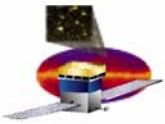


## GLAST Large Area Telescope:

Electronics, Data Acquisition &  
Flight Software W.B.S 4.1.7

August Status Meeting 08-05-04

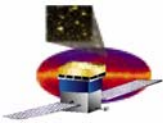
Mike Huffer/Gunther Haller  
[haller@slac.stanford.edu](mailto:haller@slac.stanford.edu)  
(650) 926-4257



# Outline

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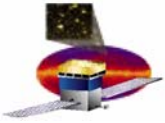
- **EGSE**
  - **GASU**
  - **PDU**
  - **TEM Assembly**
  - **TPS Assembly**
  - **Test-Stands**
  - **Crates (SIU/EPU)**
- **Flight Production**
  - **GASU**
  - **PDU**
  - **TEM/TPS**
  - **Crates (SIU/EPU)**
- **Test-Bed and ISIS covered in separate talks**
- **Schedule/cost**
- **Schedule/budget**



# GASU (EGSE)

Test-Stand	Use	GASU	DAQ 1	DAQ 2	PDU 1	PDU 2	Lid	Status	Notes
0996	I & T	0896	1289	1290	1096	1095	1286	Waiting Connectors	
0887	I & T	0897	1291	1292	1085	1087	1285	Waiting Connectors	
1268	DAQ testbed	0898	1293	1294	1098	1024	1284	Waiting Connectors	replace
n/a	SLAC	0899	1295	1296	1105	1086	1283	Waiting Connectors	I & T?
1132	ACD Test-Bed	1145	1135	1134	1100	1104	N/I	Conformal/Staking	
1267	DAQ ELF14	0903	0952	N/A	1065	N/A	1280	In Use	V2
n/a	DAQ	0901	1297	1298	1066	1097	1282	Waiting Connectors/Test PS	
n/a	SLAC	1150	1302	1303	1054	N/A	N/A	Waiting Connectors/Lid/PS	
0892	DAQ ELF2	1272	0951	N/A	0883	N/A	1278	In Use	V2

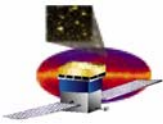
- **Connectors (due to arrive this week)! (arrived)**
- **Production order:**
  - **DAQ testbed (replaces current)**
  - **I & T**
- **Added *true* external trigger functionality**
  - **New test connector (reflected on shield)**
  - **VHDL complete**
  - **Rework all DAQ boards *except* ACD**



## PDU (EGSE)

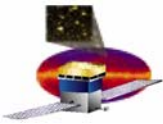
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- 1 on Test-bed
  - Will replace (connectors have moved)
- 1 given to ISIS (plus load box)
- Need load boxes (2 under construction)
- Fabricated 10 more boards
  - In loading (2 per enclosure)
    - FSW/DAQ (2)
    - I&T (2)



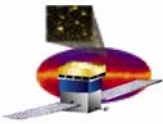
# TEM (EGSE) Assembly

Use	TEM	TEM Case	TEM Lid	Status	Notes
SLAC	0264	0281	0521	Tested	For internal use only
SLAC	0262	0498	0461	Waiting Test	
SLAC	0638	0497	1245	In Repair	
TKR	0656	0442	0516	In Repair	conformal
CAL	0252	0439	0266	Tested	conformal
CAL	0686	0282	0269	Tested	conformal
CAL	0865	0440	0457	Tested	conformal
TKR	0253	0452	0520	Tested	conformal
DAQ	0658	0503	1248	Retest/silkscreen	new firmware
DAQ	0265	1240	1249	Retest/silkscreen	new firmware
DAQ	0685	0512	0459	Waiting Test	new firmware
DAQ	0692	0450	0458	Waiting Test	new firmware
DAQ	0655	1241	1250	Waiting Test	new firmware
DAQ	0774	0489	0272	Rework	new firmware
DAQ	0256	0493	0481	Rework	new firmware
DAQ	0691	0451	474	Rework	new firmware
DAQ	0665	0443	479	Rework	new firmware
DAQ	0689	0438	476	Rework	new firmware
DAQ	0666	0491	0274	Rework	new firmware
CAL	1158	0449	1251	Retest/silkscreen	conformal
DAQ	0877	1243	1246	Retest/silkscreen	new firmware
SLAC	0664	1244	1247	?	missing
CAL	0864	0450	0458	Tested	conformal
SLAC	0251	0502	0523	Tested	
SLAC	0683	0510	0463	Tested	
SLAC	0687	0513	0522	In Repair	
SLAC	0692	1242	1251	In Repair	
CAL	1117	0512	0460	Tested	conformal



# TPS (EGSE) Assembly

Use	TPS Case	TPS	TPS Lid	Status	Notes
SLAC	n/a	0410	n/a	In Repair	
SLAC	n/a	0419	n/a	In Repair	
SLAC	n/a	0872	n/a	In Repair	
SLAC	1233	0870	1255	In Repair	silkscreen
SLAC	1234	0871	1256	In Repair	silkscreen
TKR	0172	0635	0435	Assembled	test?
SLAC	1235	0651	1257	In Repair	silkscreen
SLAC	n/a	0654	1258	In Repair	silkscreen
SLAC	n/a	0295	0431	In Repair	
SLAC	n/a	0612	0430	In Repair	
SLAC	n/a	0294	n/a	In Repair	
TKR	1236	0418	0431	Tested/Assemble	silkscreen
TKR	1237	0417	0432	Tested/Assemble	silkscreen
SLAC	1238	0296	0433	Tested/Assemble	silkscreen
SLAC	1239	0869	0434	Tested/Assemble	silkscreen
TKR	0347	0146	0357	Assembled	conformal
CAL	0345	0149	0375	Rework	conformal
I& T	0346	0565	0367	Assembled	test?
SLAC	0171	0868	0387	Assembled	test?
TKR	0177	0147	0374	Assembled	conformal
CAL	0169	0648	0376	Rework	conformal
CAL	0173	0616	0385	Rework	conformal
CAL	0168	0409	0366	Rework	conformal
CAL	0176	0152	0436	Rework	conformal
CAL	0175	0417	0382	Rework	conformal
SLAC	?	0154	?	?	missing
SLAC	0164	0537	0365	In Repair	
SLAC	1230	0297	1252	Tested/Assemble	silkscreen
SLAC	1231	0636	1253	Tested/Assemble	silkscreen
SLAC	1232	0614	1254	Tested/Assemble	silkscreen



# Calorimeter Test-Stands

USE	SBC	LCB	Xbrd	TEM	CABLES	STATUS	Notes
AFEE EGSE #1	0323	0123	0216	0349	0238	In Use	
AFEE EGSE #2	0026	0820	0210	0400	0977	In Use	
AFEE EGSE #3	0561	0815	0202	0391	0978	In Use	
AFEE EGSE #4	0326	0814	0777	0350	0235	In Use	
AFEE EGSE #5	0976	0813	0199	0394	0245	In Use	
AFEE EGSE #6	0990	0819	0187	0344	0994	In Use	Conformal (FM)
AFEE EGSE #7	0079	0829	0203	0399	1056	In Use	Conformal (FM)
AFEE EGSE #8	0336	0792	0226	0345	240	Test Xbrd/ Rework TPS	Conformal (FM)
AFEE EGSE #9	0315	1406	0225	0169	1313	Test Xbrd/ Rework TPS	Conformal (FM)
AFEE EGSE #10	1331	0805	0222	0173	1312	Test Xbrd/Rework TPS	Conformal (FM)
AFEE EGSE #11	0338	0826	0224	0168	1322	Test Xbrd/Rework TPS	Conformal (FM)
AFEE EGSE #11	1112	1307	0222	0175	1312	Test Xbrd/Rework TPS	Conformal (FM)
AFEE EGSE #12	1331	0826	0222	0176	1312	Test Xbrd/Rework TPS	Conformal (FM)

- **Waiting Zener diodes for Power Supply (due by end of week)**
  - **Install**
  - **Recoat**
  - **Retest Power Supply**
  - **Integrate and retest TEM/TPS**
  - **Assemble and test test-stand**



# Tracker Test-Stands

USE	SBC	LCB	Xbrd	TEM	CABLES	STATUS	Notes
EGSE #2 (Italy)	0310	0782	0193	0356	1059	In Use	
EGSE #3 (Italy)	0317	0781	0201	0343	0246	In Use	
EGSE #4 (Italy)	0423	0810	0207	0396	0982	In Use	
EGSE #5 (Italy)	0144	0821	0211	0353	0983	In Use	
EGSE MCM burn-in (Clean-Room)	0319	0135	0214	0341	0244	In Use	
EGSE (UCSC)	0991	0833	0198	0170	1057	In Use	
EGSE #6 (Italy)	0313	0827	0221	0347	1316	Test Xbrd/Assemble/Test	conformal (FM)
EGSE #7 (Italy)	0314	0825	0227	0147	1309	Test Xbrd/Assemble/Test	conformal (FM)
EGSE #8 (Italy)	0338	1305	1265	0172	1310	Test Xbrd/Assemble/Test	
EGSE #9 (Italy)	0333	0803	0084	1236	1317	Test Xbrd/Silkscreen	
EGSE #10 (Italy)	1111	1308	1260	1237	1318	Test Xbrd/Silkscreen	

- **Waiting on silk-screening on enclosures**
- **Waiting on transition board testing**



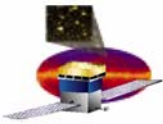


# ACD Test-Stands

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Use	SBC	LCB	VME	GASU	28V	CABLES	STATUS
EGSE #2	0320	0818	0853	0931	0291	Yes	In Use
EGSE #3	0329	0812	0893	0988	0919	Yes	In Use
EGSE #4	1118	0133	1116	0878	0288	Yes	In Use
Test-Bed (#5)	0318	0125	1132	1145	0292	Yes	In Assembly

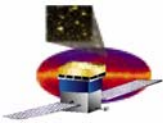
- **ACD testbed**
  - **Waiting on conformal/staking (1 week)**
  - **Retest (1 week)**



# I & T Test-Stands

Intended USE	SBC	LCB	VME	GASU	TEM	PDU	PDU-load	Xbrd	28V	CABLES	STATUS
Software development	0309	0793	0996	0896	0346	Test	Test	0213	0995	Yes	In Use
Tower integration(EM2)	0335	0128	1226	1224	None	Assemble	None	0208	0290	Yes	In Use
CAL Integration	0078	0801	0791	None	None	None	None	0035	1334	1311	Test
TKR Integration	1160	0804	0888	None	None	None	None	1263	0944	1223	Test
LAT Integration	0307	0802	0887	0897	None	Assemble	None	1264	0108	1315	In Assembly

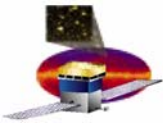
- **Software test-stand accretes GASU PDU/PDU load**
- **GASUs and PDUs have high priority in production line**
- **CAL and TKR integration test-stands are a testing (manpower) issue**



# Electronics Test-Stands

Intended USE	SBC	LCB	VME	TEM	PDU	PDU-load	28V (1)	Xbrd	CABLES	STATUS	28V (2)	28V (3)
TEM Production	0311	?	0404	None	None	None	0947	0216	0233	In Use	0141	0525
TEM production	0308	0823	1222	None	None	None	0420	?	1221	In Use	0529	
TPS Production	0306	0126	0985	None	None	None	?	0190	0234	In Use		
Thermo-Vac Chamber	0322	0122	1287	None	None	None	0289	0200	None	In Use		
PDU Development (MLF)	0325	0132	0057	None	?	?	0528	0055	0250	In Use		
ASIC Burn-In (Clean-Room)	0327	0799	0890	None	None	None	0299	0205	0247	In Use	0138	
Dave Nelson's office	1119	None	N/I	None	None	None	0298	None	None	In Use		
TEM Flight Production (NM)	0305	0822	0886	0167	None	None	N/A	0219	1314	Waiting P/S		
TPS Flight Production (NM)	0086	0117	0885	None	None	None	N/A	None	None	Waiting P/S	N/A	N/A
Leonid's office	0102	None	None	None	None	None	None	None	None	In Use		

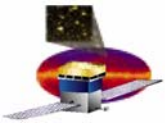
- **Flight TEM production**
  - **Needs precision 28 V precision supplies**
    - **Languishing in purchasing since 6/17**
    - **Found alternative source**



# DAQ/FSW Test-Stands

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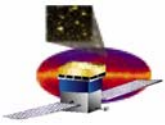
Intended USE	SBC	LCB	VME	GASU	TEM	XBRD	PDU	PDU-load	1553	28V	CABLES	STATUS
ELF11	0993	0832	889	None	None	N/A	None	None	None	0301	Yes	In Use
ELF14	0316	0831	1267	0903	None	None	0926	1163	1266	0940	Yes	In Use
JJ's Office	0087	0120	1274	None	EM1	1277	None	None	None	1275	0249	In Use
ELF18	0334	0124	1268	1120	None	None	0920	None	0851	0293	Yes	In Use
Ohio State	0332	0798	0854	None	857	0204	None	None	None	0855	0232	In Use
FE tower	0321	0817	0859	None	?	0197	None	None	None	0860	0243	In Use
ELF5	0304	0121	1269	0902	None	None	None	None	None	0942	Yes	In Use
FES Test	0992	0828	1101	None	EM1	0209	None	None	None	0946	0242	In Use
ELF2	0328	0816	0892	None	EM1	0085	None	None	None	0339	None	In Use
ELF1	0337	0136	1270	0900	None	1276	None	None	None	0143	None	In Use
ELF3	1273	None	1271	1272	None	None	None	None	None	0930	Yes	In Use



# Test-Stand Summary

Client	Shipped	Assemble/Test	Total
Calorimeter (conformal)	2	6	8
Calorimeter	5	0	5
Tracker (conformal)	0	2	2
Tracker	6	3	9
ACD	3	1	4
I & T	2	2	4
DAQ/FSW	11	0	11
Electronics Support	11	0	11
<b>Total</b>	<b>39</b>	<b>14</b>	<b>53</b>

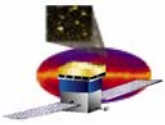
- **Issues**
  - Zener diodes (this week)
  - Silk-screening (this week)
  - Transition board testing (ongoing, finished before end of week)
  - TEM Power Supply Repair
  - ACD testbed GASU (2 weeks)
  - Testing Resources (lack there of)
- Parts for about 60 TEMS (last 4-7 are going to be hard)
- Parts for additional test-stands paced by SBC



## EGSE Crates (SIU/EPU)

---

- **Crates**
  - Crates are being used by Testbed/FSW for FSW development/test
  - Production is 10 crates
  - **Six Assembled, tested crates (plus support structure)**
    - 3 testbed
    - 1 FSW/Hardware development
    - 1 ISIS (done)
    - 1 goes to NRL (done)
  - All parts in hand to build 2 more, *including* backplanes
  - BAE boards and LCBs will preclude the remainder
  - BAE750 boards
    - Received all ordered boards (have total of 8)
    - Two additional ones which were to be ordered can't be purchased anymore
      - However BAE will instead be loaning 2 boards for a while....



## The “SIB problem”

---

- **EEPROM randomly and spontaneously fails**
  - Lots of literature and history on this problem
  - A number of failure modes observed
  - We have observed failures in the SIB
  - Not clear all failures have a common cause
  - “good” could become bad and vis versa
- **Convened a set of “wise men” to discuss issue**
- **JJ has produced a draft of recommendations (under review)**
- **Consequences *two* places**
  - **SIB (LAT) (relatively easy)**
    - Replace file system with memory mapped system
  - **SUROM (BAE 750) (very hard)**
    - Used in *both* instrument and spacecraft
    - Anchors all software systems (used as solution to SIB)
    - Discussions underway with BAE and Spectrum-Astro

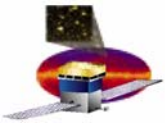


# GASU/GPS & PDU (flight)

	Start/Status	End/Release
Fab Drawing Release (all mechanical GASU drawings were submitted)		July 15
Vendor: Enclosure Fabrication (all 3, qual/flight/spare)	Aug 15	Sep 30
Vendor: PCB Fabrication (all 6 plus 4 spare)	Sept 15	Sep 30
All components in		Sep 30
Test-plan/procedures	now	Aug 30
TC/Vibration/TV/EMI procedures (EMI plan is risk)	now	Sep 30
Vendor: Assembly ( first article, qual; deliver box to SLAC)	Sep 30	Oct 30
TC (1d); Vibration (2d); TV (5d); Dyn. Burn-in (5d); EMI (5d)	Oct 30	Nov 30
Done Qual	Nov 30	
Vendor: Assembly (2; 1 + 1 spare); deliver box to SLAC **	Nov 15	Dec 15
Flight Acceptance Test	Dec 15	Jan 19
RFI	Jan 19	

- To be done:
  - PDU common-mode filter, test with SAI PRU (done)
  - ACD power-switch & monitoring circuit (done)
  - More testing of trigger & event-builder (in progress)

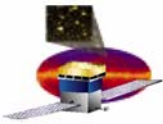




## TEM/TPS (flight)

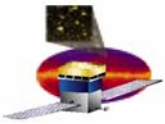
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- Established production meeting with B. Estey (3 times/week!)
- New Shottky diode due August 10 (**received**)
- ACTEL FPGA programming (done at ACTEL)
- Lead-forming contract placed.
- Program for ACTEL finalized (**documentation sent**)
- Lead forming contract placed
- Found some CRYSTEK connectors with internal shorts...
  - **NCR made, screening gives enough parts**
- Poly-switches in screening at GSFC (**done and returned**)
- Meeting with SLAC personnel at assembly vendor (**done**)
- Test-stands being readied

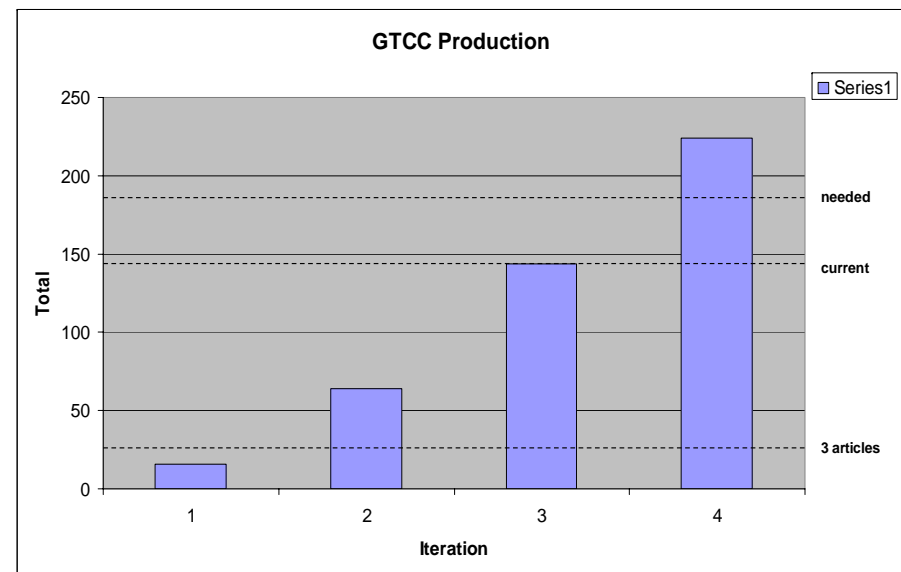
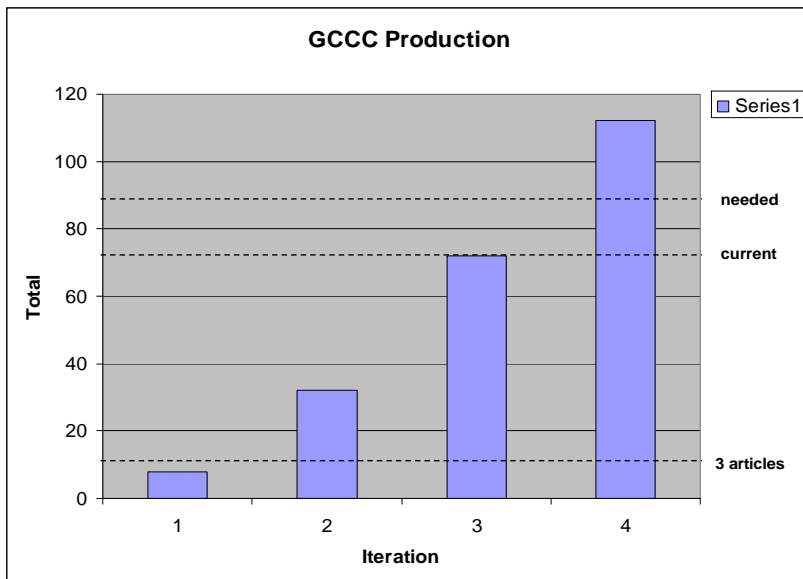


# Production highlights

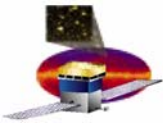
	Start/Status	End/Release
Fab Drawing Release		Done
Vendor: Enclosure Fabrication (all 21)	Received all TEM enclosures, TPS not yet.	9/1
PCB Fabrication must be respun	8/9	8/14
TPS/TEM inventoried (missing 1 uf capacitor)	Capacitors ship 8/5	8/7
Test-plan/procedures	Final draft	?
TC/Vibration/TV/EMI procedures (Dave and Brian)	Draft released and under review	?
Vendor: Assembly (3 first article, one qual, TWR A &B); TC & vibration. Deliver box to SLAC	9/7	9/23
TV (5d); Dyn. Burn-in (5d); EMI (5d)	10/13	10/27
RFI TWR A	11/1	1/7/2005
Vendor: Assembly (19; 15 + 4 spare); deliver box to SLAC **	1/7/2005	?
Flight Acceptance Test	2/1/2005	?
RFI	2/7/2005; sets of 2 with 2 weeks lag	3/25/2005



# ASIC Production



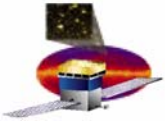
- 1 iteration roughly every 10 days
- GLTC ASICs (for GASU)
  - Waiting on burn-in and test fixture
  - Completed in 10 days



# Flight crates (SIU/EPU)

	Start/Status	End/Release
Fab Drawing Release (all mechanical drawings were submitted)		Aug 15
Vendor: Enclosure Fabrication (all 8, qual (1) /flight (5) /spare (2))	Aug 30	Oct 15
Vendor: PCB Fabrication (all 10 plus 2 spare)	Oct 1	Oct 15
All components in ( <b>Issue: Oscillator, see below</b> )		Oct 15
Test-plan/procedures	now	Sep 15
TC/Vibration/TV/EMI procedures ( <b>EMI plan is risk</b> )	now	Oct 15
Vendor: Assembly ( first article, qual; deliver boards to SLAC)	Oct 15	Nov 30
TC (1d); Vibration (2d); TV (5d); Dyn. Burn-in (5d); EMI (5d)	Nov 30	Jan 15
Done Qual	Jan 15	
Vendor: Assembly; deliver boards to SLAC	Jan 1	Feb 15
Flight Acceptance Test	Feb 15	Mar 30
RFI	Mar 30	

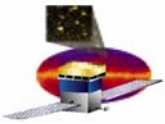
- To be done:
  - Figure out details of test-plan/procedure for each PCI module (**continues**)
  - PCI code/P&R tailoring to make PCI standard-timing in 72 series (**done**)
  - Test LCB FPGA slave interface code function (is used in EPU) (**done**)
  - Investigate occasional SIB EEPROM first-address corruption when power-up (**done**)
  - More testing (**continues**)
- Issue: delivery of 48-MHz oscillator for SIB: now Jan 5 delivery date (Able to locate one part for **qual**)



## Threads to maintain schedule/cost

---

- **Connector savers (\$100k just for TEMs)**
- **Lead-forming (\$40k)**
- **EGSE cost (cables very expensive, paid substantial expedite fees)**
- **TEM assembly more than expected (many QA clauses)**



## Schedule/Budget

---

- **Total budget: \$21,685**
- **Work Scheduled up to date: \$18,050**
- **Work Performed: \$15,773**
- **Actuals: \$15,878**
- **Schedule Variance \$-2,277 (-14.3%)**
  - **Qual/Flight work is behind**
  - **EGSE production is behind**
  - **CCB on increased BAE cost (350)**
- **Cost Variance: \$105k (.7%)**
  - **EGSE Labor over budget (26-00068)**