

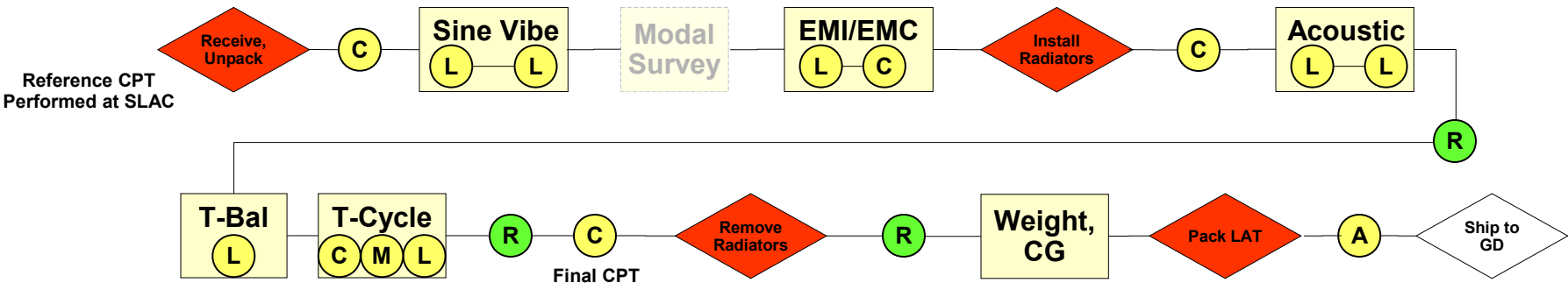
**LAT Environmental Test Planning and Design Review**

**3-4 May 2005**

**Operations and Logistics**

**Paul Dizon**

# LAT Environmental Test Flow



(A)

Aliveness

(C)

Limited Performance

(C)

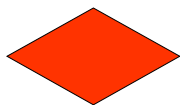
Comprehensive Performance

(M)

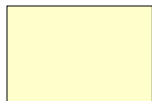
Muon Survey

(R)

Rotation of LAT



Non-Test Events / High-Bay Operations



Test Events Requiring Handling Operations

# Handling Operations

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- **Handling Operations Supporting Non-Test Events**
  - Unpacking LAT Instrument from Shipping Container
  - Installation of Radiator onto LAT Instrument
  - Rotation of LAT Instrument
  - Removal of Radiator onto LAT Instrument
  - Packing LAT Instrument for Shipment
  
- **Handling Operations Supporting Test Events**
  - Sine Vibration Test / Modal Survey
  - EMI/EMC Test
  - Acoustic Test
  - Thermal Balance/Thermal Cycle Test
  - Weight/CG Measurement

## Building A-59 Area of Operations

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- **NRL Vibration Test Facility – approximately 27 ft x 53 ft floor area**
- **NRL Acoustic Test Chamber – approximately 17 ft x 21 ft test area**
- **EMI/EMC Test Chamber – approximately 19 ft x 19 ft test area**
- **LAT Area – approximately 40 ft x 60 ft floor area for assembly operations and storage**
- **LAT Clean Tent – approximately 15 ft x 16 ft floor area for assembly and functional test operations with additional “non-clean” area for EGSE**
- **LAT Clean Room – approximately 21 ft x 33 ft floor area**

# Unpacking/Packing LAT Instrument

- **Location – Building A-59**
  - **LAT Area**
  - **LAT Clean Tent**
- **Mechanical Configuration**
  - **LAT Instrument will be oriented with the Z-axis vertical (+Z up) throughout this operation**
- **Electrical Configuration**
  - **EGSE required for Comprehensive Performance Testing following unpacking**
  - **EGSE required for Aliveness Testing following packing**
- **GSE Requirements**

MGSE	Use / Comments	Provider
Overhead Crane (20,000 lb)	Lift Operations	NRL
Forklift	Transport Operations	NRL
Test Stand	Supports the LAT	SLAC
Test Interface Plate Ass'y	Mounts LAT to shipping container/test stand	SLAC
Grid Perimeter Ring	Lifting fixture for hoisting LAT into position	SLAC
4x4 Lift Fixture	Lifting fixture for hoisting LAT into position	SLAC
MGSE Cart	Parking space for GPR/4x4 Fixture	SLAC
Heat Pipe Restraining Plates	Supports un-attached DSHP's/XLHP's	SLAC
Chill Bars and Aux. Cooling	Cool LAT for pre-/post-test LPT's	SLAC
Personnel Platforms	Access	NRL / SLAC

# Unpacking /Packing LAT Instrument - continued

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- **Operations Plan - Unpacking**
  - **Movement of Shipping Container and associated MGSE containers into LAT Area by means of NRL Forklift**
  - **Unpacking of MGSE from associated shipping containers**
  - **Positioning of Test Stand inside the LAT Clean Tent**
  - **Overhead crane will be used for the following operations:**
    - **Positioning of LAT Clean Tent away from the Test Stand**
    - **Removal of Shipping Container cover**
    - **Installation of the Grid Perimeter Ring**
    - **Removal of LAT from Shipping Container using the 4x4 Lift Fixture**
    - **Installation of LAT onto the Test Stand**
    - **Installation of the 4x4 Lift Fixture onto the MGSE Cart**
    - **Positioning of the LAT Clean Tent over the LAT**
  - **Installation of Heat Pipe Restraint Plates and Chill Bars**
- **Potential Obstacles**
  - **None**
- **Issues**
  - **Recommend pathfinder activity at NRL to verify unpacking/packing procedure**

# Installation/Removal of LAT Radiators

- **Location – Building A-59**
  - LAT Area
  - LAT Clean Tent
- **Mechanical Configuration**
  - LAT Instrument will be oriented with the Z-axis vertical (+Z up) throughout this operation
- **Electrical Configuration**
  - EGSE required for Comprehensive Performance Testing and is stationed outside of the LAT Clean Tent
- **GSE Requirements**

MGSE	Use / Comments	Provider
Overhead Crane (20,000 lb)	Lift Operations	NRL
Test Stand	Support the LAT	SLAC
Test Interface Plate Ass'y	Mounts LAT to test stand	SLAC
SC Strut Sim's	Simulates SC support struts for Radiators	SLAC
Chill Bars and Aux. Cooling	Cool LAT for pre-/post-test LPT's	SLAC
Personnel Platforms	Access	NRL / SLAC

# Installation of LAT Radiators - continued

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- **Operations Plan**
  - **Overhead crane will be used for the following operations:**
    - Positioning of LAT Clean Tent away from the LAT-Test Stand
    - Installation of the LAT Radiators (after removal of Heat Pipe Restraint Plates)
    - Positioning of the LAT Clean Tent over the LAT-Test Stand
  - **Installation of SC Strut Simulators**
  - **Installation of Chill Bars**
- **Potential Obstacles**
  - **None**
- **Issues**
  - **Recommend pathfinder activities at SLAC to verify installation procedure**



# Rotation of LAT Instrument

- **Location – Building A-59**
  - LAT Area
  - LAT Clean Tent
- **Mechanical Configuration**
  - LAT Instrument will be oriented with the Z-Axis horizontal (+X up) for Thermal Balance/Cycle and Weight/CG Measurement test activities
  - LAT Instrument will be oriented with the Z-Axis vertical (+Z up) for all other handling and test activities
- **Electrical Configuration**
  - None
- **GSE Requirements**

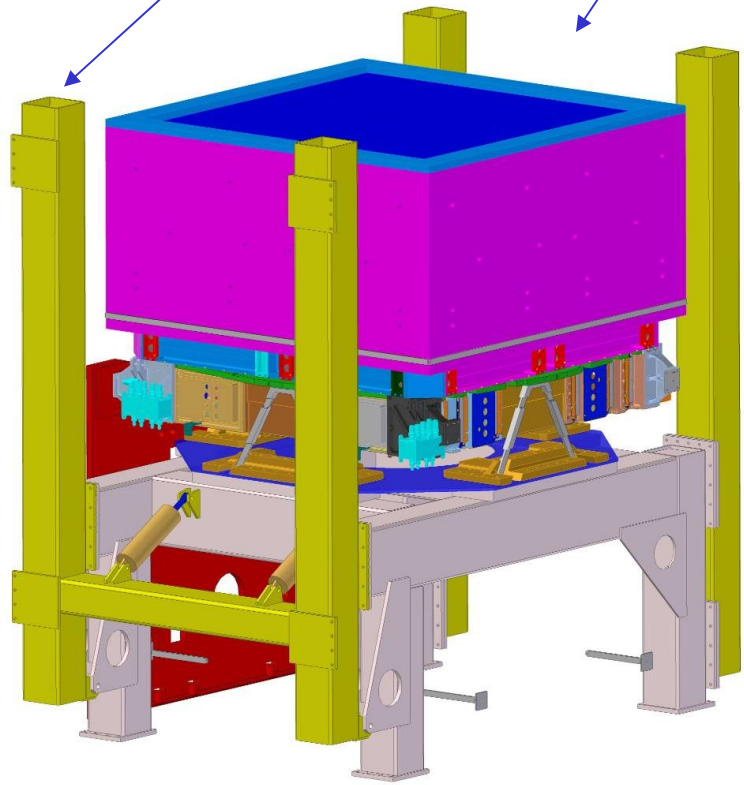
MGSE	Use / Comments	Provider
Overhead Crane (20,000 lb)	Lift/Rotation operations	NRL
Test Interface Plate Ass'y	Mounts LAT to Test Stand	SLAC
Test Stand	Supports the LAT	SLAC
Extension Beams	Supports the Test Stand during rotation of LAT	SLAC
Personnel Platforms	Access	NRL / SLAC

# Rotation of LAT Instrument - continued

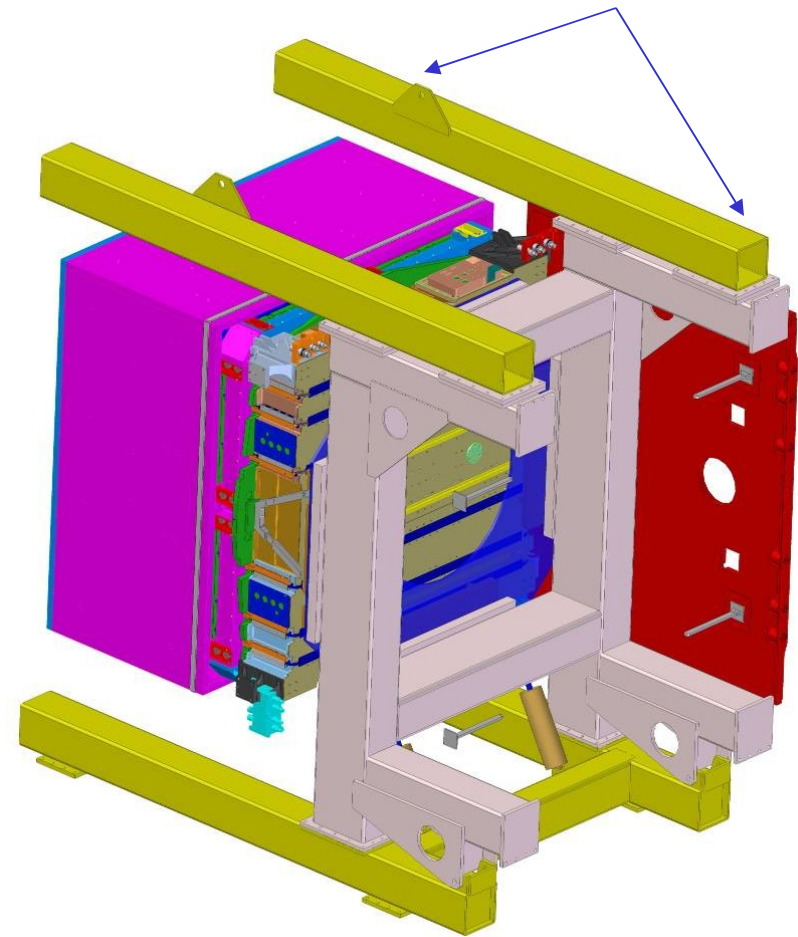
Extension beams bolt to Test Stand to allow for over-the-cg lift

Will likely need spreader bars or frame to close out extensions

Need 4 pick points for crane lift in horizontal configuration



LAT on Test Stand with Extension Beams for Lifting



LAT on Test Stand with Extender Beams Horizontal Lift and Feet

## Rotation of LAT Instrument - continued

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- **Operations Plan**
  - **Overhead crane in the LAT Area will be used for the following operations:**
    - **Installation of Extension Beams onto the LAT Test Stand**
    - **Rotation of the LAT - both trolleys of the Overhead Crane (20,000 lb) will be used to support rotation of the LAT Instrument in conjunction with the LAT Test Stand**
- **Potential Obstacles**
  - **None**
- **Issues**
  - **Recommend pathfinder activity at NRL to verify rotation procedure**

# Sine Vibration Test with Modal Survey Option

- **Location – Building A-59**
  - **NRL Vibration Test Facility**
- **Mechanical Configuration**
  - **LAT Instrument with Chill Bars, X-LAT Cooling, and Heat Pipe Restraint Plates**
  - **LAT Instrument will be oriented with the Z-Axis vertical (+Z up) throughout this test**
- **Electrical Configuration**
  - **EGSE required for Limited Performance Testing and is stationed next to vibration table**
  - **EGSE disconnected during vibration testing**
- **GSE Requirements**

MGSE	Use / Comments	Provider
Overhead Crane (10,000 lb)	Lift Operations	NRL
Dust Tent	Covers LAT in un-regulated environment	NRL
Test Stand	Support the LAT	SLAC
Test Interface Plate Ass'y	Mounts LAT to test stand, slip table, or expander head	SLAC
Grid Perimeter Ring	Lifting fixture for hoisting LAT into position	SLAC
4x4 Lift Fixture	Lifting fixture for hoisting LAT into position	SLAC
MGSE Cart	Parking space for GPR/4x4 Fixture	SLAC
Heat Pipe Restraining Plates	Supports un-attached DSHP's/XLHP's	SLAC
Chill Bars and Aux. Cooling	Cool LAT for pre-/post-test LPT's	SLAC
Personnel Platforms	Access	NRL / SLAC

- **Operations Plan – Installation for Axial (+Z axis up) Vibration Test**
  - **LAT-Test Stand Assembly will be rolled from the LAT Clean Tent to the Vibration Test Facility**
    - Access to Vibration Test Facility through either 12 ft or 18 ft wide roll-up door
  - **Overhead crane in the Vibration Test Facility will be used for the following operations:**
    - Lifting the LAT over the Ling B335/Kimball vibration table
    - Installation of the LAT onto the Expander Head of the Unholtz-Dickie T5000/TEAM vibration table
    - Removal of Dust Tent, if required (or suspend over LAT using the overhead crane)
    - Removal of Grid Perimeter Ring
    - Installation of the Grid Perimeter Ring and 4x4 Lift Fixture onto the MGSE Cart
  
- **Operations Plan – Installation for Lateral Vibration Test**
  - **Overhead crane in the Vibration Test Facility will be used for the following disassembly operations:**
    - Removal of the LAT from the Expander Head
    - Temporary installation of the LAT onto the slip table of the adjacent vibration table (Ling B335/Kimball) or lift over the adjacent vibration table onto the LAT Test Stand
    - Removal of the Expander Head from the Unholtz-Dickie T5000 shaker (stored adjacent to shaker)
    - Removal of the Load Support Frame (stored adjacent to shaker)
  - **Rotate Unholtz-Dickie T5000 shaker and attach to the slip table via the transfer bar**

- **Operations Plan – Installation for Lateral Vibration Test - continued**
  - **Overhead crane in the Vibration Test Facility will be used for the following installation operations:**
    - **Lifting the LAT over the Ling B335/Kimball vibration table**
    - **Installation of the LAT onto the Slip Table of the Unholtz-Dickie T5000/TEAM vibration table**
    - **Removal of Dust Tent, if required (or suspend over LAT using the overhead crane)**
    - **Removal of Grid Perimeter Ring**
    - **Installation of the Grid Perimeter Ring and 4x4 Lift Fixture onto the MGSE Cart**
- **Potential Obstacles**
  - **LAT Instrument must be lifted over the Ling B335/Kimball vibration table to access test area.**
- **Issues**
  - **Need to fit-check LAT Test Interface Plate with slip table and expander head**
  - **Recommend pathfinder activity at NRL to verify movement of the LAT within the Vibration Test Facility**

## EMI/EMC Test

- **Location – Building A-59**
  - **EMI/EMC Test Chamber**
- **Mechanical Configuration**
  - **LAT Instrument with Chill Bars, X-LAT Cooling, and Heat Pipe Restraint Plates**
  - **LAT Instrument will be oriented with the Z-Axis vertical (+Z up) throughout this test**
- **Electrical Configuration**
  - **EGSE required for Comprehensive and Limited Performance Testing**
  - **EGSE is stationed inside EMI test control room**
- **GSE Requirements**

MGSE	Use / Comments	Provider
Dust Tent	Covers LAT in un-regulated environment	NRL
Test Stand	Support the LAT	SLAC
Test Interface Plate Ass'y	Mounts LAT to test stand	SLAC
Heat Pipe Restraining Plates	Supports un-attached DSHP's/XLHP's	SLAC
Chill Bars and Aux. Cooling	Cool LAT for pre-/post-test LPT's	SLAC
Personnel Platforms	Access	NRL / SLAC

## EMI/EMC Test - continued

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- **Operations Plan**

- **LAT-Test Stand Assembly will be rolled from the Vibration Test Facility to the EMI/EMC Test Facility**
  - Access to EMI/EMC Test Facility through the 12.75 ft wide sliding door
- **Removal of casters once the LAT is positioned inside the EMI/EMC chamber**
- **Securing of Dust cover**
- **Connection of Auxiliary cooling**

- **Potential Obstacles**

- **¾ inch lip at entrance to EMI/EMC test chamber door**

- **Issues**

- **Recommend pathfinder to verify that LAT can be loaded into EMI/EMC chamber using a ramp**
- **Need to verify the load capacity of the bridge spanning the tracks between the LAT Area and the EMI/EMC Test Chamber by load testing**



# Acoustic Test

- **Location – Building A-59**
  - **Acoustic Test Chamber**
- **Mechanical Configuration**
  - **LAT Instrument with Radiators**
  - **LAT Instrument will be oriented with the Z-Axis vertical (+Z up) throughout this test**
- **Electrical Configuration**
  - **EGSE required for Limited Performance Testing**
  - **EGSE is stationed outside of Acoustic Chamber**
- **GSE Requirements**

MGSE	Use / Comments	Provider
Test Interface Plate Ass'y	Mounts LAT to Test Stand	SLAC
Test Stand	Use with casters/jacks to move into chamber	SLAC
SC Top Deck Acoustic Sim	Simulates SC top deck acoustic response	SLAC
SC Strut Sim's	Simulates SC support struts for Radiators	SLAC
Dust Tent	Covers LAT in un-regulated environment	SLAC
Chill Bars and Aux. Cooling	Cool LAT for pre-/post-test LPT's	SLAC
Personnel Platforms	Access	NRL / SLAC

## Acoustic Test - continued

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- **Operations Plan**
  - After installation of Radiators, the SC Top Deck Acoustic Simulator and Strut Simulator is installed
  - LAT-Test Stand Assembly is then rolled from the EMI/EMC Test Facility to the Acoustic Chamber
    - Access to Acoustic Chamber through the 12 ft wide sliding door
  - Removal of casters once the LAT is positioned inside the EMI/EMC chamber
  - Connection of Auxiliary cooling
- **Potential Obstacles**
  - ¼ inch lip seal on floor at entrance to Acoustic Chamber door
- **Issues**
  - Recommend pathfinder to verify that LAT can be loaded into Acoustic chamber using a ramp
  - Volumetric flow rate of the nitrogen through the speakers may prevent the use of the LAT Dust Tent – recommend cleaning of chamber

# Thermal Testing

- **Location – Building A-59**
  - Thermal-Vacuum Chamber (Big Blue)
  - LAT Area
  - LAT Clean Tent
- **Mechanical Configuration**
  - LAT Instrument with Radiators
  - LAT Instrument will be oriented with the Z-Axis horizontal (+X up) throughout this test
  - Radiators must be leveled to 0.1 degrees from horizontal or better
- **Electrical Configuration**
  - EGSE required for Comprehensive / Limited Performance Testing and Muon Testing
  - EGSE is stationed on the East-side of the Thermal-Vacuum Chamber
- **GSE Requirements**

MGSE	Use / Comments	Provider
Test Interface Plate Ass'y	Mounts LAT to Test Stand	SLAC
Test Stand	Use with adapters to facilitate rotation of LAT	SLAC
TVAC Trolley Table	Supports the LAT for TVAC testing	NRL
TVAC Trolley Transport	Rolling Platform for LAT/TVAC Trolley Table Assy	NRL
Dust Tent	Covers LAT in un-regulated environment	SLAC
Chill Bars and Aux. Cooling	Cool LAT for pre-/post-test LPT's	SLAC
Personnel Platforms	Access	NRL / SLAC

## Thermal Testing - continued

- **Operations Plan – Rotation of LAT and Installation onto TVAC Trolley Table**
  - Positioning of TVAC Trolley Table Assembly inside LAT Clean Tent
  - Overhead crane in the Acoustic Chamber will be used for the following operations:
    - Positioning of LAT Clean Tent away from the TVAC Trolley Table Assembly
    - Performing LAT Rotation Procedure
    - Installation of Rotated LAT-Test Stand Assembly onto the TVAC Trolley Table Assembly
    - Installation of Thermal Panel Assembly onto the LAT
    - Positioning of the LAT Clean Tent over the TVAC Trolley Table Assembly
  - Complete final TVAC close-out prior to loading LAT into TVAC Chamber
- **Operations Plan –Installation of the LAT into the TVAC Chamber**
  - LAT-Trolley Table Assembly will be rolled from the LAT Clean Tent to the TVAC Chamber
  - Attachment of Trolley to the track within the TVAC chamber
  - Rolling TVAC Trolley Table from the Trolley Transport into the TVAC Chamber and secure
- **Potential Obstacles**
  - Overhead I-beam in front of thermal-vacuum chamber
- **Issues**
  - Recommend pathfinder activity at NRL to verify procedure
  - Complete assessment of load capacity for TVAC Table/Trolley and rails within the TVAC chamber to determine if modifications are required

# Weight and CG Measurement

- **Location – Building A-59**
  - **LAT Area**
  - **T-Slotted Floor Area**
- **Mechanical Configuration**
  - **LAT Instrument without Radiators**
  - **Two configurations: +X and +Z facing upward**
- **Electrical Configuration**
  - **EGSE is not required for this activity**
- **GSE Requirements**

MGSE	Use / Comments	Provider
Test Interface Plate Ass'y	Mounts LAT to Test Stand	SLAC
Test Stand	Use with adapters to facilitate rotation of LAT	SLAC
Load Cells	3K, 5K, 10K load capacity is available	NRL

## Weight and CG Measurement - continued

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- **Operations Plan**
  - Following removal of the radiators, the weight and CG measurement will take place in the LAT Area
  - Overhead crane in the LAT Area will be used for the following operations:
    - Rotation of the LAT for axial or lateral CG measurements
    - Installation of Rotated LAT-Test Stand Assembly onto the CG test fixture
- **Potential Obstacles**
  - None
- **Facility-Specific Issues**
  - Overhead Crane (20,000 lb) will be used to support the LAT Instrument during measurement.
  - Both trolleys of the Overhead Crane (20,000 lb) will be used to support rotation of the LAT Instrument
- **Issues**
  - Recommend pathfinder activity at NRL to verify procedure

# Proposed Pathfinder Test Activities

Pathfinder Activity	Objective	Required MGSE
LAT Unpacking/Packing	Verify procedure	Shipping Container LAT Test Fixture LAT Mass Simulator Lift Fixture/GPR
LAT Radiator Installation	Verify procedure	LAT Test Fixture LAT Mass Simulator Lift Fixture/GPR
LAT Rotation	Verify procedure	LAT Test Fixture LAT Mass Simulator Extension Beams Lift Fixture/GPR
LAT / Test Fixture Movement	Verify movement of LAT/Test Fixture between test facilities	LAT Test Fixture LAT Mass Simulator

## Proposed Pathfinder Test Activities - continued

Pathfinder Activity	Objective	Required MGSE
Vibration Test Facility	Verify movement of LAT within the Vibration Test Facility Verify installation procedure of LAT onto the Slip Table and Expander Head	LAT Test Fixture LAT Mass Simulator
EMI/EMC Chamber	Verify procedure Verify ability to load LAT into the EMI/EMC chamber	LAT Test Fixture LAT Mass Simulator
Acoustic Chamber	Verify procedure Verify ability to load LAT into the Acoustic chamber	LAT Test Fixture LAT Mass Simulator
TVAC Trolley Movement	Verify procedure Verify movement of LAT/TVAC Trolley between LAT Clean Tent and TVAC Chamber	TVAC Table TVAC Trolley LAT Mass Simulator
TVAC Table Installation	Verify procedure Verify transfer from Trolley to TVAC Chamber	TVAC Table TVAC Trolley LAT Mass Simulator
Weight/CG Measurement	Verify procedure	LAT Test Fixture LAT Mass Simulator Extension Beams Lift Fixture/GPR