoustic test.

Inspect LAT and collect tarp from under LAT.

Remove ACD-XLAT and ACD-Radiator MLI blankets.

Move chiller into acoustic test cell and plumb hoses to LAT. Turn on.

Move EGSE crates into acoustic test cell and re-connect EGSE cabling to LAT.

Turn on LAT, run **Aliveness** test, then LAT **LPT** test.

9.5.4. **Transport from Acoustic Test**

Disconnect EGSE cabling from LAT. Remove EGSE from test cell.

Disconnect cooling hoses from LAT. Remove hoses and chiller from test cell.

Disconnect fly-away and test accelerometers and microphones from LAT and MGSE.

Roll LAT on Test Stand out of acoustic test cell and back to High Bay.

9.6. **LAT Re-Orientation**

Jack Test Stand off its casters and remove casters and jacks.

Mount Extension Beams to Test Stand.

Rig Spreader Bars one on each hook in A-59 west high bay.

Rig Spreader Bars to Test Stand Extension Beams. Lift LAT on Test Stand with two hooks using two spreader bars. Lower hook 1 to roll LAT until entire load is hanging from hook 2. Break Spreader Bar hanging from hook 1 off the Extension Beams and pirouette LAT on Test Stand 180 degrees by swiveling hook 2. Re-rig hook 1 Spreader Bar to bottom of Test Stand and continue rotation by lifting hook 2. Once LAT is horizontal, set down.

Remove top two Extension Beams from top of Test Stand.
9.7. Thermal-Vacuum Test

9.7.1. Transport to Thermal-Vacuum Chamber

Open door of T-Vac chamber and set up temporary trolley supports and rails. Roll out trolley from inside T-Vac chamber.

Re-pick LAT using one hook and TBD rigging. Move over and set down on T-Vac trolley. Secure Test Stand on Trolley.

Move GN2 source and re-route hoses up onto trolley.

Move LAT in horizontal configuration on T-Vac Trolley to T-Vac chamber and connect Trolley rails to chamber rails.

9.7.2. Test Preparation

Install EGSE crates and run outside cabling from EGSE crates and chamber DAQ to chamber port plates. Make connections to outer feedthroughs.

Connect internal EGSE cabling from inner feedthroughs on port plates.

Check end-to-end continuity of all cabling and connections through to LAT EGSE crates and chamber DAQ.

Disassemble and remove Dust Tent from around LAT.

Mount remainder of specialized test equipment (STE), including thermal sink plates around LAT while it is sitting outside the chamber.

Roll trolley into T-Vac chamber.

Level Test Stand to ensure that heat pipes are within required level.

Connect cooling hoses to Grid Chill Bars and X-LAT auxiliary cooling line. Place chiller on trolley or on floor directly outside chamber. Turn on

Connect internal EGSE cabling to LAT.

Run LAT **Aliveness** test.

Mount thermal instrumentation to LAT, MGSE, and inside of chamber. Connect instrumentation cabling to inner chamber port plate feedthroughs and check.

Wrap MGSE MLI blankets around Test Stand, instrumentation cabling, and to patch up blanket open regions around Radiator-Grid volume.

Run LAT **LPT** test.

Connect thermal panels to cooling source (TBR) and connect STE heaters to port plate feedthroughs.

Check chamber instrumentation and heating/cooling.
9.7.3. Pre-T-Vac Performance Testing

Run LAT CPT test.

Run LAT SVAC test.

Drain cooling lines, purge lines, and disconnect cooling hoses from Grid Chill Bars and X-LAT auxiliary cooling line.

Turn off GN2 purge and remove purge lines from LAT and Test Stand.

Mount ACD-XLAT and ACD-Radiator MLI blankets.

9.7.4. T-Vac Test

Close T-Vac chamber door.

Pump down chamber

Bake out LAT and ground support equipment (GSE) inside chamber.

Hot survival: run Initialization, Aliveness and CPT tests.

Thermal-balance hot: run LPT, SVAC, and TCS Perf tests.

Thermal-balance cold: run LPT, SVAC, and TCS Perf tests.

Cold-survival: run Initialization, Aliveness, and CPT tests.

Thermal cycle hot (2): run LPT test.

Thermal cycle cold (2): run LPT test.

Thermal cycle hot (3): run LPT test.

Thermal cycle cold (3): run LPT test.

Thermal cycle hot (4): run CPT test.

Thermal cycle cold (4): run CPT test.

Return to ambient temperature

Vent chamber.

Open T-Vac chamber door.

Remove ACD-XLAT MLI blankets and ACD-Radiator MLI blankets.

Connect GN2 purge lines to LAT and turn on purge.

Connect cooling hoses to Grid Chill Bars and X-LAT auxiliary cooling line. Place chiller on trolley or on floor directly outside chamber. Turn on

Run final CPT test.

Run LAT SVAC test.
9.7.5. **Transport from T-Vac Test**

Disconnect STE sink plates and MGSE MLI blankets.

Re-assemble Dust Tent around LAT.

Drain cooling lines, purge lines, and disconnect cooling hoses from Grid Chill Bars and X-LAT auxiliary cooling line.

Disconnect test instrumentation.

Disconnect LAT EGSE cabling from port plate feedthroughs.

Disconnect fly-away and other thermal instrumentation from LAT, Test Stand, and Chamber. Remove.

Roll LAT on Test Stand out of chamber.

Move LAT on T-Vac Trolley to west high bay.

Lift LAT off Trolley. Set down on and move trolley.

---

**9.8. Radiator Removal**

9.8.1. **LAT Re-Orientation**

Mount top Extension Beams to Test Stand.

Rig Spreader Bars one on each hook in A-59 west high bay.

Rig Spreader Bars to Test Stand top Extension Beams. Lift LAT on Test Stand with two hooks using two spreader bars. Lower hook 1 to roll LAT until entire load is hanging from hook 2. Break Spreader Bar hanging from hook 1 off the top Extension Beams and pirouette LAT on Test Stand 180 degrees by swiveling hook 2. Re-rig hook 1 Spreader Bar to Extension Beams on opposite side of Test Stand and continue rotation by lifting hook 2. Once LAT is vertical, set down.

9.8.2. **Radiator Removal**

Electrically de-integrate Radiator from LAT.

Raise Dust Tent to clear top of Radiators.

Mechanically de-integrate Radiator from LAT and Test Stand. Break VCHP-XLHP/DSHP thermal joints, unbolt strut mount to Test Stand, and disconnect Radiator connection to RMB.

Lift Radiator off LAT and place in shipping container.

Repeat Radiator dismounting for second Radiator.

Mount heat pipe restraint plates at all 12 XLHP/DSHP joints.

Lower dust tent back over LAT.

Lift GPR with 4x4 Lift Fixture and connect to LAT.
Set dust tent down on the GPR.
Position Mass Properties Plate in west high-bay and check out.
Lift LAT with 4x4 Lift Fixture and set down on Mass Properties Plate. Disconnect GPR and remove. Set down GPR and 4x4 Lift Fixture.
Measure LAT/TIP mass and X/Y center of gravity.
Lift GPR using 4x4 Lift Fixture and mount to LAT.
Lift LAT off Mass Properties Plate and set on Test Stand. Break rigging and leave GPR with LAT.

10. Shipping to General Dynamics

10.1. LAT Packaging

Re-rig 4x4 Lift Fixture to GPR on LAT. Lift LAT with 4x4 Lift Fixture and set LAT into place in LAT Transport Container mount plate. Mount TIP to mount plate.
Disconnect GPR from RMB’s and remove.
Disconnect GN2 purge lines from under dust tent.
Disassemble dust tent from around LAT.
Install environmental and acceleration monitors on the LAT for shipping.
Bag LAT with ESD bagging.
Mount Transport Container cover.
Purge Transport Container with GN2 for TBD hours, then seal purge ports (TBD).

10.2. Shipping

Turn on environmental and acceleration monitors.
Ship.
11. **Appendix A: Ground Support Equipment List**

The following is a table of M-GSE and E-GSE and STE that is called-for in the environmental test sequence described in this document.

Note that this list includes all GSE described in the respective Test Plans, as well.

<table>
<thead>
<tr>
<th>MGSE Assembly</th>
<th>Ship/Receive</th>
<th>High-Bay Ops</th>
<th>Sine Vibe</th>
<th>EMI/EMC</th>
<th>Acoustic</th>
<th>T-Vac</th>
<th>Use / Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Interface Plate Ass’y</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Mounts LAT to slip table/expander head/Test Stand</td>
</tr>
<tr>
<td>Test Stand</td>
<td>X</td>
<td>?</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Support for EMI, acoustic, T-Vac tests; transports</td>
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<tr>
<td>Transport Container</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Holds LAT for shipping, storage</td>
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<td>Chill Bars and Aux. Cooling</td>
<td>?</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Cools LAT for in-air LPTs/CPTs</td>
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<td>SC Top Deck Acoustic Sim</td>
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<td></td>
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<td>Simulates SC top deck acoustic response</td>
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<td>Radiator SC Strut Sim’s</td>
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<td>Simulates SC support struts for Radiators</td>
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<td>Grid Perimeter Ring</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Lifting fixture for hoisting LAT into position</td>
</tr>
<tr>
<td>4 x 4 Lift Fixture</td>
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<td></td>
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<td>Lifting fixture for hoisting LAT into position</td>
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<tr>
<td>Radiator Lift Fixture</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Supports Radiators during integration</td>
</tr>
<tr>
<td>MGSE Cart</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Parking space for GPR / 4 x 4 Fixture</td>
</tr>
<tr>
<td>Heat Pipe Restraining Plates</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Supports un-attached DSHP’s/XLHP’s</td>
</tr>
<tr>
<td>Extension Beams</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>Used for turn-over and horiz lift/support of Test Stand</td>
<td></td>
</tr>
<tr>
<td>Spreader Bars</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>Used for turn-over</td>
<td></td>
</tr>
<tr>
<td>Radiator heater frame</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>Supports cartridge heaters for Rad sinks</td>
<td></td>
</tr>
<tr>
<td>ACD sink plates</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>Provides equiv sink env for ACD sides</td>
<td></td>
</tr>
<tr>
<td>ACD sink plate support frame</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Supports ACD sink plates</td>
<td></td>
</tr>
<tr>
<td>SC Simulator sink plates</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>Provides equiv sink env for Rad backsides</td>
<td></td>
</tr>
<tr>
<td>Top deck sink plate</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>Provides equiv sink env for X-LAT Plate</td>
<td></td>
</tr>
</tbody>
</table>

X = needed for test  ? = need is TBD or TBR for test

12. **Appendix B: TBX and CCC List**

TBD’s

6. [7]: LAT-DS-TBD, “LAT Cable Flow Layout”

9.7.1 Re-pick LAT using one hook and TBD rigging. Move over and set down on T-Vac trolley. Secure Test Stand on Trolley.

10.1 Purge Transport Container with GN2 for TBD hours, then seal purge ports (TBD).

TBR’s

9.7.2 Connect thermal panels to cooling source (TBR) and connect STE heaters to port plate feedthroughs.

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