

LAT-TD-07690-02

13 September 2006

LAT Interface Survey Analysis Report

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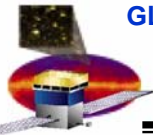
Revision Information and Supporting Documents

- **Revision History**
 - **Rev 02:**
 - 13 Sep 2006: added ACD, final Radiator panel, and X-LAT Plate dimensional inspection data from NRL inspections after thermal-vacuum testing
 - 23 Aug 2006: added heat pipe data and stayclear envelope survey checks; added heat pipe data and stayclear checks; changed name and scope to include only surveys supporting interface verification (was “LAT Final Survey Results”)
 - 13 Apr 2006: added E-box third layer and EMI Shield flatness/step height survey data and conclusions

- **Supporting Documents**
 - LAT-DS-00851, “TKR-LAT Interface Definition Drawing”
 - LAT-MD-00895, “LAT Survey Plan”
 - LAT-MD-03566, “Tracker Tower Assembly and Alignment Plan”
 - LAT-MD-01196, “LAT Dynamics Test Plan”
 - LAT-DS-01221, “Radiator Interface Definition Drawing
 - LAT-DS-00040, “LAT Envelope Drawing”

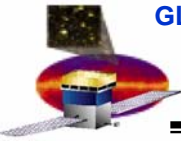
- **Other documents containing survey results**
 - LAT-TD-06368, “Grid Survey Analysis Report”
 - LAT-TD-08509, “LAT Internal Features Survey Analysis Report

All dimensions in millimeters (mm) unless expressly shown otherwise



Outline

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Introduction

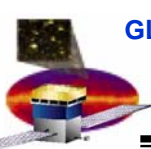
- **This documents compliance with LAT dimensional and interface requirements**
 - **The following chart lists all dimensional and interface requirements needing verification, the results of verification surveys, and a cross-reference to the chart containing the compliance details**
 - **This document contains the survey data and compliance analysis**
- **The reference numbers (e.g.: C17) identify the data product and refers back to the initial definition of that data item in LAT-MD-00895, the “LAT Survey Plan”**
 - **Note that not all data products called out in the LAT Survey Plan are delineated in this document**
 - **Only those data products related to the verification of an interface are included**

Summary of LAT Interface Verification Results

Verif ID	Req ID	Topic	Requirement Text	Inspections Req'd	Page	Comply
LVP119	LPS355	Instrument Interface Surface	The LAT shall interface to the Instrument Interface Structure using the mounting locations as shown in IRD Figure A-1.	S/C I/F size & locations	8, 11	Use As-Is
LVP381	LPS1134	LAT Alignment Features	The LAT shall provide features as defined in LAT-Spacecraft ICD (doc # 1196 EI-Y46311-000C) Appendix A to provide measurement of the LAT coordinate system.	Tooling holes, S/C pads	19	Provided
LVP38	LPS351	Mechanical Envelope	The maximum static dimensions of the LAT shall be constrained as defined in the LAT-SC IRD, Figure A-1.	LAT & Radiator envelope	22, 23, 24	Comply
LVP118	LPS353	LAT Stay Clear Zone	The LAT shall not violate the static stay-clear dimensions defined in drawing A-1. The dimensions define the maximum envelope available for the instrument for static design purposes, and margin to allow for dynamic instrument motions under load.	LAT & Radiator envelope	22, 23, 24	Comply
LVP136	LPS415	LAT Static Design Envelope	The SC will accommodate the LAT's thermal radiators, as shown in drawing Figure A-1, and described in the following subparagraphs. Figure A-1 shall define the static design envelope for the LAT hardware, and the SC will allow for the LAT's violation of this envelope under load, as negotiated and documented in the SC-LAT ICD.	LAT & Radiator envelope plus Ku's analysis that says we stay within dynamic envelope	22, 23, 24	Comply
LVP339	MEC3-117	Mechanical Systems Static Envelope	Mechanical Systems components and assemblies, including Radiators, shall stay within the static envelope, and not place other subsystem components outside said envelope, as defined in the IRD, Appendix A. [same as IRD 3.2.2.1 Ver: I]	LAT & Radiator envelope	22, 23, 24	Comply
LVP344	MEC3-172	LAT Alignment	The Grid structure with CAL, ACD, and TKR mounted, shall maintain alignment of subsystem interfaces to 30 arc-minutes with respect to the LAT Interface Plane (LIP), after ground testing and launch. [derived from (TBD) Ver: I]	Subsystem measurements	25	Comply

Summary of Radiator Interface Verification Results

Verif ID	Req ID	Topic	Requirement Text	Inspections Req'd	Page	Comply
LVP562	LPS425	LAT Radiator to SC Interface	The LAT Radiator shall interface to the spacecraft provided Radiator Support Struts using the pad size and locations defined in IRD Figure A-1 View G-G of Appendix A.	Radiator - Strut I/F size & locations	28	Comply
LVP141	LPS431	LAT Radiator Mounting	The LAT radiators shall be supported by both the LAT and the SC. The SC-LAT-radiator mount point location(s) on each radiator shall be negotiated and documented in the SC-LAT ICD. Each SC-LAT-radiator mount point will allow complete translational freedom of movement in the plane of the radiator and complete rotational freedom of movement about the mount point.	Rad strut pad locations	28	Comply
LVP382	LPS1136	LAT Radiator Mounting Inserts	The LAT shall provide threaded inserts for the strut mounting holes in the radiators.	Radiator strut mount insert locations	28	Comply
LVP137	LPS417	LAT Radiator Size and Configuration	The SC shall accommodate, and the LAT thermal design shall be consistent with, a minimum radiating area for the LAT Radiators of 5.4 m ² . This area shall be configured as two separate radiators, each with a minimum radiating area of 2.7 m ² , including the outward facing surfaces of the VCHP reservoir volume. The radiators shall be no more than 1.903 m wide, with a stay-clear dimension of 54.5 mm to accommodate the thickness of the radiators and any attached MLI.	Radiator dimensions	30, 32	Comply
LVP139	LPS427	Dynamic and Thermal Motion Cutouts	Five cutouts are defined in View B-B of 433-IRD-0001 Appendix A. The radiators shall not encroach into these cutout volumes. The spacecraft shall ensure that hardware penetrating through these cutouts maintains a clearance to the envelope to accommodate all predicted dynamic and thermal relative motions.	Radiator dimensions	30	Comply
LVP138	LPS423	VCHP Stay Clear	An additional stay-clear dimension of 59.5 mm, 48 mm on the outboard side and 11.5 mm on the inboard side, is included at the -Z end of the radiators to accommodate the Variable Conductance Heat Pipes (VCHPs), as shown in View A-A of 433-IRD-0001 Figure	Radiator dimensions	33	Comply
LVP140	LPS429	LAT Radiator Positioning	The LAT radiators shall be nominally positioned as shown in drawing 433-IRD-0001, Figure A-1. The nominally flat radiating surfaces shall be positioned parallel to the XZ-plane of the Observatory, to a tolerance consistent with meeting the yaw-steering heat load requirement contained in the Spacecraft Performance Specification, 433-SPEC-0003.	Radiator location	33	Comply



2. SC-LAT Interface Features

SC-LAT Interface Holes: Reamed Pin Holes

- Reamed pin holes
 - Pin holes were located using the drill template delivered by General Dynamics
 - 3 out of 4 reamed pin holes are out of the tolerances shown on EIY46311-000D, the SC-LAT ICD (true position to 0.120 [0.006”])
 - Worst hole is out of tolerance by 0.028 [0.001”], radially
 - All holes were fit-checked using the drill template supplied by General Dynamics, the mate of which was used to drill the flexure holes, thus their absolute position is not as important as how well they align with the tool

LVP119

Conclusion: **OK to use as-is**

SC-LAT Interface Holes: Tapped Bolt Holes

- **7/16-20 UNF tapped holes with keenserts**
 - These were drilled and tapped to tolerances on the Grid drawing
 - LAT-DS-01279 Grid Machining drawing: 5 out of 8 holes are out of the tolerance shown on the Grid drawing (tolerance: true position to 0.203 [0.008”])
 - EIY46311-000D SC-LAT ICD: the same 5 out of 8 holes are out of the tolerance shown on the ICD drawing (tolerance: true position to 0.250 [0.010”])
- **Rationale for investigating the possibility of using the tapped holes as-is: hole positions with respect to the Flexures**
 - The flexures are mounted to the SC using the mating half of the LAT drill template, so the flexure reamed hole and LAT reamed pin hole centerlines will be very collinear
 - Since the two mating reamed holes are aligned by definition, what matters most is that the position of the tapped holes in the Grid *with respect to the neighboring pin hole* in the Grid allows the bolt to fit through the clearance hole in the flexure, given its tolerances *with respect to the neighboring pin hole* in the flexure
 - Analysis discussed on the following pages shows the relative alignment of these mounting hole features relative to the pin holes for both the Grid and Flexures, as well as the expected fit that results
- **The conclusion is that all tapped holes align to their corresponding flexure holes, with margin, and can be used as-is**

SC-LAT Interface Hole Details

- **Methodology for analyzing relative hole locations**
 - Grid tapped hole and flexure clearance hole locations were calculated relative to the neighboring pin holes—these as-built offsets are the vector difference between their global as-built locations
 - The as-built relative locations are then subtracted from the nominal offsets of 36.51 (from the ICD)—this is the delta, or error in the hole's location from its nominal, relative to the neighboring pin hole (dX and dY)
 - The as-built true position tolerance (TP) of the hole is calculated from the deltas—this is the diameter of a circle with the nominal hole center at its center, and the as-built hole center on the circle. Thus, the radius of the circle is the root sum of the squares of dX and dY
 - Finally, the as-built true position is added to the actual hole diameter to yield the apparent diameter—this is the diameter that the feature would need to be if its center were at the nominal location and the perimeter just touched the perimeter of the real feature
 - The apparent diameter of the tapped hole (which will contain a collinear screw) must be smaller than that of the clearance hole for the two to fit together—subtracting the radii of these two apparent circles gives the expected minimum gap (margin) at the point of closest approach
- The table on the next page shows the expected gaps between the screw and the clearance hole in the flexure for each of the 8 hole locations

SC-LAT Interface Hole Analysis Summary

- The table shows that the minimum expected gap is 0.136 [0.0054”]
- The analysis that results in the gaps shown in the table use all as-built inspection data
 - **Grid:** uses hole location inspection data from the Grid optical survey
 - **Flexures:** uses hole location and diameter inspection data of the flight flexures
- The survey established hole locations by making a best-fit circle of the inside of the keensert
 - Standard deviation of the fit was 0.025 [0.001”] or less for all but 1 hole
 - All survey data was transformed into the Grid Coordinate System, which used the datum D and E holes in the Grid (same holes as those called out in the SC-LAT ICD)
 - For all 8 holes, the expected gap size is more than six times larger than the survey precision

LVP119

Disposition

- **OK to use as-is**
- **Use all Grid-SC interface holes as-is, with no further analysis or inspection needed**
- **See LAT-SC ICD, ICN #095 dated 24 August 2005**

(dims in mm)	Expected Gap	
Pin Hole	Left	Right
P0 Hole (+X side)	0.190	0.167
P1 Hole (+Y side)	0.220	0.136
P2 Hole (-X side)	0.314	0.321
P3 Hole (-Y side)	0.278	0.185

SC-LAT Interface Hole Detailed Analysis: +X Side

Grid-SC Interface Hole Fit

Summary of Gaps Between Bolt and Flexure Hole

Print Date: 25-Aug-06

Data Date: 1/2-Apr-05

(uses Grid tapped hole and flexure through hole as-built dims)

P0 Hole (+X side)	Left Tapped Hole		Center Pin Hole		Right Tapped Hole	
	X	Y	X	Y	X	Y
P0 Nom	775.005	36.513	775.005	0.000	775.005	-36.513
P0 Actual	775.036	36.311	774.948	-0.054	775.067	-36.710
Delta (Act-Nom)	0.031	-0.202	-0.057	-0.054	0.062	-0.197
T.P. Delta	0.408		0.157		0.414	
LAT-DS-01279 Grid						
T.P. Tolerance	0.203		---		0.203	
Pass/Fail	FAIL		---		FAIL	
EIY46311-000D ICD						
T.P. Tolerance	0.250		0.120		0.250	
Pass/Fail	FAIL		FAIL		FAIL	
Grid Relative to Pin Hole						
Nom from nom pin hole	0.000	36.513	0	0	0.000	-36.513
Act from actual pin hole	0.088	36.365	-0.057	-0.054	0.119	-36.656
T.P. Delta from act pin hole	0.344				0.373	
Screw max apparent diam from nom	11.456				11.485	
Flexure Relative to Pin Hole						
Nom from nom pin hole	0.000	36.513	0.000	0.000	0.000	-36.513
Act from actual pin hole	0.041	36.533			-0.005	-36.523
T.P. Delta from act pin hole	0.091				0.023	
Flexure hole as-built diam	11.928				11.841	
Hole min apparent diam from nom	11.837				11.819	
Gap at screw and hole MMC (+)=gap	0.190				0.167	
Fit OK?	OK				OK	

Tolerance from Grid drawing

Tolerance from ICD drawing

= tapped hole actual - pin hole actual

= $2 * \text{RSS}(dX, dY)$

= Nom diam + T.P. diametral tolerance

Same as nominals on Grid

Copied from 'Spectrum Flexure Survey Data' sheet

= $2 * \text{RSS}(dX, dY)$

Inspection data from Spectrum

= (flexure hole as-built diam) - (T.P. diametral tol)

Gap=(hole min apparent diam - screw max apparent diam)/2

SC-LAT Interface Hole Detailed Analysis: +Y Side

Grid-SC Interface Hole Fit

Summary of Gaps Between Bolt and Flexure Hole

Print Date: 25-Aug-06

Data Date: 1/2-Apr-05

(uses Grid tapped hole and flexure through hole as-built dims)

P1 Hole (+Y side)	Left Tapped Hole		Center Pin Hole		Right Tapped Hole	
	X	Y	X	Y	X	Y
P1 Nom	-36.513	775.005	0.000	775.005	36.513	775.005
P1 Actual	-36.433	774.999	-0.055	775.019	36.655	774.936
Delta (Act-Nom)	0.080	-0.006	-0.055	0.014	0.142	-0.069
T.P. Delta	0.159		0.114		0.316	
LAT-DS-01279 Grid						
T.P. Tolerance	0.203		---		0.203	
Pass/Fail	PASS		---		FAIL	
EIY46311-000D ICD						
T.P. Tolerance	0.250		0.120		0.250	
Pass/Fail	PASS		PASS		FAIL	
Grid Relative to Pin Hole						
Nom from nom pin hole	-36.513	0.000	0	0	36.513	0.000
Act from actual pin hole	-36.378	-0.020	-0.055	0.014	36.710	-0.083
T.P. Delta from act pin hole	0.272				0.428	
<i>Screw max apparent diam from nom</i>	11.384				11.541	
Flexure Relative to Pin Hole						
Nom from nom pin hole	-36.513	0.000	0.000	0.000	36.513	0.000
Act from actual pin hole	-36.487	0.033			36.553	-0.005
T.P. Delta from act pin hole	0.083				0.082	
Flexure hole as-built diam	11.908				11.895	
<i>Hole min apparent diam from nom</i>	11.824				11.813	
Gap at screw and hole MMC (+)=gap	0.220				0.136	
Fit OK?	OK				OK	

Tolerance from Grid drawing

Tolerance from ICD drawing

= tapped hole actual - pin hole actual

= 2* RSS(dX, dY)

=Nom diam + T.P. diametral tolerance

Same as nominals on Grid

Copied from 'Spectrum Flexure Survey Data' sheet

= 2* RSS(dX, dY)

Inspection data from Spectrum

= (flexure hole as-built diam) - (T.P. diametral tol)

Gap=(hole min apparent diam - screw max apparent diam)/2

SC-LAT Interface Hole Detailed Analysis: -X Side

Grid-SC Interface Hole Fit

Summary of Gaps Between Bolt and Flexure Hole

(uses Grid tapped hole and flexure through hole as-built dims)

Print Date: 25-Aug-06

Data Date: 1/2-Apr-05

P2 Hole (-X side)	Left Tapped Hole		Center Pin Hole		Right Tapped Hole	
	X	Y	X	Y	X	Y
P2 Nom	-775.005	-36.513	-775.005	0.000	-775.005	36.513
P2 Actual	-774.979	-36.594	-775.038	-0.082	-774.996	36.470
Delta (Act-Nom)	0.026	-0.081	-0.033	-0.082	0.009	-0.043
T.P. Delta	0.171		0.177		0.087	
LAT-DS-01279 Grid						
T.P. Tolerance	0.203		---		0.203	
Pass/Fail	PASS		---		PASS	
EIY46311-000D ICD						
T.P. Tolerance	0.250		0.120		0.250	
Pass/Fail	PASS		FAIL		PASS	
Grid Relative to Pin Hole						
Nom from nom pin hole	0.000	-36.513	0	0	0.000	36.513
Act from actual pin hole	0.059	-36.512	-0.033	-0.082	0.042	36.552
T.P. Delta from act pin hole	0.118				0.115	
<i>Screw max apparent diam from nom</i>	11.231				11.228	
Flexure Relative to Pin Hole						
Nom from nom pin hole	0.000	-36.513	0.000	0.000	0.000	36.513
Act from actual pin hole	-0.066	-36.579			-0.005	36.413
T.P. Delta from act pin hole	0.187				0.198	
Flexure hole as-built diam	12.045				12.068	
<i>Hole min apparent diam from nom</i>	11.858				11.869	
Gap at screw and hole MMC (+)=gap	0.314				0.321	
Fit OK?	OK				OK	

Tolerance from Grid drawing

Tolerance from ICD drawing

= tapped hole actual - pin hole actual

= $2^* \text{RSS}(dX, dY)$

=Nom diam + T.P. diametral tolerance

Same as nominals on Grid

Copied from 'Spectrum Flexure Survey Data' sheet

= $2^* \text{RSS}(dX, dY)$

Inspection data from Spectrum

= (flexure hole as-built diam) - (T.P. diametral tol)

Gap=(hole min apparent diam - screw max apparent diam)/2

SC-LAT Interface Hole Detailed Analysis: -Y Side

Grid-SC Interface Hole Fit

Print Date: 25-Aug-06

Summary of Gaps Between Bolt and Flexure Hole

Data Date: 1/2-Apr-05

(uses Grid tapped hole and flexure through hole as-built dims)

P3 Hole (-Y side)	Left Tapped Hole		Center Pin Hole		Right Tapped Hole	
	X	Y	X	Y	X	Y
P3 Nom	36.513	-775.005	0.000	-775.005	-36.513	-775.005
P3 Actual	36.620	-775.188	0.065	-775.052	-36.444	-775.238
Delta (Act-Nom)	0.107	-0.183	0.065	-0.047	0.069	-0.233
T.P. Delta	0.425		0.161		0.486	
LAT-DS-01279 Grid						
T.P. Tolerance	0.203		---		0.203	
Pass/Fail	FAIL		---		FAIL	
EIY46311-000D ICD						
T.P. Tolerance	0.250		0.120		0.250	
Pass/Fail	FAIL		FAIL		FAIL	
Grid Relative to Pin Hole						
Nom from nom pin hole	36.513	0.000	0	0	-36.513	0.000
Act from actual pin hole	36.555	-0.136	0.065	-0.047	-36.509	-0.186
T.P. Delta from act pin hole	0.285				0.372	
Screw max apparent diam from nom	11.397				11.485	
Flexure Relative to Pin Hole						
Nom from nom pin hole	36.513	0.000	0.000	0.000	-36.513	0.000
Act from actual pin hole	36.553	-0.013			-36.452	-0.048
T.P. Delta from act pin hole	0.085				0.156	
Flexure hole as-built diam	12.040				12.009	
Hole min apparent diam from nom	11.954				11.854	
Gap at screw and hole MMC (+)=gap	0.278				0.185	
Fit OK?	OK				OK	

Tolerance from Grid drawing

Tolerance from ICD drawing

= tapped hole actual - pin hole actual
 = $2 * \text{RSS}(dX, dY)$

=Nom diam + T.P. diametral tolerance

Same as nominals on Grid

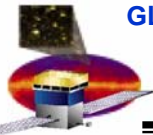
Copied from 'Spectrum Flexure Survey Data' sheet

= $2 * \text{RSS}(dX, dY)$

Inspection data from Spectrum

= (flexure hole as-built diam) - (T.P. diametral tol)

Gap=(hole min apparent diam - screw max apparent diam)/2

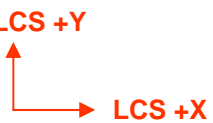
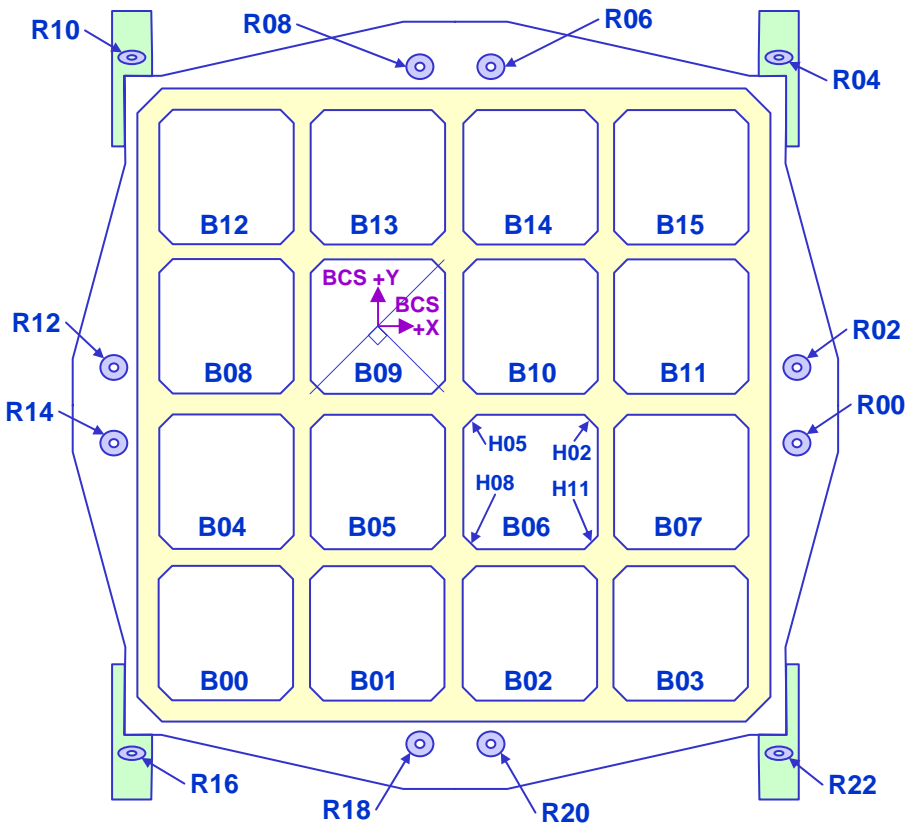
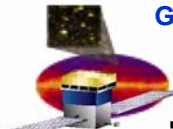


3. LAT Alignment Fiducials

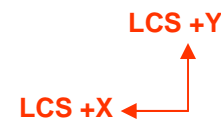
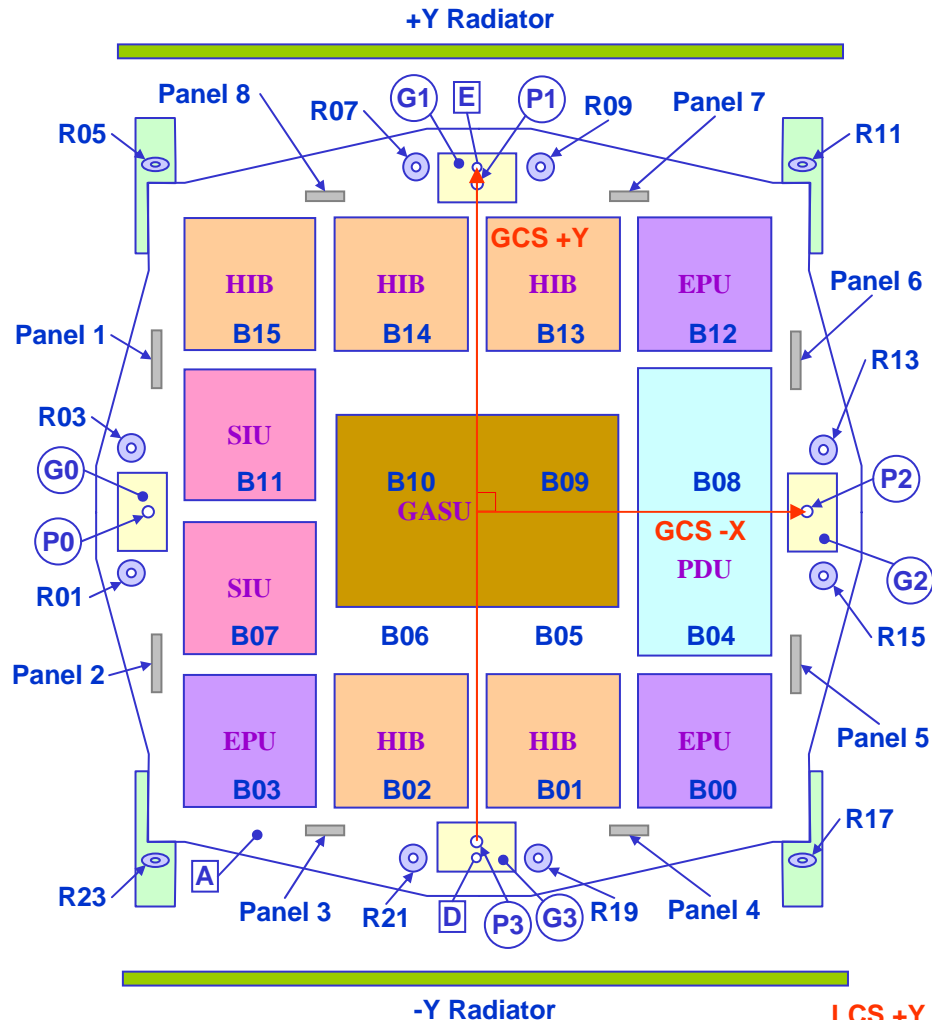
LAT Alignment Fiducial Definitions

- The LAT Grid includes precision reamed holes that are used for establishing the location of the Grid and LAT coordinate systems
 - The holes are used in conjunction with retro-reflector tooling balls and laser trackers to re-construct the location and relative positions of components on the LAT
 - This is done by determining the XYZ-offset of each ball to the origin of the LAT Coordinate System
- The following charts show a map of the approximate locations of the reflector balls on the Grid, and a table detailing the actual, as-surveyed locations of the ball centers, relative to the LAT Coordinate System
- Note that the offset from the Grid Coordinate System to the LAT Coordinate System is -249.143 mm along the Z-axis

Retro-Reflector Ball Location Map



LAT Top View



LAT Bottom View

B = Bay number
 G = Grid interface planes
 H = Holes at TKR interface
 P = Points at SC Mount shear pin
 R = Reflector ball hole locations

Retro-Reflector Ball Location Offsets

LVP381

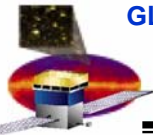
The table shows the location offsets of the retro-reflector balls to the LCS origin

- Note that the actual values only are needed to reconstruct the LCS
- All coordinates are to the center of a 1.5000" ball diameter, 1.0000" offset from the intersection of the reamed hole and spotfaced surface

Grid Feature Locations

Data Date: April 1-2, 2005
 Sheet Rev'd on: 25-Aug-06
 Print Date: 25-Aug-06

Item	Grid Feature	CS	Actual Surveyed Coords		
			X	Y	Z
Grid Reflector Ball Holes					
D3	R00: +X Wing Top	LCS	816.082	-50.829	-211.211
D3	R01: +X Wing Bot	LCS	815.907	-101.547	-235.496
D3	R02: +X Wing Top	LCS	816.061	50.785	-211.219
D3	R03: +X Wing Bot	LCS	815.883	101.662	-235.537
D3	R04: +X/+Y RMB Top	LCS	783.546	836.439	-256.261
D3	R05: +X/+Y RMB Bot	LCS	783.576	836.485	-443.475
D3	R06: +Y Wing Top	LCS	50.774	816.120	-211.165
D3	R07: +Y Wing Bot	LCS	101.543	816.045	-235.527
D3	R08: +Y Wing Top	LCS	-50.820	816.107	-211.146
D3	R09: +Y Wing Bot	LCS	-101.631	816.012	-235.439
D3	R10: -X/+Y RMB Top	LCS	-783.756	836.322	-255.993
D3	R11: -X/+Y RMB Bot	LCS	-783.706	836.348	-443.092
D3	R12: -X Wing Top	LCS	-816.026	50.760	-211.132
D3	R13: -X Wing Bot	LCS	-816.010	101.586	-235.450
D3	R14: -X Wing Top	LCS	-816.029	-50.866	-211.147
D3	R15: -X Wing Bot	LCS	-816.025	-101.622	-235.486
D3	R16: -X/-Y RMB Top	LCS	-783.692	-836.568	-256.224
D3	R17: -X/-Y RMB Bot	LCS	-783.734	-836.574	-443.411
D3	R18: -Y Wing Top	LCS	-50.764	-816.077	-211.168
D3	R19: -Y Wing Bot	LCS	-101.574	-815.998	-235.438
D3	R20: -Y Wing Top	LCS	50.833	-816.083	-211.154
D3	R21: -Y Wing Bot	LCS	101.636	-815.974	-235.400
D3	R22: +X/-Y RMB Top	LCS	783.667	-836.271	-255.987
D3	R23: +X/-Y RMB Bot	LCS	783.677	-836.268	-443.130



4. LAT Instrument Interfaces and Envelope Verification

LAT Instrument Envelope Verification

- **ACD envelopes**
 - **C1: Transverse location of ACD BEA outer extremity**
 - **C2: Transverse location of ACD outer extremity above BEA**
- **X-LAT Plate and EMI Skirt envelopes**
 - **C3: Z-dimension to bottom-most extremity of X-LAT Plate**
 - **C4: Half-width of EMI Skirt recess behind SC Mount**
 - **C5: Location of EMI Skirt back wall behind SC Mount**
 - **C6: Location of step in EMI Skirt back wall behind SC Mount**
 - **C7: Z-dimension of EMI Skirt recess step**
 - **C8: X-dimension of extreme location of X-side EMI Skirts**

ACD Envelope

- LAT instrument envelope dimensions were verified through a combination of surveying and hand measurement using a Romer arm
 - Optical surveying established best-fit planes defining the location of each Base Electronics Assembly (BEA) cover
 - Surveying was also used to find the most extreme point on each cover
 - A Romer portable CMM was used to find the location of the “tallest” protrusion sticking above the surface of each BEA cover, both in the BEA region, and further forward at the ACD MLI interface above the BEA
 - The cover extreme point and height of the tallest protrusion were added to arrive at a conservative boundary of LAT hardware
 - This was compared with the stayclear value

As the table shows, in all cases there is at least 22 mm of margin to the LAT stayclear

Conclusion: LAT instrument complies with its stayclears around the ACD

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ACD Base Elect Ass'y, Radiator Mnt Bkt, X-LAT Plate Rev Date: 13-Sep-06
Coordinates with respect to the Grid Coordinate System; dimensions in mm Print Date: 13-Sep-06

ACD Stayclear	Survey Data		Height of Tallest Point off BEA Plane	Height of Tallest Point above BEA	Stay-Clear	Min Margin	Pass/Fail
	Best-Fit Plane	Extreme Point					
C1, ACD BEA Outer Extremity							
C2, ACD +X BEA +Y Cover		868.723	36.83	38.20	937.500	30.577	PASS
ACD +X BEA -Y Cover		868.723	36.83	38.20	937.500	30.577	PASS
ACD +Y BEA +X Cover	868.439	868.558	35.56	39.62	937.500	29.322	PASS
ACD +Y BEA -X Cover	868.566	868.707	35.56	39.62	937.500	29.173	PASS
ACD -X BEA +Y Cover		-868.723	-36.00	-38.02	-937.500	30.757	PASS
ACD -X BEA -Y Cover		-868.723	-36.00	-38.02	-937.500	30.757	PASS
ACD -Y BEA +X Cover	-868.611	-868.825	-36.17	-46.79	-937.500	21.885	PASS
ACD -Y BEA -X Cover	-868.568	-868.723	-36.17	-46.79	-937.500	21.987	PASS

EMI Shield Envelope

- The EMI Shield locations around the LAT were optically surveyed to establish best-fit planes for each surface, and identify the extreme point for each side
- The coordinate of each extreme point was compared with LAT stayclear allowables
- The width of the step-back in the EMI Shield for the SC flexures was measured with calipers and compared with stayclear allowables

Conclusion: LAT instrument complies with its stayclear around the EMI Shield perimeter

Center EMI Shield Position, Width				Rev Date: 13-Sep-06
Coordinates with respect to the Grid Coordinate System; dimensions in mm				Print Date: 13-Sep-06

		Survey Data					
C5	Center EMI Shield Near X-LAT Plate	Best-Fit Plane Location	Extreme Point	NTE	Margin	Pass/ Fail	
		EMI Shield +X	749.684	749.715	750.000	0.285	PASS
	EMI Shield +Y	749.775	749.829	750.000	0.171	PASS	
	EMI Shield -X	-749.478	-749.540	-750.000	0.460	PASS	
	EMI Shield -Y	-749.507	-749.581	-750.000	0.419	PASS	
C6	Center EMI Shield Near Grid	Best-Fit Plane Location	Extreme Point	NTE	Margin	Pass/ Fail	
	EMI Shield +X	756.874	756.974	757.000	0.026	PASS	May 4, 2006 Survey
EMI Shield +Y	756.857	749.829	757.000	7.171	PASS		
EMI Shield -X	-756.748	-756.810	-757.000	0.190	PASS		
EMI Shield -Y	-749.507	-756.752	-757.000	0.248	PASS		

		Measured				
C4	Center EMI Shield Width	Min Width	Min	Margin	Pass/ Fail	
		EMI Shield +X	225.33	224.500	0.830	PASS
	EMI Shield +Y	225.30	224.500	0.800	PASS	
	EMI Shield -X	225.10	224.500	0.600	PASS	
	EMI Shield -Y	225.21	224.500	0.710	PASS	
C7	Z-Dim of Center EMI Shield Step	Dim of Lowest Pt	NTE	Margin	Pass/ Fail	
	EMI Shield +X	-95.000	-97.370	2.370	PASS	12 Sep 2006 Romer arm measurements at NRL
EMI Shield +Y	-95.000	-97.370	2.370	PASS		
EMI Shield -X	-95.000	-97.370	2.370	PASS		
EMI Shield -Y	-94.740	-97.370	2.630	PASS		

X-LAT Plate Envelope

- LAT instrument Z-dimension envelope under the X-LAT Plate was verified through a combination of surveying and hand measurement using a Romer arm
 - Optical surveying established a best-fit plane and extreme Z-dimension for the X-LAT Plate surface
 - A Romer portable CMM was used to find the location of the “tallest” protrusion sticking above the surface of the X-LAT Plate
 - The X-LAT Plate extreme point and height of the tallest protrusion were added to arrive at a conservative boundary of LAT hardware on the underside of the LAT
 - This was compared with the stayclear value
- The minimum margin from any hard point on the LAT to the LAT stayclear is 35.2 mm

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Conclusions

- LAT instrument complies with its stayclear under the X-LAT Plate
- LAT complies with all stayclear allowables on all sides of the instrument

ACD Base Elect Ass'y, Radiator Mnt Bkt, X-LAT Plate				Rev Date: 13-Sep-06	
Coordinates with respect to the Grid Coordinate System; dimensions in mm				Print Date: 13-Sep-06	

X-LAT Plate Bottom Stayclear	Survey Data		Height of Tallest Point off X-LAT Plate	Stay-Clear	Margin	Pass/ Fail
	Best-Fit Plane	Extreme Point				
C3 Bottom hardpoint	-232.549	-233.041	-31.75	-300.000	35.209	PASS
Billowing MLI blanket		-233.041	-63.50	-300.000	3.459	PASS

12 Sep 2006 Romer arm measurements at NRL

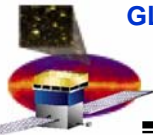
Subsystem Alignment Verification

- Verification of the 30 arc-minute subsystem interface alignment tolerance was performed by visual inspection
 - 30 arc-minutes = 0.00873 radians = 8.73 mm tip / 1 meter length
 - Inspection involved checking the degree of tip over the width of each interface feature
- Inspection results
 - ACD interface
 - The width of the ACD interface is 1.6 m, so the allowed rise = $0.00873 \text{ rad} \times 1600 \text{ mm} = 14.0 \text{ mm}$
 - The ACD interface is machined into the Grid, and met all LAT interface requirements with tolerances that were nearly two orders of magnitude less than this
 - Conclusion: **interface complies**
 - CAL interface
 - The width of the CAL interface is 374.5 mm, so the allowed rise = $0.00873 \text{ rad} \times 374.5 \text{ mm} = 3.3 \text{ mm}$
 - The CAL interface is machined into the Grid, and met all LAT interface requirements with a 0.1 mm flatness tolerance over the entire width of the Grid
 - Conclusion: **interface complies**
 - TKR interface
 - The height of the TKR is 640 mm, so the allowed tip of a TKR module at this maximum allowed interface alignment tolerance = $0.00873 \text{ rad} \times 640 \text{ mm} = 5.6 \text{ mm}$
 - The total gap between TKR modules is 2 mm, meaning that modules would need to collide for the interface alignment tolerance to be exceeded
 - The test-verified LAT and TKR structural models predict relative motions between two TKR modules of 0.213 mm, which is 20 times less than the interface alignment tolerance would allow
 - Conclusion: **interface complies**

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5. Radiator Interfaces and Envelope Verification

Radiator Interfaces and Stayclear Verification

- **Interface mount holes**
 - **C18: XYZ-coordinates to strut mount holes**
- **Radiator panel dimensions**
 - **C9: Z-dimension to extreme-most bottom feature of Radiator**
 - **C10: Z-dimension to top of VCHP reservoir region**
 - **C16: X-dimension of panel half-width**
 - **C19: XZ-coordinate of circular hole cut-out center**
 - **C20: Circular hole cut-out diameter**
 - **C21: XZ-coordinates of square cut-outs**
 - **C22: Square cut-out width x height**
- **Radiator panel surfaces**
 - **C11: Y-dimension of best-fit plane of panel FOSR surface**
 - **C12: Flatness of panel FOSR surface**
 - **C13: Y-dimension to VCHP reservoir outer extremity**
 - **C14: Y-dimension to panel innermost surface**
 - **C15: Y-dimension to VCHP reservoir inner extremity**
 - **C17: Y-dimension to SC strut mount pads on Radiator inside**

Radiator Interface Mount Holes

- The Radiators interface to the spacecraft through sets of four holes where the spacecraft Y-support strut brackets mount to the backside of the Radiator
 - The holes in the Radiator are comprised of a clearance hole in the facesheet doubler, with a tapped hole in a floating insert
 - The clearance holes in the doubler were placed to a relatively loose tolerance and made large enough so that the floating insert could be positioned as needed, providing the ability to locate the tapped interface holes in the correct location
- The interface hole features and locations were verified in 3 steps
 - First, the tapped holes were inspected to verify size and depth
 - Conclusion: **all tapped holes comply with interface requirement for thread and depth**
 - Second, the location of the clearance holes in the doubler surveyed and their offset from nominal were calculated
 - Third, the offset was compared to the 0.913 mm radial range of the travel of the floating insert—if the offset was less than the radial range, then the insert could be moved to place the tapped hole exactly at the nominal location
- Interface hole inspection results (see the following chart for inspection details)
 - Minimum margin on insert float is 0.264 mm on the radial range of travel
 - All holes and inserts comply with the interface position requirements
- Further margin and risk mitigation
 - The SC brackets have considerable ability to move in X and Z (in the plane of the Radiator) since they are mounted on struts with rod-end connections
 - Furthermore, functionally-identical MGSE struts have been mounted and used for supporting the Radiators during environmental testing of the LAT

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Conclusion: **all holes comply**

Radiator Interface Mount Hole Inspection Details

Name	Description	Radiator Panel #1 (-Y)							
		Surveyed Dimension		Nominal Dimension		Radial Delta	Insert Float	Margin	P/F
SC Strut Mount Pads		X (mm)	Y (mm)	X	Y				
R_TBHole1M	Center pin hole pad 1	187.498	1254.098	187.600	1254.420				
Clearance hole tolerance to Rad									
R_Hole11	Center bolt hole pad 1	162.127	1229.016	162.200	1229.020	0.073	0.913	0.840	PASS
R_Hole12	Center bolt hole pad 1	212.983	1228.826	213.000	1229.020	0.195	0.913	0.718	PASS
R_Hole13	Center bolt hole pad 1	212.911	1279.711	213.000	1279.820	0.141	0.913	0.772	PASS
R_Hole14	Center bolt hole pad 1	162.179	1279.657	162.200	1279.820	0.164	0.913	0.749	PASS
R_TBHole2M	Center pin hole pad 2	1341.393	1254.058	1341.600	1254.420				
Clearance hole tolerance to Rad									
R_Hole21	Center bolt hole pad 2	1316.028	1228.910	1316.200	1229.020	0.204	0.913	0.709	PASS
R_Hole22	Center bolt hole pad 2	1366.886	1229.109	1367.000	1229.020	0.145	0.913	0.768	PASS
R_Hole23	Center bolt hole pad 2	1366.903	1279.854	1367.000	1279.820	0.103	0.913	0.810	PASS
R_Hole24	Center bolt hole pad 2	1315.737	1279.365	1316.200	1279.820	0.649	0.913	0.264	PASS

		Radiator Panel #1 (-Y)							
		Surveyed Dimension		Nominal Dimension		Radial Delta	Insert Float	Margin	P/F
		X (mm)	Y (mm)	X	Y				
		187.411	-1254.223	187.600	-1254.420				
		213.010	-1228.814	213.000	-1229.020	0.206	0.913	0.707	PASS
		162.222	-1228.837	162.200	-1229.020	0.184	0.913	0.729	PASS
		212.684	-1279.796	213.000	-1279.820	0.317	0.913	0.596	PASS
		162.242	-1279.675	162.200	-1279.820	0.151	0.913	0.762	PASS
		1341.335	-1254.452	1341.600	-1254.420				
		1366.646	-1228.999	1367.000	-1229.020	0.355	0.913	0.558	PASS
		1315.877	-1228.963	1316.200	-1229.020	0.328	0.913	0.585	PASS
		1315.863	-1279.740	1316.200	-1279.820	0.346	0.913	0.567	PASS
		1366.746	-1280.039	1367.000	-1279.820	0.335	0.913	0.578	PASS

Radiator Panel Dimensions

- Radiator panel dimensions were surveyed on the individual Radiators before integration
 - Dimensions were surveyed with respect to the Radiator-LAT interface, and not the LCS
 - All panel and cut-out dimensions were well within the maximum material condition limits set in LAT-DS-01221, “Radiator Interface Definition Drawing”
 - The minimum margin of any panel dimension to its MMC boundary is 1.057 mm
 - See the chart on the following page for a detailed list of measurements and margins
- Since measurements were not made with respect to the LCS, an additional offset must be factored in, to account for rigid-body misalignment of the Radiator to its nominal location, with respect to the LCS
 - Radiator offset must include dX, dZ, and tilt angle
 - If the sum of the effects of these three contributions is still less than the minimum margin to the MMC boundary, then we still have margin
 - There is further margin, since all LAT-SC interface dims bound the LAT-Rad envelope
- Radiator rigid-body misalignments, based on optical survey of the Radiator Mount Bracket pin locations with respect to the LAT Coordinate System
 - X: $0.139 + (0.222 \text{ mrad} * 1503 \text{ mm long}) = 0.473 \text{ mm}$ lateral swing/offset due to pin misalignment → this is well within the 1.057 X-margin on stayclear envelope
 - Z: $0.229 + (0.222 \text{ mrad} * 1712.6 \text{ mm wide}) = 0.609 \text{ mm}$ z-direction dip of one corner → this is well within the Z-1.057 mm margin on stayclear envelope

Conclusion: All Radiator panel dimensions comply with LAT-SC IDD envelope allowables

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Radiator Panel Dimensions Compliance Table

Radiator Panel Survey and Verification of Radiator IDD Dimensions

Rev Date: 26-Jun-06

Dimensions are to an auxiliary Radiator coordinate system, defined below; dimensions in mm

Print Date: 23-Aug-06

Results delivered 6-Jun-2006

This verifies Radiator interface dimensions off of LAT-DS-01221, but not to LAT interface dimensions

+X: from hole to slot
 +Z: positive normal to inside face of Radiator panel
 +Y: follows right-hand rule

= raw survey data
 = value passes tolerance evaluation criteria
 = value fails tolerance evaluation criteria

TP = true position tolerance
 Min = nominal is minimum allowed dimension
 NTE = nominal is not-to-exceed dimension

		Radiator Panel #1 (-Y)						
		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Panel Perimeter								
PanelCorner1	Outer top edge corner 1	-183.610	0.000	-185.400		NTE	1.790	PASS
PanelCorner2	Outer top edge corner 2	1712.661	0.000	1714.600		NTE	1.939	PASS
PanelCorner3	Outer bottom edge corner 1	-183.521	1503.589	-185.400	1508.710	NTE	1.879	PASS
PanelCorner4	Outer bottom edge corner 2	1712.643	1503.221	1714.600	1508.710	NTE	1.957	PASS

		Radiator Panel #2 (+Y)						
		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
		-183.726	0.000	-185.400		NTE	1.674	PASS
		1712.499	0.000	1714.600		NTE	2.101	PASS
		-183.900	-1503.649	-185.400	-1508.710	NTE	1.500	PASS
		1712.460	-1503.649	1714.600	-1508.710	NTE	2.140	PASS

SADA Cut-Out		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
R_CircleHole	Center circle cut out	764.440	1101.666	764.600	1101.770	TP 0.000	2.104	PASS
R_HoleDiam	Center circle cut out diam	222.589		218.000		Min	2.295	PASS

		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
		764.333	-1101.759	764.600	-1101.770	TP 0.000	1.944	PASS
		222.423		218.000		Min	2.212	PASS

Launch-Lock Cut-Outs		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Center square cut out 1		Nom: 412.600 431.110						
R_Square11	Corner square cut out 1	359.458	377.343	53.142	53.767	> 52.000	1.142	PASS
R_Square12	Corner square cut out 1	359.444	484.466	53.156	53.356	> 52.000	1.156	PASS
R_Square13	Corner square cut out 1	466.469	484.537	53.869	53.427	> 52.000	1.427	PASS
R_Square14	Corner square cut out 1	466.520	377.265	53.920	53.845	> 52.000	1.845	PASS

		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Center square cut out 1		Nom: 412.600 -431.110						
		466.563	-484.536	53.963	53.426	> 52.000	1.426	PASS
		359.386	-484.581	53.214	53.471	> 52.000	1.214	PASS
		359.270	-377.345	53.330	53.765	> 52.000	1.330	PASS
		466.531	-377.568	53.931	53.542	> 52.000	1.542	PASS

Center square cut out 2		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Center square cut out 2		Nom: 412.600 1195.680						
R_Square21	Corner square cut out 2	466.465	1142.308	53.865	53.372	> 52.000	1.372	PASS
R_Square22	Corner square cut out 2	466.444	1249.183	53.844	53.503	> 52.000	1.503	PASS
R_Square23	Corner square cut out 2	359.410	1249.134	53.190	53.454	> 52.000	1.190	PASS
R_Square24	Corner square cut out 2	359.474	1141.675	53.126	54.005	> 52.000	1.126	PASS

Center square cut out 2		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Center square cut out 2		Nom: 412.600 -1195.680						
		359.236	-1249.301	53.364	53.621	> 52.000	1.364	PASS
		466.720	-1249.322	54.120	53.642	> 52.000	1.642	PASS
		466.378	-1142.137	53.778	53.543	> 52.000	1.543	PASS
		359.196	-1142.150	53.404	53.530	> 52.000	1.404	PASS

Center square cut out 3		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Center square cut out 3		Nom: 1116.600 1195.680						
R_Square31	Corner square cut out 3	1062.631	1141.970	53.969	53.710	> 52.000	1.710	PASS
R_Square32	Corner square cut out 3	1062.531	1249.175	54.069	53.495	> 52.000	1.495	PASS
R_Square33	Corner square cut out 3	1169.592	1249.142	52.992	53.462	> 52.000	0.992	PASS
R_Square34	Corner square cut out 3	1169.594	1141.962	52.994	53.718	> 52.000	0.994	PASS

Center square cut out 3		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Center square cut out 3		Nom: 1116.600 -1195.680						
		1169.777	-1249.337	53.177	53.657	> 52.000	1.177	PASS
		1062.559	-1249.400	54.041	53.720	> 52.000	1.720	PASS
		1062.577	-1142.137	54.023	53.543	> 52.000	1.543	PASS
		1169.806	-1142.166	53.206	53.514	> 52.000	1.206	PASS

Center square cut out 4		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Center square cut out 4		Nom: 1116.600 431.110						
R_Square41	Corner square cut out 4	1062.760	377.317	53.840	53.793	> 52.000	1.793	PASS
R_Square42	Corner square cut out 4	1062.348	484.445	54.252	53.335	> 52.000	1.335	PASS
R_Square43	Corner square cut out 4	1169.657	484.710	53.057	53.600	> 52.000	1.057	PASS
R_Square44	Corner square cut out 4	1169.763	377.313	53.163	53.797	> 52.000	1.163	PASS

Center square cut out 4		Surveyed Dimension		Nominal Dimension			Margin	P/F
Name	Description	X (mm)	Y (mm)	X	Y	Tolerance		
Center square cut out 4		Nom: 1116.600 -431.110						
		1062.710	-377.557	53.890	53.553	> 52.000	1.553	PASS
		1169.764	-377.572	53.164	53.538	> 52.000	1.164	PASS
		1169.893	-484.791	53.293	53.681	> 52.000	1.293	PASS
		1062.586	-484.733	54.014	53.623	> 52.000	1.623	PASS

RMB Interface to Rad	Nominal Dimensions			Survey Data			Offsets of -X Pin			
	Pin X Coord	Face Y Dim	Pin Z Coord	Pin X Coord	Face Y Dim	Pin Z Coord	dX	dZ	Pin-Pin Dist	Angle (mrad)
+Y Radiator, +X RMB	764.600	924.941	-62.570	764.663	925.071	-62.908				
+Y Radiator, -X RMB	-764.600	924.941	-62.570	-764.646	924.936	-62.448	-0.046	0.122	1529.309	-0.300789
-Y Radiator, +X RMB	764.600	-924.941	-62.570	764.747	-924.710	-62.460				
-Y Radiator, -X RMB	-764.600	-924.941	-62.570	-764.461	-924.881	-62.799	0.139	-0.229	1529.208	0.221683

Radiator Panel Surface Area

- The ICD requirement defines a “minimum radiating area” for a Radiator as 2.7 m²
- This has been interpreted by the LAT as minimum area agreed to by the LAT for use as radiating surface
- Thus, compliance with this requirement can be demonstrated by the LAT by showing that the envelope dimensions provide at least this surface area, and that the LAT stays within this envelope
 - The envelope dimensions must result in at least 2.7 m²
 - If the LAT verifies its thermal performance with Radiators that stay within this envelope, then this requirement is met
- Inspection results
 - Maximum available radiating area provided by the LAT stayclear dimensions of the LAT-SC ICD
 - (1903 w x 1591.9 h) – 4*(101.6 x 101.6 launch lock cut-outs) – pi/4 *(215.9 diameter SADA cut-out)²
 - = 3.0294 m² – 0.0413 m² – 0.03661 m²
 - = 2.952 m²
 - The previous two charts detail LAT Radiator compliance with the Radiator stayclear envelope
 - The LAT Thermal-Vacuum Test Report demonstrates LAT thermal control capability with these dimensionally-compliant Radiators
 - Thus, the LAT meets this requirement

Conclusion: complies

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Radiator Panel Surfaces

- The Y- or out-of-plane dimension of the Radiator panels was surveyed on the FOSR (outer) side of each panel
 - The survey was done with the Radiators in a “free” state, held at the two Radiator Mount Brackets only
 - The SC interface struts were then mounted and adjusted to bring the four points into a plane parallel to the LCS XZ-plane
 - The resulting panel surface numbers are shown in the table on the following page
 - This represents the ideal location for the Radiators, with a surveyed maximum angle out of a plane parallel to the YZ-plane of only 32 microns over the width of the Radiators
 - Radiators panels are flat and parallel to the YZ-plane to within the survey tolerance
- This adjustment and survey process was done prior to environmental testing, and was also used to verify the following:
 - Radiator panels can be adjusted out-of-plane at the SC strut interface by up to +/- 4 mm
 - The panels were in this “bent” state for all environmental tests, verifying this allowable value
 - The +/- 4 mm adjustment range should be used as the not-to-exceed value for positioning the Radiator on the SC during Observatory integration
 - The existing Radiator shims at the RMB are adequate as-is, and do not require thinning or tapering
- Hand measurements were performed to verify stayclears for VCHP reservoirs and Radiator panel thickness, with the results also shown in the chart on the following page

Conclusions

- Radiator panel flatness and parallelism: **OK**
- Maximum allowed adjustment of Rad-SC struts from “free” state: **+/- 4 mm**
- Radiator Y-stayclears: **All panel surfaces comply with LAT-SC IDD envelope allowables**

Radiator Panel Surface Feature Details

LAT Radiator Survey on the LAT at NRL		Rev Date: 13-Sep-06
Coordinates with respect to the LAT Coordinate System; dimensions in mm		Print Date: 13-Sep-06
Summary of LAT Radiator Survey of 6/28/06 and NRL inspection of 9/13/06		= raw survey data

	Radiator Panel Surfaces	+Y Rad	-Y Rad	Not-to-Exceed Dim	Margin	P/F		
C11	Y-dim of extreme point on panel FOSR surface	969.015	-968.763	972.000	max	2.985	PASS	extreme Y-coord on the Rad outer surface best-fit YZ-plane for outer surface of Rad
	Y-dim of best-fit plane of panel FOSR surface	968.893	-968.666					
C12	Flatness of panel FOSR surface	0.247	0.189					peak-to-valley excursion of flatness from best-fit plane
C13	Y-dim to VCHP reservoir outer extremity	997.06	995.26	1020.000	max	22.940	PASS	extreme Y-coord on outside of any of the reservoirs
C14	Y-dim to panel innermost surface	907.3	913.15	906.000	min	1.300	PASS	extreme Y-coord on inside of Rad, not incl velcro
C15	Y-dim to VCHP reservoir inner extremity	919.69	919.95	906.000	min	13.690	PASS	extreme Y-coord on inside of any of the reservoirs
C17	Y-dim to SC strut mount pads: +X pad	933.89	932.50	931.310	nom			
	Y-dim to SC strut mount pads: -X pad	933.26	933.61	931.310	nom			

LAT Survey Program Conclusions

- All LAT interfaces and stayclear envelopes have been inspected
 - This was performed through a combination of optical survey and conventional dimensional measurement
 - Inspection was performed at both the sub-assembly and LAT assembly level
- All LAT interface and envelope features comply with interface requirements except the SC-LAT mounting hole locations at the Grid-Flexure interface
- Grid-Flexure hole fit-up has been analytically checked and verified in hardware using flight-duplicate flexures
 - This near-flight configuration was used for all LAT environmental testing
 - The disposition is to use all as-is
 - This is documented further in ICN #095