ManTech International Corporation

ACD-RPT-000387

GLAST ACD ENVELOPE METROLOGY

33-07-1306

August 2005

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ManTech International Corporation

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Aerospace Technology Applications Center
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ManTech
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To: Henry Sampler August 3, 2005

From: G. Wenzel/ManTech OSF

Subject: GLAST ACD interior envelope metrology

Between March 28th and April 5th , the Optics Support Function supported metrology of the GLAST ACD structure . The objective of the metrology operation was to measure the envelope.
To accomplish this, photogrametry targets were placed on the ACD structure and on the floor. The TBH photogrametry targets were used to place the measured target locations in to the ACD reference frame by fitting to the TBH targets measured earlier with the laser tracker (see **figure 1**).

The data was then analyzed using Spatial Analyzer and Excel. The Excel workbook is divided into 11 spreadsheets. The worksheets are divided into the stay clear planes of the ACD structure. The distance from each point measured on the ACD to the stay clear plane is listed in the last column. The stay clear plane locations were defined using the drawing specifications called out in LAT-DS-00309. All coordinates listed are in the ACD reference frame and in inches.

The interior structure was analyzed against the tolerances called out on Drawing LAT-DS-00309. The interior of the ACD structure was found to meet specification with the exception of the wire running up the +Y side of the interior ACD to the +Z interior (see **Analysis Detail For Wire, table 3 and figures 4&5**).

The base structure was analyzed against the tolerances called out on Drawing LAT-DS-00309. The base of the ACD structure was found to meet specification with the exception of a few points measured on the +X and -Y sides (see **Analysis Detail For Base Structure, tables 1&2 and figures 2&3**).

1166 points on the entire structure were analyzed against the outside stay clear region defined by Drawing LAT-DS-00309. No violations were found.

I will be available to answer any questions you may have on these data. I can be contacted at 6-1523 or at gwenzel@mscmail.gsfc.nasa.gov

Greg Wenzel
Optical Engineer
ManTech Optics Support Function

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ACD THB Target Locations

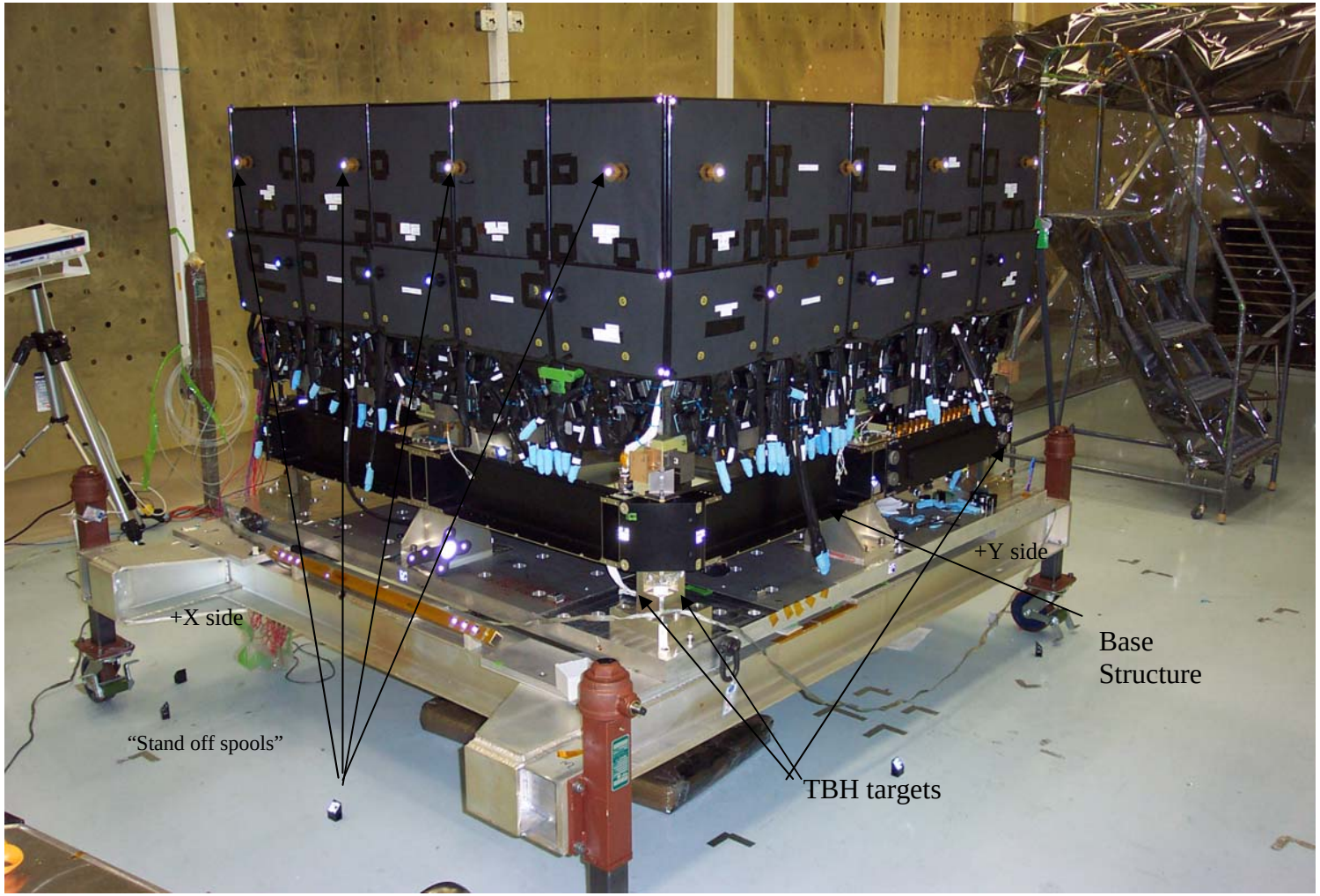

Figure 1

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Analysis Detail for Base Structure

Table 1
+X out of tolerance points

Vector	Begin [Inches] Stay Clear Plane Point X	Y	Z	End [Inches] Measured Point X	Y	Z	Delta [Inches] X	Y	Z		
LOWERFRAME+X-8	61.10236	57.70767	5.643117	61.08286	57.70767	5.643117	-0.0195	7.11E-15	0	0.0195	0.0135
LOWERFRAME+X-29	61.10236	26.5167	5.778925	61.09418	26.5167	5.778925	-0.00818	0	0	0.0082	0.0022
LOWERFRAME+X-30	61.10236	26.31772	5.776572	61.09391	26.31772	5.776572	-0.00845	3.55E-15	0	0.0084	0.0024
LOWERFRAME+X-31	61.10236	26.71866	5.782611	61.09183	26.71866	5.782611	-0.01053	0	0	0.0105	0.0045
LOWERFRAME+X-32	61.10236	25.91754	5.772146	61.09319	25.91754	5.772146	-0.00917	3.55E-15	8.88E-16	0.0092	0.0032
LOWERFRAME+X-33	61.10236	14.94129	3.36008	61.09351	14.94129	3.36008	-0.00885	1.78E-15	4.44E-16	0.0088	0.0028
LOWERFRAME+X-34	61.10236	14.7412	3.378428	61.09456	14.7412	3.378428	-0.0078	1.78E-15	0	0.0078	0.0018
LOWERFRAME+X-35	61.10236	14.54235	3.397808	61.09463	14.54235	3.397808	-0.00773	1.78E-15	8.88E-16	0.0077	0.0017
LOWERFRAME+X-36	61.10236	14.34486	3.418776	61.09247	14.34486	3.418776	-0.00989	1.78E-15	0	0.0099	0.0039
LOWERFRAME+X-37	61.10236	14.14525	3.437542	61.09383	14.14525	3.437542	-0.00853	1.78E-15	0	0.0085	0.0025
LOWERFRAME+X-38	61.10236	13.94564	3.456438	61.09535	13.94564	3.456438	-0.00701	0	0	0.0070	0.0010

The magnitude listed in the table above is the distance from the stay clear boundary to the measured (violating) point. The magnitude in the last column was adjusted for target thickness (.006 in). 11 out of 47 total points on +X side are out of tolerance. Two, in red, are out by more than the measurement error (.004 in). The point +X-8 Looks anomalous with respect to other data points (See Figure 2). Other points measured on the same target tape in close proximity (.2in) are within tolerance. The above points represent three targeted tape strips placed on the base frame of the ACD.

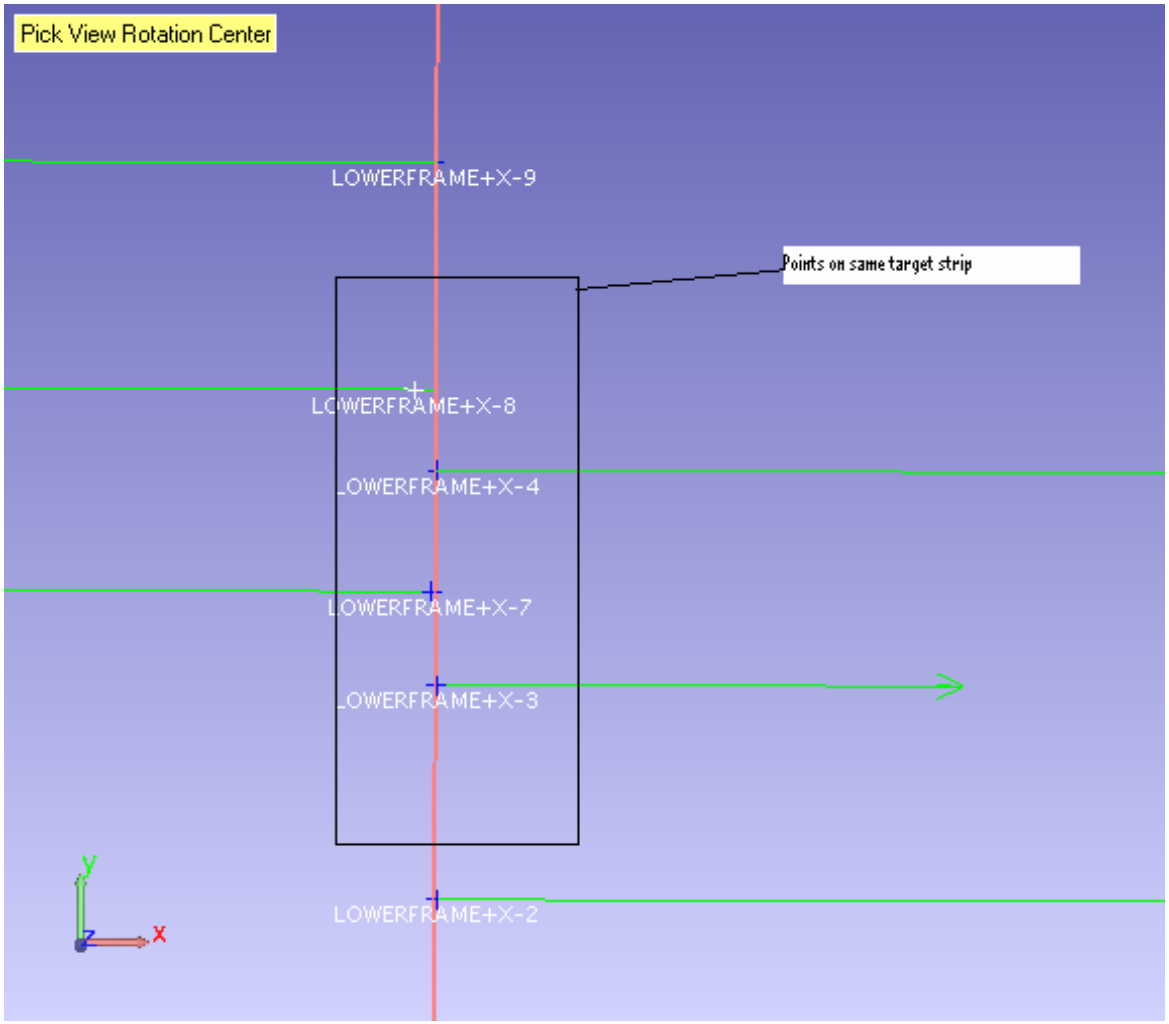

Pick View Rotation Center
LOWERFRAME+X-9
Points on same target strip
LOWERFRAME+X-8
LOWERFRAME+X-4
LOWERFRAME+X-7
LOWERFRAME+X-3
LOWERFRAME+X-2
Y
X

Figure 2

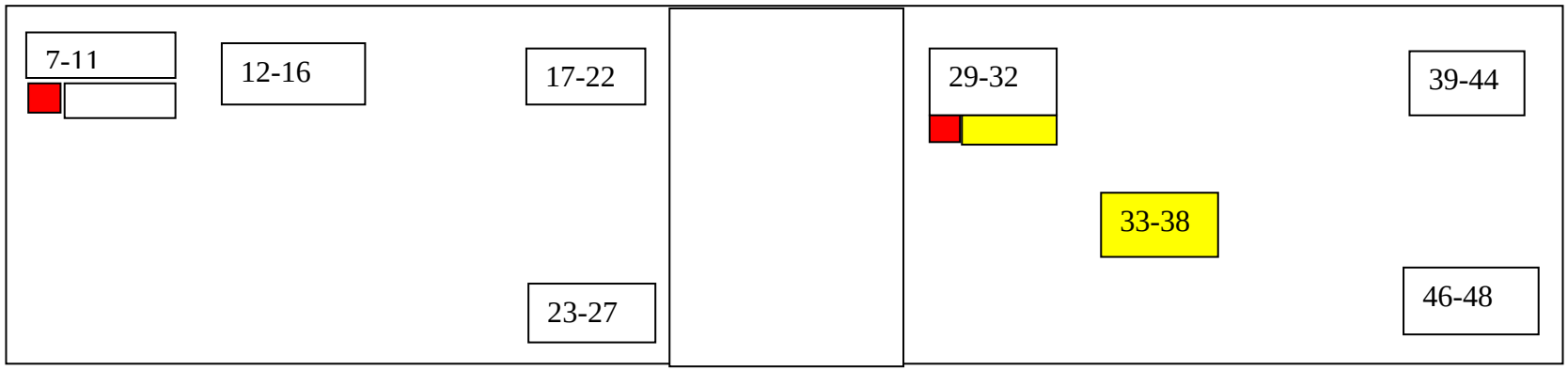
Table 2
-Y out of tolerance points

Vector	Begin [Inches] Stay Clear Plane Point			End [Inches] Measured Point			Delta [Inches]				
Name	X	Y	Z	X	Y	Z	X	Y	Z	Mag.	Mag. Adjusted for Target Thickness
LOWERFRAME-Y-1	26.27296	-0.86614	5.701932	26.27296	-0.8477	5.701932	0	0.018438	0	0.0184	0.0124
LOWERFRAME-Y-2	26.47269	-0.86614	5.686712	26.47269	-0.84636	5.686712	3.55E-15	0.019783	0	0.0198	0.0138
LOWERFRAME-Y-3	25.87074	-0.86614	5.733828	25.87074	-0.84847	5.733828	0	0.017675	0	0.0177	0.0117
LOWERFRAME-Y-4	26.0721	-0.86614	5.718523	26.0721	-0.84797	5.718523	0	0.018169	0	0.0182	0.0122
LOWERFRAME-Y-5	25.67177	-0.86614	5.750578	25.67177	-0.84709	5.750578	0	0.019053	0	0.0191	0.0131
LOWERFRAME-Y-6	13.54908	-0.86614	3.511186	13.54908	-0.8597	3.511186	-3.55E-15	0.006446	-4.44E-16	0.0064	0.0004
LOWERFRAME-Y-7	13.74986	-0.86614	3.501347	13.74986	-0.85843	3.501347	0	0.007713	0	0.0077	0.0017
LOWERFRAME-Y-8	13.94953	-0.86614	3.491221	13.94953	-0.85823	3.491221	3.55E-15	0.007914	8.88E-16	0.0079	0.0019
LOWERFRAME-Y-11	12.95094	-0.86614	3.542735	12.95094	-0.8596	3.542735	0	0.006537	0	0.0065	0.0005
LOWERFRAME-Y-12	13.15096	-0.86614	3.532338	13.15096	-0.85965	3.532338	3.55E-15	0.006489	4.44E-16	0.0065	0.0005
LOWERFRAME-Y-13	13.35094	-0.86614	3.522167	13.35094	-0.85925	3.522167	0	0.006897	0	0.0069	0.0009
LOWERFRAME-Y-36	34.03847	-0.86614	5.755895	34.03847	-0.8453	5.755895	7.11E-15	0.02084	0	0.0208	0.0148
LOWERFRAME-Y-37	34.23677	-0.86614	5.773293	34.23677	-0.84593	5.773293	0	0.020215	-8.88E-16	0.0202	0.0142
LOWERFRAME-Y-38	33.83524	-0.86614	5.733745	33.83524	-0.85687	5.733745	0	0.009268	0	0.0093	0.0033
LOWERFRAME-Y-39	33.57781	-0.86614	0.574529	33.57781	-0.85623	0.574529	0	0.009909	0	0.0099	0.0039
LOWERFRAME-Y-40	33.77377	-0.86614	0.614881	33.77377	-0.85482	0.614881	0	0.011326	-8.88E-16	0.0113	0.0053
LOWERFRAME-Y-41	33.9703	-0.86614	0.653721	33.9703	-0.85512	0.653721	0	0.011023	-8.88E-16	0.0110	0.0050
LOWERFRAME-Y-42	33.38185	-0.86614	0.535503	33.38185	-0.85561	0.535503	0	0.010536	-4.44E-16	0.0105	0.0045

The magnitude listed in the table above is the distance from the stay clear boundary to the measured (violating) point. The magnitude in the last column was adjusted for target thickness (.006 in). 18 points out of 40 total points on –Y side are out of tolerance. 10 points are out by more than the measurement error (.004 in). The above points represent five targeted tape strips placed on the base frame of the ACD.

Approximate Locations Of Targets On Base Frame

+X Side Base Frame



-Y Side Base Frame

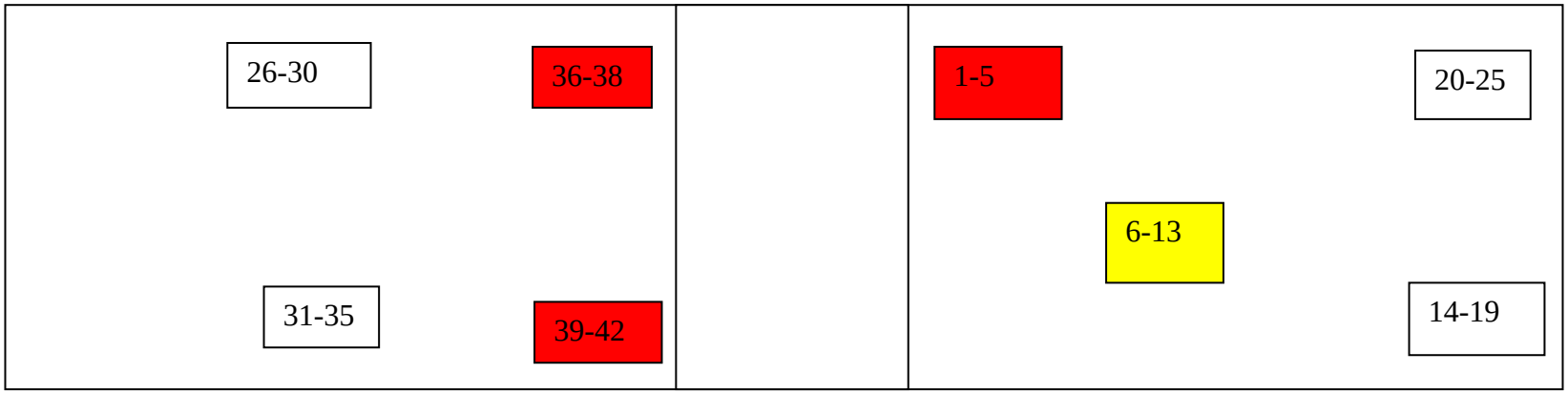


Figure 3

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Analysis Detail For Wire

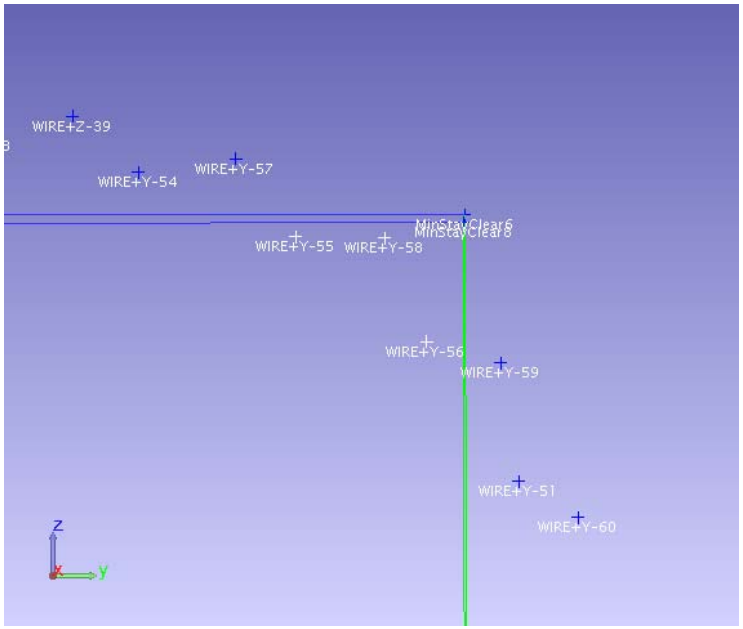

Figure 4

Table 3
Magnitude of Wire Violation

+Y+Z Wire	Data Point			Delta			
Name	X	Y	Z	X	Y	Z	Mag.
WIRE+Y-55	26.207700	59.756400	33.628100	0.000000	0.000000	0.021506	0.021506
WIRE+Y-56	26.207700	59.756400	33.628100	0.000000	0.194387	0.000000	0.194387
WIRE+Y-58	26.817600	59.859000	33.626700	0.000000	0.000000	0.022906	0.022906

The magnitude listed in the table above is the distance from the stay clear boundary to the measured (violating) point. The magnitude has not been adjusted for target thickness (.006 in).

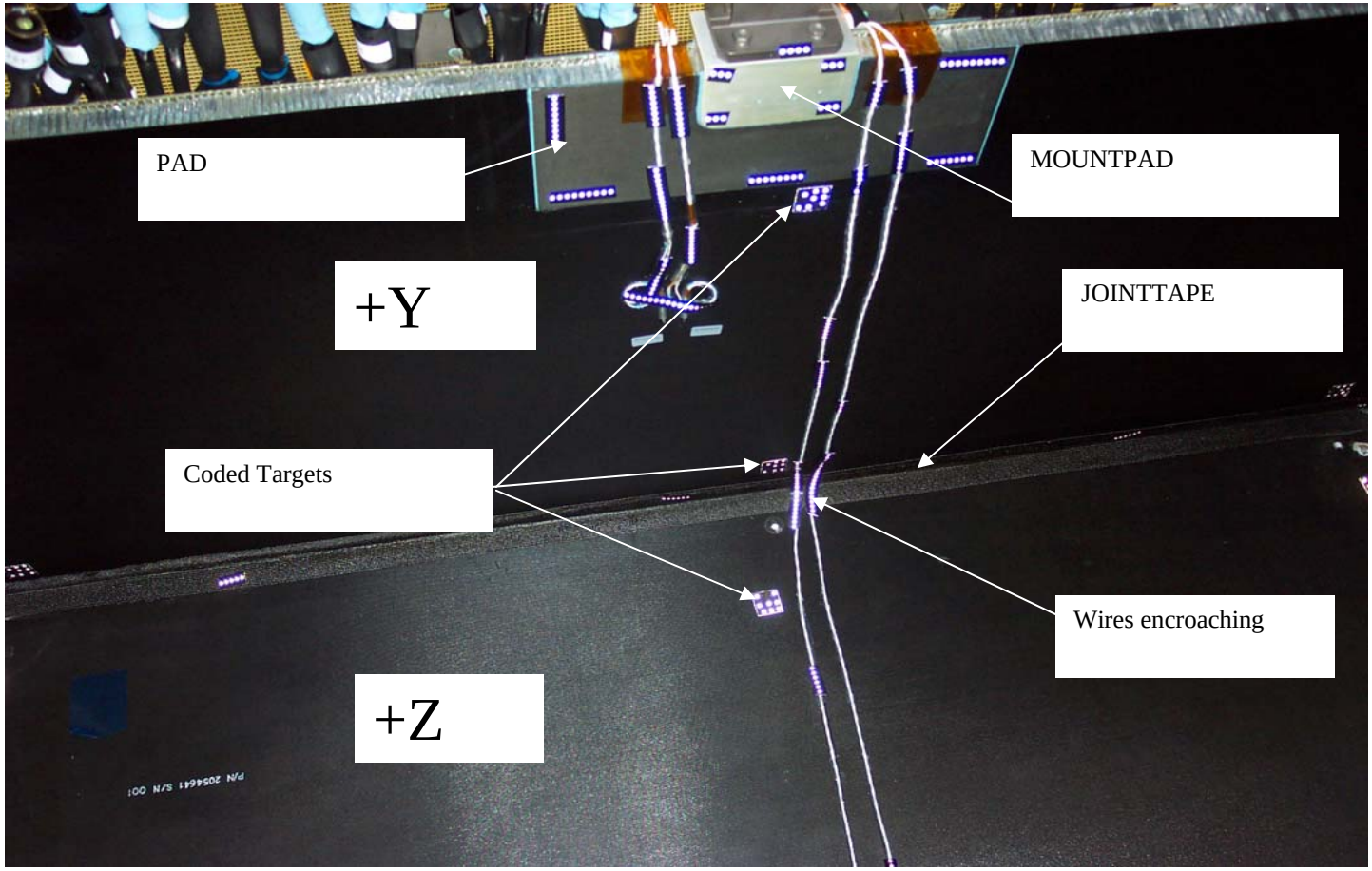

Figure 5

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Dimensions

Dimensions were calculated using inner or outer most points on each side of the ACD.

Table 4
Outside Dimensions

	X	Y	Z
Max	65.2756	65.2756	41.3386
Min	-5.4331	-5.4331	0.2756
in	70.7087	70.7087	41.0630
in adjusted for target Thickness	70.6967	70.6917	41.0460
mm	1795.6952	1795.5682	1042.5671
Requirement	< 1796	< 1796	< 1050

Table 5
Inside X Dimensions

Min +X side	60.0436
Max -X side	0.0402
in	*60.0033*
in adjusted for target Thickness	*60.0153*
mm	***1524.3892***
Requirement	***>1515.5***

Table 6
Inside Y Dimensions

		Without Violating Wires
Min +Y side	59.5751	59.9555
Max -Y side	0.1518	0.1518
in	*59.4233*	*59.8037*
in adjusted for target Thickness	*59.4353*	*59.8157*
mm	***1509.6574***	***1519.3196***
Requirement	***>1515.5***	***>1515.5***

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Table 7
Inside Z Dimension

Min +X side	33.7455
Max -Z side (set)	0.0000
in	*33.7455*
in adjusted for target Thickness	*33.7515*
mm	***857.2877***
Requirement	***>854.7***

Table 8
Inside X Base Dimensions

		Exclude "bad" target (see Figure 2)
Min +X side	61.0829	61.1018
Max -X side	-0.8712	-0.8712
in	*61.9541*	*61.9730*
in adjusted for target Thickness	*61.9661*	*61.9730*
mm	***1573.9388***	***1574.1154***
Requirement	***>1574***	***>1574***

Table 9
Inside Y Base Dimensions

		Exclude "bad" targets
Min +Y side	61.1048	61.1048
Max -Y side	-0.8453	-0.8582
in	*61.9501*	*61.9630*
in (adjusted for target Thickness)	*61.9621*	*61.9750*
mm	***1573.8364***	***1574.1647***
Requirement	***>1574***	***>1574***

Table 10
Stay Clear Boundary Definitions Used

ACD Stay Clear Tracker					
x	y	z	**X**	**Y**	**Z**
7.25	7.25	0	**0.285433**	**0.285433**	**0**
7.25	1522.75	0	**0.285433**	**59.95079**	**0**
1522.75	7.25	0	**59.95079**	**0.285433**	**0**
1522.75	1522.75	0	**59.95079**	**59.95079**	**0**
7.25	7.25	854.7	**0.285433**	**0.285433**	**33.64961**
7.25	1522.75	854.7	**0.285433**	**59.95079**	**33.64961**
1522.75	7.25	854.7	**59.95079**	**0.285433**	**33.64961**
1522.75	1522.75	854.7	**59.95079**	**59.95079**	**33.64961**
Base Stay Clear					
x	y	z	**X**	**Y**	**Z**
-22	-22	0	**-0.86614**	**-0.86614**	**0**
-22	1552	0	**-0.86614**	**61.10236**	**0**
1552	-22	0	**61.10236**	**-0.86614**	**0**
1552	1552	0	**61.10236**	**61.10236**	**0**
-22	-22	214.7	**-0.86614**	**-0.86614**	**8.452756**
-22	1552	214.7	**-0.86614**	**61.10236**	**8.452756**
1552	-22	214.7	**61.10236**	**-0.86614**	**8.452756**
1552	1552	214.7	**61.10236**	**61.10236**	**8.452756**
Outside Stay Clear					
x	y	z	**X**	**Y**	**Z**
-138	-138	0	**-5.43307**	**-5.43307**	**0**
-138	1658	0	**-5.43307**	**65.27559**	**0**
1658	-138	0	**65.27559**	**-5.43307**	**0**
1658	1658	0	**65.27559**	**65.27559**	**0**
-138	-138	1050	**-5.43307**	**-5.43307**	**41.33858**
-138	1658	1050	**-5.43307**	**65.27559**	**41.33858**
1658	-138	1050	**65.27559**	**-5.43307**	**41.33858**
1658	1658	1050	**65.27559**	**65.27559**	**41.33858**

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Error Analysis

Table 11
Photogrametry Measurement Errors (in)

Bundle Adjust error	0.000
Best Fit error (measured THB to template THB data error)	0.004
Scaling error (from laser tracker measurements of scalebar)	0.002
Target Thickness (not included in error- used micrometer to measure)	0.006
RSS	0.004

Aerospace Technology Applications Center
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To: Henry Sampler August 24, 2005

From: G. Wenzel/ManTech OSF

Subject: GLAST ACD exterior envelope metrology

On August 8^{8h}, the Optics Support Function supported metrology of the GLAST ACD structure . The objective of the metrology operation was to measure the exterior envelope. To accomplish this, the LDT 500 Laser tracker was used. The TBH targets were used to place the measured target locations in to the ACD reference frame by fitting to the TBH targets measured earlier with the laser tracker (see figure **6**).

The data was then analyzed using Spatial Analyzer and Excel. The Excel workbook is divided into three spreadsheets; Exterior Points, StayClearCoordinates, and Failed targets. The stay clear plane locations were defined using the drawing specifications called out in LAT-DS-00309 and adjusted for the size of the retro reflector used. All coordinates listed are in the ACD reference frame and in inches.

The exterior structure was analyzed against the tolerances called out on Drawing LAT-DS-00309. Most points were soft points measured by placing the retro reflector in contact with the outer thermal blanket layer. 51 targets out of 232 failed the rectangular stay clear region as shown in tables 12 through 16. A circular stay clear region was defined from the rectangular dimensions of the stay clear region called out in on Drawing LAT-DS-00309 to more accurately represent the launch faring(see table 18). None of the 232 targets failed the circular stay clear.

I will be available to answer any questions you may have on these data. I can be contacted at 6-1523 or at gwenzel@mscmail.gsfc.nasa.gov

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Optical Engineer
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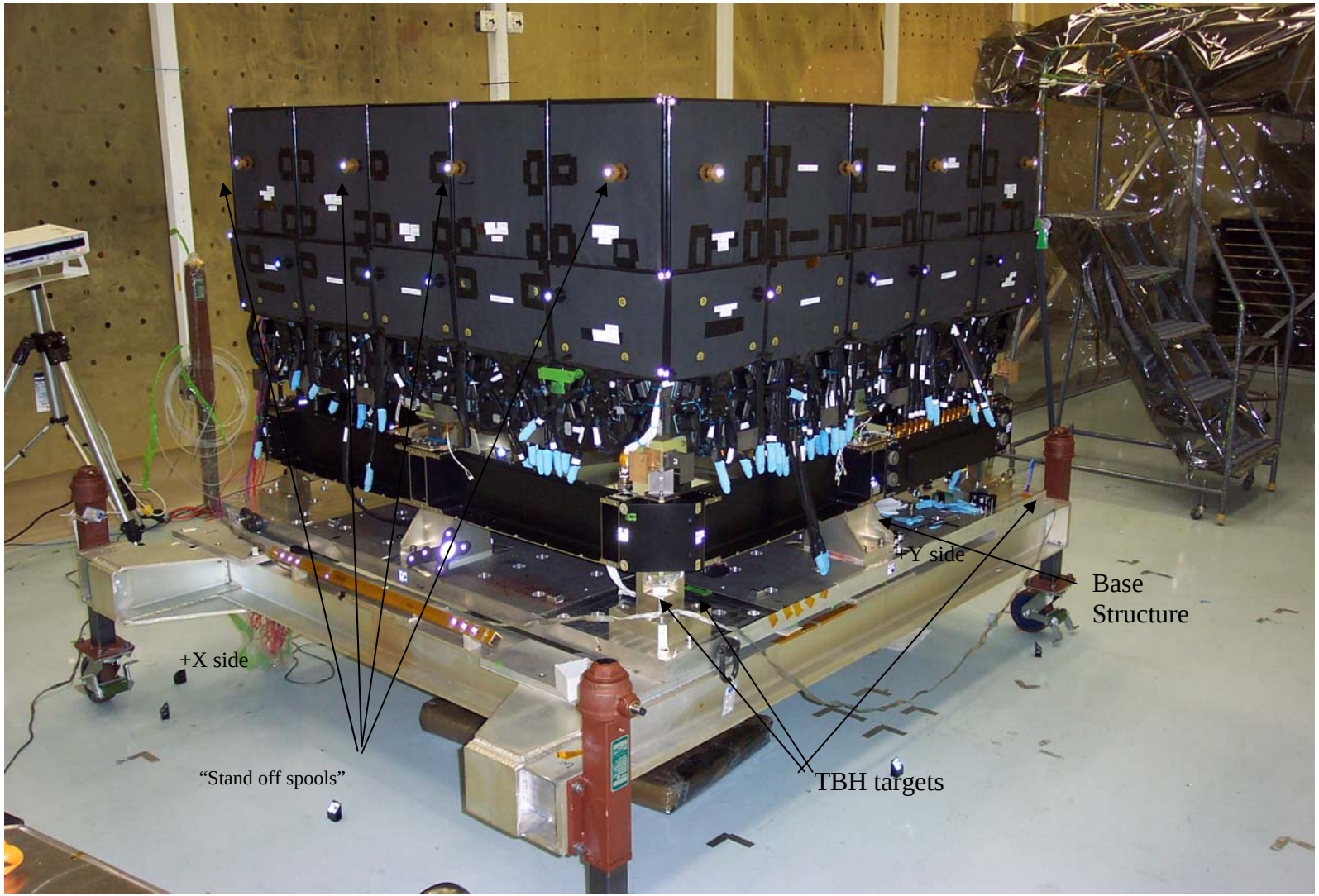
ACD TBH Target Locations



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Soft Points –MMS/MLI Measurement Results

Table 12 Failed Targets

Group::Name	X [Inches]	Y [Inches]	Z [Inches]	X check	Ycheck	Z Check	Mag from Center Stay Clear	Δ from stay clear -x	Δ from stay clear +x	Δ from stay clear +y	Δ from stay clear -y	Δ from stay clear +Z
corner-bot-yp1	63.0664	-6.0898	4.7992	TRUE	FALSE	TRUE	48.9551			-0.1311		
corner-bot-yp3	38.2528	-6.2299	4.6735	TRUE	FALSE	TRUE	37.2471			-0.2712		
corner-bot-yp5	4.8902	-6.1367	4.7199	TRUE	FALSE	TRUE	44.1685			-0.1780		
corner-bot-yp6	-1.0257	-6.4296	4.7297	TRUE	FALSE	TRUE	48.0174			-0.4710		
corner-bot+xp1	66.3261	57.5179	4.5763	FALSE	TRUE	TRUE	45.4067		0.1312			
corner-bot+xp2	66.5675	42.5930	4.7669	FALSE	TRUE	TRUE	38.5251		0.3726			
side+xp13	66.3242	31.8695	23.1034	FALSE	TRUE	TRUE	36.2484		0.1293			
side+xp16	66.6511	50.6804	8.5319	FALSE	TRUE	TRUE	41.9221		0.4562			
side+xp17	66.3184	61.1729	24.3035	FALSE	TRUE	TRUE	47.6955		0.1235			
side-yp13	46.4220	-6.3062	7.7926	TRUE	FALSE	TRUE	39.9067			-0.3475		
side-yp16	27.3151	-6.1092	38.6008	TRUE	FALSE	TRUE	36.3356			-0.1505		
side-yp17	16.0228	-6.1894	24.5363	TRUE	FALSE	TRUE	38.9476			-0.2308		
side-yp19	9.2945	-6.3296	10.9468	TRUE	FALSE	TRUE	41.9769			-0.3710		
side-yp20	0.9171	-6.2223	24.3281	TRUE	FALSE	TRUE	46.6189			-0.2637		
top-yp1	63.8767	-2.6882	41.6088	TRUE	TRUE	FALSE	47.0733					0.0202
top-yp2	55.0378	-3.7351	41.6789	TRUE	TRUE	FALSE	42.0361					0.0903
top-yp3	47.6811	-3.7946	41.6709	TRUE	TRUE	FALSE	38.1908					0.0823
top-yp5	22.0450	-4.3570	41.6678	TRUE	TRUE	FALSE	35.4078					0.0792
top-yp6	12.9730	-4.4916	41.6054	TRUE	TRUE	FALSE	38.6236					0.0168
top+xp1	64.4165	-2.1449	41.6700	TRUE	TRUE	FALSE	47.0880					0.0815
bot+yp4	43.2949	66.2949	4.7062	TRUE	FALSE	TRUE	38.5018				0.1000	
bot+yp6	62.0453	66.3856	4.8123	TRUE	FALSE	TRUE	48.3185				0.1907	
side+yp13	11.6127	66.4651	9.6441	TRUE	FALSE	TRUE	40.7867				0.2702	
side+yp14	16.6222	66.6352	23.1539	TRUE	FALSE	TRUE	38.9312				0.4404	
side+yp15	22.0223	66.4569	19.6044	TRUE	FALSE	TRUE	37.2297				0.2620	

Figure 6

Table 12 Continued.

Group::Name	X [Inches]	Y [Inches]	Z [Inches]	X check	Ycheck	Z Check	Mag from Center Stay Clear	Δ from stay clear -x	Δ from stay clear +x	Δ from stay clear +y	Δ from stay clear -y	Δ from stay clear +Z
side+yp17	30.2607	66.2100	9.2670	TRUE	FALSE	TRUE	36.0921				0.0151	
side+yp18	43.7562	66.3093	22.5578	TRUE	FALSE	TRUE	38.6756				0.1144	
side+yp19	46.1082	66.2726	39.2065	TRUE	FALSE	TRUE	39.5326				0.0777	
side+yp20	50.7034	66.5492	8.6101	TRUE	FALSE	TRUE	41.8447				0.3543	
side+yp21	58.6992	66.4481	7.9453	TRUE	FALSE	TRUE	46.2249				0.2532	
side+yp22	63.4874	66.4849	18.1871	TRUE	FALSE	TRUE	49.3564				0.2900	
side+yp23	63.9731	66.3612	25.6186	TRUE	FALSE	TRUE	49.5956				0.1663	
top+yp1	-1.9499	64.3977	41.7381	TRUE	TRUE	FALSE	46.9409					0.1495
top+yp2	6.6503	63.9530	41.7253	TRUE	TRUE	FALSE	41.1769					0.1367
top+yp3	17.3485	63.1465	41.8997	TRUE	TRUE	FALSE	35.4110					0.3111
top+yp4	22.9840	63.7999	41.8290	TRUE	TRUE	FALSE	34.4291					0.2404
top+yp5	36.7860	64.4151	41.6648	TRUE	TRUE	FALSE	34.9392					0.0762
top+yp6	49.4016	64.4908	41.6059	TRUE	TRUE	FALSE	39.4124					0.0173
top-xp3	-4.0603	46.9246	41.6749	TRUE	TRUE	FALSE	38.0870					0.0863
top-xp4	-4.3034	38.4714	41.6205	TRUE	TRUE	FALSE	35.4206					0.0319
top-xp5	-4.1461	24.3877	41.6182	TRUE	TRUE	FALSE	34.7400					0.0296
top-xp8	-3.7886	-1.2383	41.7279	TRUE	TRUE	FALSE	46.1832					0.1393
side-xp5	-6.1591	49.6286	13.4415	FALSE	TRUE	TRUE	41.1909	-0.2004				
side-xp9	-5.9799	37.1757	19.1334	FALSE	TRUE	TRUE	36.7814	-0.0212				
side-xp10	-6.1350	28.9116	8.0304	FALSE	TRUE	TRUE	36.2732	-0.1764				
side-xp11	-6.2891	27.6691	19.6725	FALSE	TRUE	TRUE	36.4895	-0.3304				
side-xp14	-5.9715	14.6293	27.0897	FALSE	TRUE	TRUE	39.2729	-0.0128				
side-xp16	-6.2782	11.0494	8.0786	FALSE	TRUE	TRUE	41.0891	-0.3196				
side-xp17	-6.4879	0.5546	6.5837	FALSE	TRUE	TRUE	47.0532	-0.5293				
side-xp18	-5.9886	-3.1082	20.4644	FALSE	TRUE	TRUE	49.0681	-0.0299				
BlanketRivitp1	63.4171	-6.0784	27.6202	TRUE	FALSE	TRUE	49.1834			-0.1198		
BlanketRivitp2	-2.9724	-6.2003	28.6660	TRUE	FALSE	TRUE	49.1326			-0.2417		
							Max Deviation	-0.5293	0.4562	-0.4710	0.4404	0.3111

**FALSE represents failure of rectangular stay clear. All targets above failed rectangular stay clear. All deltas + & - are outside stay clear.*

Hard Points

Table 13
ACD MMS Standoffs with and without MLI +X side

Hard Points - Thermal Blanket Removed								Hard Points + Thermal Blanket				
Group::Name	X [Inches]	Y [Inches]	Z [Inches]	X check	Δ from stay clear +x	□	Group::Name	X [Inches]	Y [Inches]	Z [Inches]	X check	Δ from stay clear +x
standoff+xp1	65.7628	1.3066	33.6897	TRUE	-0.4321		Side+xp9	65.8464	1.6752	33.5149	TRUE	-0.3485
standoff+xp2	65.7654	1.5207	15.3472	TRUE	-0.4295		Side+xp10	65.8845	1.7790	15.5456	TRUE	-0.3104
standoff+xp3	65.7493	8.6279	23.2220	TRUE	-0.4456		Side+xp8	65.8964	8.9684	23.3994	TRUE	-0.2985
standoff+xp4	65.7503	21.7482	33.8064	TRUE	-0.4445		Side+xp6	65.8225	22.0963	33.5884	TRUE	-0.3723
standoff+xp5	65.7044	21.8634	15.4303	TRUE	-0.4905		Side+xp7	65.8731	22.0991	15.3343	TRUE	-0.3218
standoff+xp7	65.6868	38.3435	15.5561	TRUE	-0.5081		Side+xp5	65.8303	38.5614	15.7412	TRUE	-0.3646
standoff+xp6	65.7064	38.3449	33.8552	TRUE	-0.4885		Side+xp4	65.7699	38.4789	33.6681	TRUE	-0.4250
standoff+xp8	65.6977	51.6497	23.4250	TRUE	-0.4972		Side+xp3	65.7928	51.8090	23.2409	TRUE	-0.4020
standoff+xp9	65.7103	58.9056	33.9036	TRUE	-0.4846		Side+xp1	65.7728	58.9509	33.7082	TRUE	-0.4221
standoff+xp10	65.6754	58.9612	15.6378	TRUE	-0.5195		Side+xp2	65.7905	59.0042	15.6514	TRUE	-0.4044

***Note there are no failures of stay clear.**

Table 14
ACD MMS Standoffs without MLI -X side

Hard Points - Thermal Blanket Removed					
Group::Name	X [Inches]	Y [Inches]	Z [Inches]	X check	Δ from stay clear -x
stanoff-xp10	-5.4484	1.2334	15.5467	TRUE	0.5103
stanoff-xp9	-5.3811	1.2569	33.8880	TRUE	0.5776
stanoff-xp8	-5.4082	8.4417	23.3869	TRUE	0.5505
stanoff-xp6	-5.3594	21.7625	33.8783	TRUE	0.5993
stanoff-xp7	-5.4115	21.8081	15.6724	TRUE	0.5471
stanoff-xp5	-5.4406	38.2838	15.6832	TRUE	0.5181
stanoff-xp4	-5.4161	38.2919	34.0073	TRUE	0.5426
stanoff-xp3	-5.4183	51.4727	23.5582	TRUE	0.5404
stanoff-xp1	-5.3981	58.6689	34.0125	TRUE	0.5606
stanoff-xp2	-5.4779	58.7244	15.6846	TRUE	0.4807

***Note there are no failures of stay clear.**

Table 15
ACD MMS Standoffs with and without MLI +Y side

Hard Points - Thermal Blanket Removed								Hard Points + Thermal Blanket				
Group::Name	X [Inches]	Y [Inches]	Z [Inches]	Ycheck	Δ from stay clear +y		Group::Name	X [Inches]	Y [Inches]	Z [Inches]	Ycheck	Δ from stay clear +y
stanoff+yp1	1.3361	65.6272	33.9874	TRUE	-0.5676		side+yp9	1.2985	65.6734	33.9374	TRUE	-0.5215
stanoff+yp2	1.3855	65.6798	15.6389	TRUE	-0.5151		side+yp10	1.5365	65.6906	15.7079	TRUE	-0.5043
stanoff+yp3	8.5076	65.6335	23.5244	TRUE	-0.5614		side+yp8	8.7935	65.6361	23.2238	TRUE	-0.5588
stanoff+yp4	21.8518	65.6288	33.9884	TRUE	-0.5661		side+yp6	21.9392	65.6575	33.7000	TRUE	-0.5374
stanoff+yp5	21.9260	65.6571	15.7424	TRUE	-0.5378		side+yp7	21.8367	65.6626	16.0238	TRUE	-0.5323
stanoff+yp6	38.4229	65.6360	33.9728	TRUE	-0.5589		side+yp4	38.5568	65.6813	33.7991	TRUE	-0.5136
stanoff+yp7	38.3784	65.6552	15.5190	TRUE	-0.5397		side+yp5	38.3550	65.6837	15.7095	TRUE	-0.5112
stanoff+yp8	51.6260	65.6301	23.3539	TRUE	-0.5647		side+yp3	51.2668	65.6320	23.5276	TRUE	-0.5629
stanoff+yp9	59.0253	65.6316	33.7760	TRUE	-0.5633		side+yp2	59.0182	65.6856	33.7836	TRUE	-0.5093
stanoff+yp10	58.7845	65.6886	15.4502	TRUE	-0.5063		side+yp1	58.6475	65.7388	15.5301	TRUE	-0.4561

***Note there are no failures of stay clear**

Table 16
ACD MMS Standoffs with and without MLI -Y side

Hard Points - Thermal Blanket Removed							Hard Points + Thermal Blanket					
Group::Name	X [Inches]	Y [Inches]	Z [Inches]	Ycheck	Δ from stay clear -y		Group::Name	X [Inches]	Y [Inches]	Z [Inches]	Ycheck	Δ from stay clear -y
standoff-yp10	59.1216	-5.5111	15.4103	TRUE	0.4476		side-yp9	58.6884	-5.5735	15.5528	TRUE	0.3852
standoff-yp9	59.0070	-5.5731	33.7296	TRUE	0.3855		side-yp10	58.7809	-5.5590	33.5495	TRUE	0.3997
standoff-yp8	51.8800	-5.5263	23.1943	TRUE	0.4324		side-yp8	51.4715	-5.6720	23.1368	TRUE	0.2866
standoff-yp6	38.4184	-5.5682	33.7699	TRUE	0.3905		side-yp7	38.2768	-5.6196	33.5257	TRUE	0.3390
standoff-yp7	38.2702	-5.4855	15.5179	TRUE	0.4731		side-yp6	38.0745	-5.6593	15.4545	TRUE	0.2994
standoff-yp5	21.9870	-5.5077	15.5443	TRUE	0.4509		side-yp5	21.8646	-5.5593	15.5627	TRUE	0.3993
standoff-yp4	21.8366	-5.5898	33.7863	TRUE	0.3688		side-yp4	21.7277	-5.5667	33.6382	TRUE	0.3919
standoff-yp3	8.7169	-5.5646	23.2987	TRUE	0.3940		side-yp3	8.8086	-5.5858	23.0463	TRUE	0.3729
standoff-yp1	1.4663	-5.6310	33.7481	TRUE	0.3276		side-yp1	1.2519	-5.7149	33.4365	TRUE	0.2437
standoff-yp2	1.4164	-5.5800	15.4665	TRUE	0.3786		side-yp2	1.4722	-5.7159	15.5485	TRUE	0.2428

***Note there are no failures of stay clear**

Table 17
Stay Clear Boundary Definitions Used

Outside Stay Clear						Adjust for tracker ball .25in		
x	**y**	**z**	**X**	**Y**	**Z**	**X**	**Y**	**Z**
-145	-145	0	**-5.70866**	**-5.70866**	**0**	-5.95866	-5.95866	-0.25
-145	1675	0	**-5.70866**	**65.94488**	**0**	-5.95866	66.19488	-0.25
1675	-145	0	**65.94488**	**-5.70866**	**0**	66.19488	-5.95866	-0.25
1675	1675	0	**65.94488**	**65.94488**	**0**	66.19488	66.19488	-0.25
-145	-145	1050	**-5.70866**	**-5.70866**	**41.33858**	-5.95866	-5.95866	41.58858
-145	1675	1050	**-5.70866**	**65.94488**	**41.33858**	-5.95866	65.69488	41.58858
1675	-145	1050	**65.94488**	**-5.70866**	**41.33858**	66.19488	-5.95866	41.58858
1675	1675	1050	**65.94488**	**65.94488**	**41.33858**	66.19488	66.19488	41.58858

Table 18
Circular Stay Clear boundary

			Center		Adjust for tracker ball .25in
Diagonal (mm)	**Diagonal (in)**	**Radius**	**X**	**Y**	**StayClear Radius**
2573.868684	101.333413	50.66671	30.11811	30.11811	50.91670637

Table 19
Fit Errors

New Data					Group GLAST dolly ref tgt.txt					
	x	y	z		x	Y	z	Δx	Δy	Δz
TBH5	62.51438	60.96019	-3.52348		62.5145	60.9611	-3.5234	0.0001	0.0009	0.0001
TBH6A	60.8782	62.61843	-3.52322		60.8781	62.6175	-3.5233	-0.0001	-0.0009	-0.0001
TBH1	-2.08482	-0.8499	-3.52459		-2.0849	-0.8505	-3.5245	-0.0001	-0.0006	0.0001
TBH2	-0.62515	-2.26942	-3.52541		-0.6251	-2.2688	-3.5255	0.0001	0.0006	-0.0001