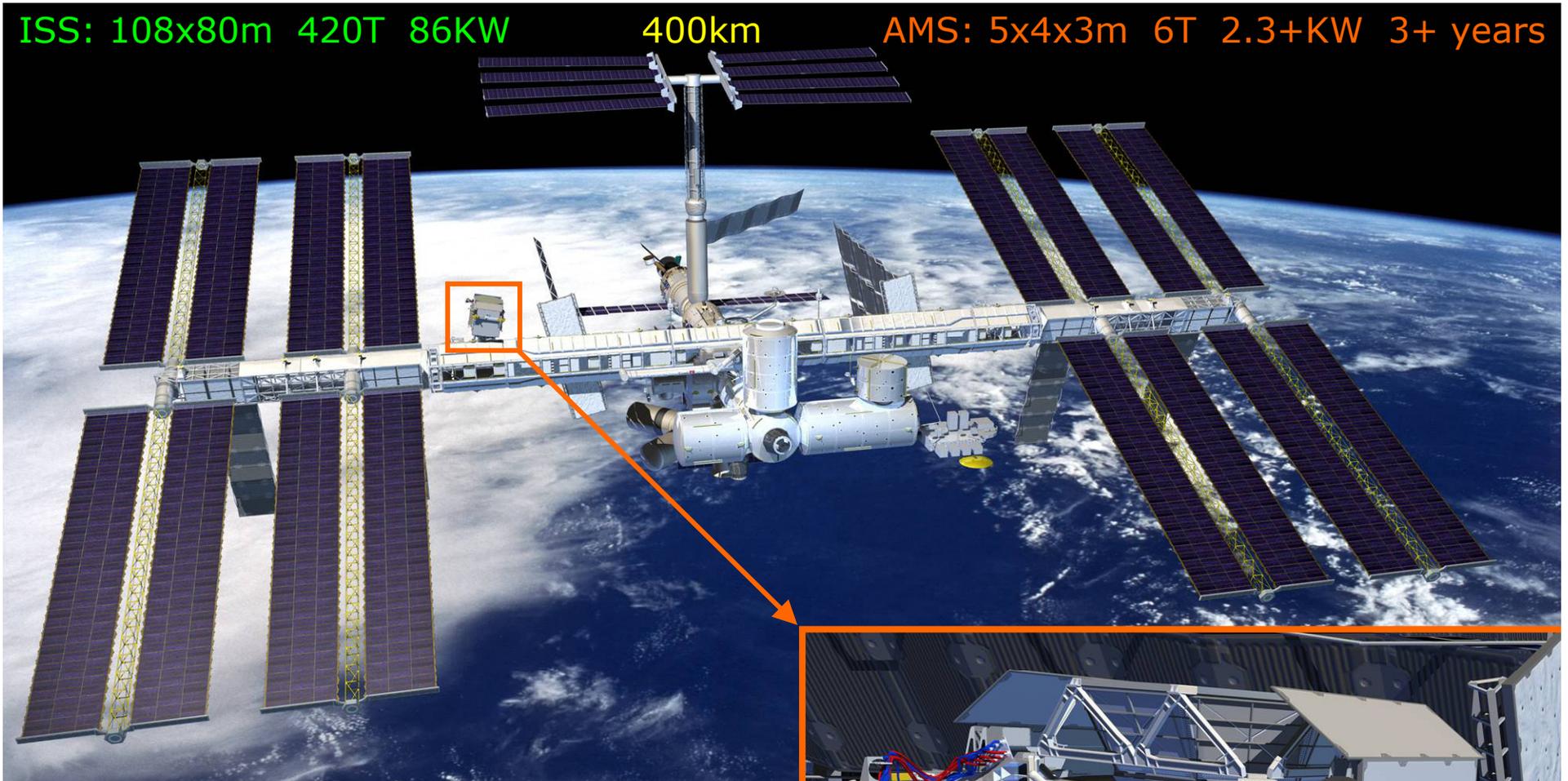


ISS: 108x80m 420T 86KW

400km

AMS: 5x4x3m 6T 2.3+KW 3+ years



AMS-02 EGSE

GSR-II (09 Sep 2008)

Mike Capell

Avionics & Operations Lead

Senior Research Scientist



Avionics: Electrical Interfaces on ISS (STS similar)

Power:

109-124VDC
~2.5 KW

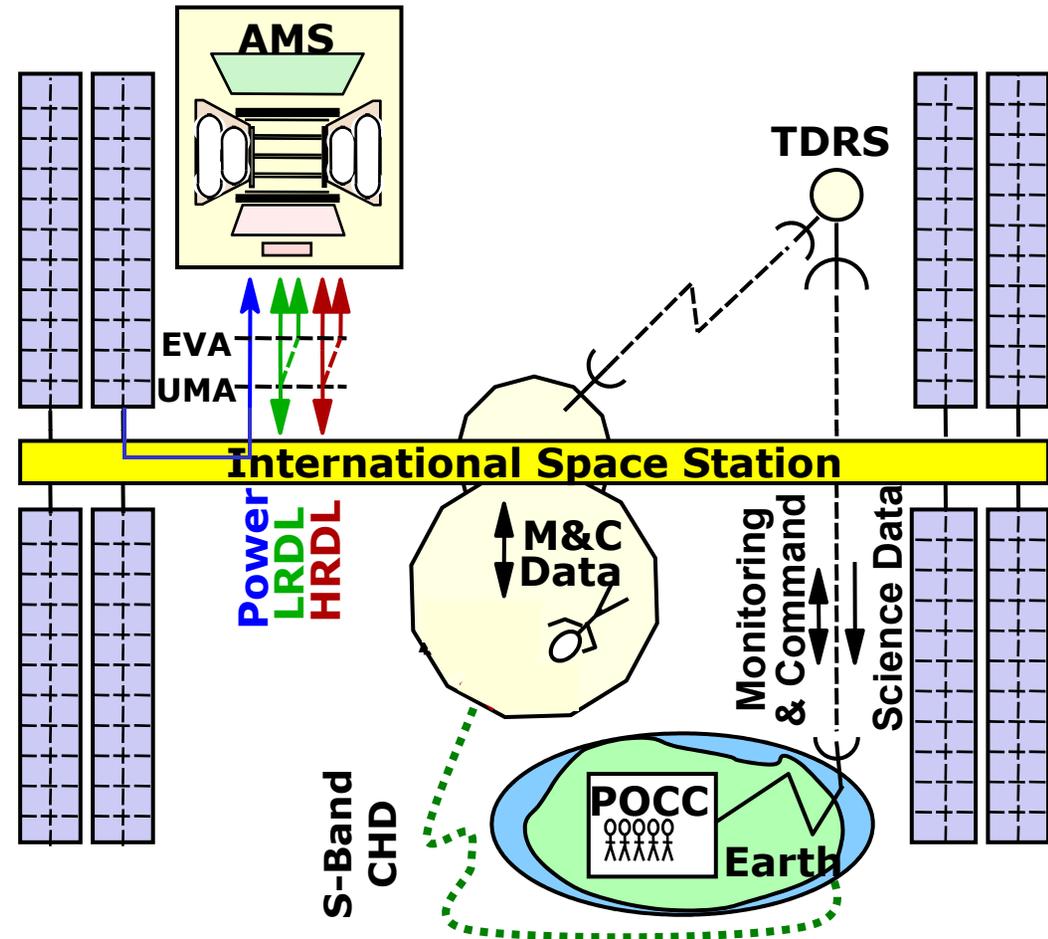
LRDL

for Cmd & Mon
1553B Bus
1 Kbit/s in
10 Kbit/s out
10 B/sec CHD

HRDL

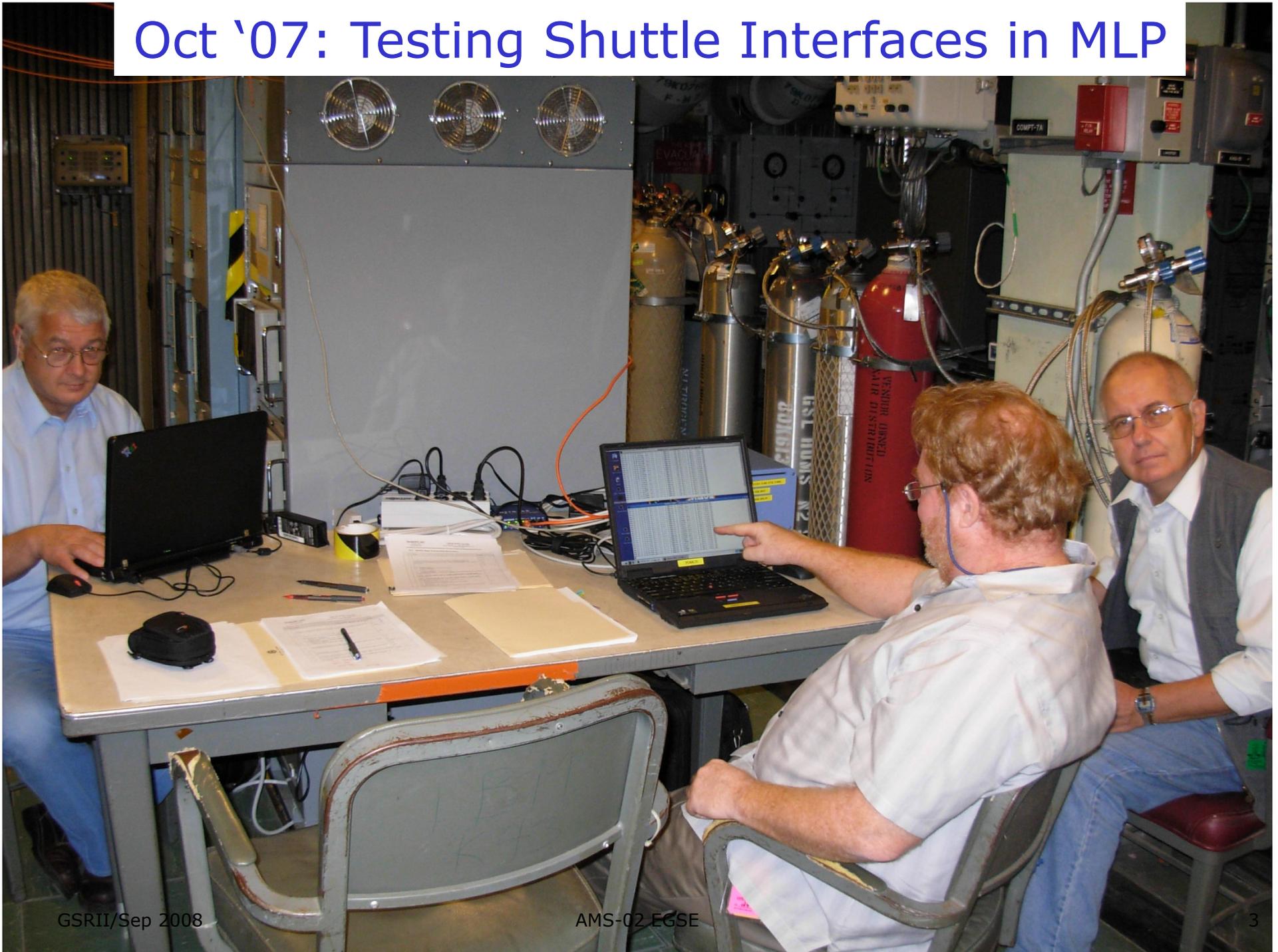
for Event Data
Taxi F/O (STS:RS422)
<2Mbit/s>_{orbit}

xRDL: Duty cycle ~70%



Ensure AMS side of interfaces conform to ISS/STS requirements

Oct '07: Testing Shuttle Interfaces in MLP



Payload Power Utilization during Ground Processing

Full payload consumption $\sim 2.2\text{KW}$

(requires thermal GSE - *items 4-6 on slide 9* - to be active for extended operations).

Steady-state (standby) requires (24/7) $\sim 875\text{W}$
PDS, J-Group, CAB, Cryocoolers+CCEB &
TRD-gas and electronics.

Item	AMS-02 Mission Phases																Notes
	Standby		[7]	T-0		STS		SSRMS		ISS (Magnet Charging)		ISS (Science Ops)					
	ON/OFF	Value		ON/OFF	Value	ON/OFF	Value	ON/OFF	Value	ON/OFF	Value	ON/OFF	Value				
PDS Overhead	ON	210.0		ON	333.0	ON	333.0	ON	200.0	ON	210.0	ON	333.0				
PDS Local Htrs	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0	OFF	0.0	OFF	0.0	[2]			
PDS 120V Out																	
ECAL Htrs - 1	OFF	0.0		OFF	0.0	OFF	0.0	[4]	ON	136.8	ON	136.8	OFF	0.0	[2]		
Ram Rad. Htrs Set #1 - 2	OFF	0.0		OFF	0.0	OFF	0.0	[4]	ON	362.4	ON	362.4	ON	362.4	[1]		
TRD + UG Htrs - 3	OFF	0.0		OFF	0.0	OFF	0.0	[4]	ON	153.6	ON	153.6	ON	153.6	[1]		
Tracker Rad. Wake Htrs - 4	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0	[2]		
Ram Rad. Htrs Set #2 - 5	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0	[2]		
2 E-Crates + 10 HVs Htrs - 6	OFF	0.0		OFF	0.0	OFF	0.0	[4]	ON	153.6	ON	153.6	ON	153.6	[1]		
RICH + Lower TOF Htrs - 7	OFF	0.0		OFF	0.0	OFF	0.0	[4]	ON	153.6	ON	153.6	ON	153.6	[1]		
Wake Rad. + CAB Htrs - 8	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0	[2]		
2X Starb. Cryocooler Htrs - 9	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0	[2]		
Tracker Rad. Ram Htrs - 10	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0	[2]		
2X Port Cryocooler Htrs - 11	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0	[2]		
CCEB - 12	ON	460.2		ON	460.2	ON	460.2		OFF	0.0	ON	20.2	ON	460.2			
CCS	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	ON	1260.0	[5]	OFF	0.0		
120V Total (W)		670.2			793.2		793.2			1160.0		2450.2			1616.4		
PDS 28V Out																	
Converter #1																	
TPD3	OFF	0.0		ON	80.1	ON	80.1		OFF	0.0	OFF	0.0	ON	80.1			
TPD7	OFF	0.0		ON	80.1	ON	80.1		OFF	0.0	OFF	0.0	ON	80.1			
JPD_N	ON	50.5		ON	50.5	ON	50.5		ON	50.5	ON	50.5	ON	50.5			
SPD1_N	OFF	0.0		ON	41.4	ON	41.4		OFF	0.0	OFF	0.0	ON	41.4			
UGPD_N	ON	32.5		ON	32.5	ON	32.5		OFF	0.0	ON	32.5	ON	32.5			
SPD0_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
TPD1	OFF	0.0		ON	80.1	ON	80.1		OFF	0.0	OFF	0.0	ON	80.1			
TTPD_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
Converter #2																	
ERP1_N	OFF	0.0		ON	94.2	ON	94.2		OFF	0.0	OFF	0.0	ON	94.2			
TPD2	OFF	0.0		ON	80.1	ON	80.1		OFF	0.0	OFF	0.0	ON	80.1			
TPD6	OFF	0.0		ON	80.1	ON	80.1		OFF	0.0	OFF	0.0	ON	80.1			
SPD3_N	OFF	0.0		ON	41.4	ON	41.4		OFF	0.0	OFF	0.0	ON	41.4			
MPD_N	ON	51.1		ON	51.1	ON	51.1		OFF	0.0	ON	51.1	ON	51.1			
UPD1	OFF	0.0		ON	45.4	ON	45.4		OFF	0.0	OFF	0.0	ON	45.4			
SPD2_N	OFF	0.0		ON	41.4	ON	41.4		OFF	0.0	OFF	0.0	ON	41.4			
CAB_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	ON	22.5	[6]	ON	19.0		
Converter #3																	
TPD0	OFF	0.0		ON	80.1	ON	80.1		OFF	0.0	OFF	0.0	ON	80.1			
TPD4	OFF	0.0		ON	80.1	ON	80.1		OFF	0.0	OFF	0.0	ON	80.1			
ERP0_N	OFF	0.0		ON	94.2	ON	94.2		OFF	0.0	OFF	0.0	ON	94.2			
MPD_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
SPD3_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
UGPD_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
SPD2_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
CAB_N	ON	71.4		ON	71.4	ON	71.4		OFF	0.0	ON	108.3	[6]	ON	71.4		
Converter #4																	
JPD_R	OFF	0.0		OFF	0.0	OFF	0.0		ON	50.5	ON	50.5	OFF	0.0			
ERP1_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
SPD1_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
ERP0_R	OFF	0.0		OFF	0.0	OFF	0.0		OFF	0.0	OFF	0.0	OFF	0.0			
UPD0	OFF	0.0		ON	45.4	ON	45.4		OFF	0.0	OFF	0.0	ON	45.4			
SPD0_N	OFF	0.0		ON	41.4	ON	41.4		OFF	0.0	OFF	0.0	ON	41.4			
TPD5	OFF	0.0		ON	80.1	ON	80.1		OFF	0.0	OFF	0.0	ON	80.1			
TTPD_N	OFF	0.0		ON	134.0	ON	134.0		OFF	0.0	OFF	0.0	ON	134.0			
28V Total (W)		205.5			1425.1		1425.1			101.0		315.4			1444.1		
Total (W)		875.7			2218.3		2218.3			1261.0		2765.6			3060.5	[3]	

NOTES

- [1] Heaters - Default ON for analysis
- [2] Heaters - Thermostat control. Once operational temp range achieved; heaters are DISABLED.
- [3] Clearly, we will stay below 25A as not all the heaters [1] will be on at the same time.
- [4] It is assumed these heaters will not be needed in the PLB
- [5] This is the power consumed at the end of the ramp up and during stabilization.
- [6] This power is consumed through the entire ramp up. H. Cuesta, 19-Aug-08
- [7] Section added 20_aug-08, Mike.

EGSE Locations

Diagnostics – may be needed anywhere.

EGSE – mounted near or on P/L in SSPF:

- Thermal EGSE for cooling P/L (items 4-6),

- Test EGSE for GPS & AST check out (7-10).

GSC (Ground Support Computers) – near P/L.

POCC – user area computers, servers.

CGSE (Cryogenics GSE) – needed at SSPF, PCR

E-CGSE – controls the CGSE.

Offices/Backroom – more computers.

ESGE Power Utilization

Payload supplied offline by (item 14)

2 pairs of Agilent N5770A

Output: 2* 25A @ 124VDC

The main vacuum pump - Leybold RUTA 2001:
400V, 3phase, 73kVA, 105A peak (item 30),
(Note: 2 pumps arriving, only one needed).

Chiller available – DAIKEN EUWAB8KAZW1—G
400V, 3 phase 50Hz, TBD A peak (for PCR,
item 33)

Most everything else is standard office
equipment (PCs, printers, etc), see following...

AMS ELECTRICAL EQUIPMENT MATRIX

Location	Item	Manufacturer	Model Number	Commercial Yes/No	Electrical Code	3-Phase Yes/No	KSC Facilities	Batteries Yes/No Commercial/Custom	Functions
Diagnostic (used wherever needed)									
	1	Tektronix	TDS 7054	Yes	UL	No	No	No	Oscilloscope
	2	Tektronix	TDS 11402	Yes	UL	No	No	No	Oscilloscope
	3	Fluke, etc,	Multimeters	Yes	N/A	N/A	No	Yes, Commercial	Multimeters
EGSE (mounted near or on payload during ground operations in SSPF, not used in PCR (TBC))									
TBC	4	Honeywell	HV180	Yes	UL	No	No	No	Fan for main radiator cooling
TBC	5	Honeywell	HV180	Yes	UL	No	No	No	Fan for Zenith radiator cooling
TBC	6	Honeywell	HT800-E	Yes	CE/GS	No	No	No	Fan for PDS and CAB cooling
	7	Texas Instruments	UNK	Yes	CE	No	No	No	AST LED
	8	Spirent	STR4500	Yes	CE	No	No	No	GPS simulator
	9	MIDWEST MICROWAVE	STA-1043-04-NNN-79	Yes	CE	No	No	No	GPS Attenuator
	10	planTec	UNK	Yes	CE	No	No	No	GPS simulator transmitter
GSC (located near payload during ground operations, e.g., on tables in SSPF High Bay or in MLP)									
	11	Hewlett-Packard	DC7700-CMT	Yes	UL	No	No	No	Personal computer (POC/GSC)
	12	Hewlett-Packard	DC7800-CMT	Yes	UL	No	No	No	Personal computer (POC)
	13	Hoojum Design	Cubit3	Yes	UL	No	No	No	Personal computer (GSC)
	14	Agilent Technologies	N5770A	Yes	UL	No	No	No	DC power supply (120V)
	15	D-Link	DGS-1016D	Yes	UL	No	No	No	Gigabit network switch
	16	3Com	4400 24PT	Yes	UL	No	No	No	10/1000 network switch
	17	NEC	Multisync LCD2170NX	Yes	UL	No	No	No	LCD Monitors
	18	Dataprobe	iBB-2N20	Yes	UL	No	No	No	Remote reboot power outlets
	19	AMS	EPPCAN	No		No	No	No	EEPCAN interface, 5V
	20	AMS	USB422	No		No	No	No	RS422-USB interface (DDRS)
POCC (located in "user area" for controlling the payload during ground operations)									
	21	Hewlett-Packard	DC7700-CMT	Yes	UL	No	No	No	Personal computer (POC/GSC)
	22	Hewlett-Packard	DC7800-CMT	Yes	UL	No	No	No	Personal computer (POC)
	23	D-Link	DGS-1016D	Yes	UL	No	No	No	Gigabit network switch
	24	3Com	4400 24PT	Yes	UL	No	No	No	10/1000 network switch
	25	NEC	Multisync LCD2170NX	Yes	UL	No	No	No	LCD Monitors
	26	Dell	PowerEdge 2900 III	Yes	UL	No	No	No	Personal computer (SOC)
	27	Dell	Dell Power Vault DP 600	Yes	UL	No	No	No	Disk server (POC)
	28		UPS	Yes	UL	No	No	Yes, Commercial	UPS for disk server
	29	Hewlett-Packard	Laserjet printer	Yes	UL	No	No	No	Network printer
CGSE (CGSE that uses electricity directly, all needed at SSPF and in PCR)									
	30	Leybold Vacuum	RUTA 2001	Yes	CE	YES	No	No	Main Vacuum Pump
	31	BOC Edwards	XDS5	Yes	CE	No	No	No	PVVV Vacuum Pump
	32	Infincon	UL 1000	Yes	CE	No	No	No	He leak detector
	33	DAIKIN EUROPE NV	EUWAB8KAZW1 - - G	Yes	CE	Yes	No	No	Chiller for PCR??

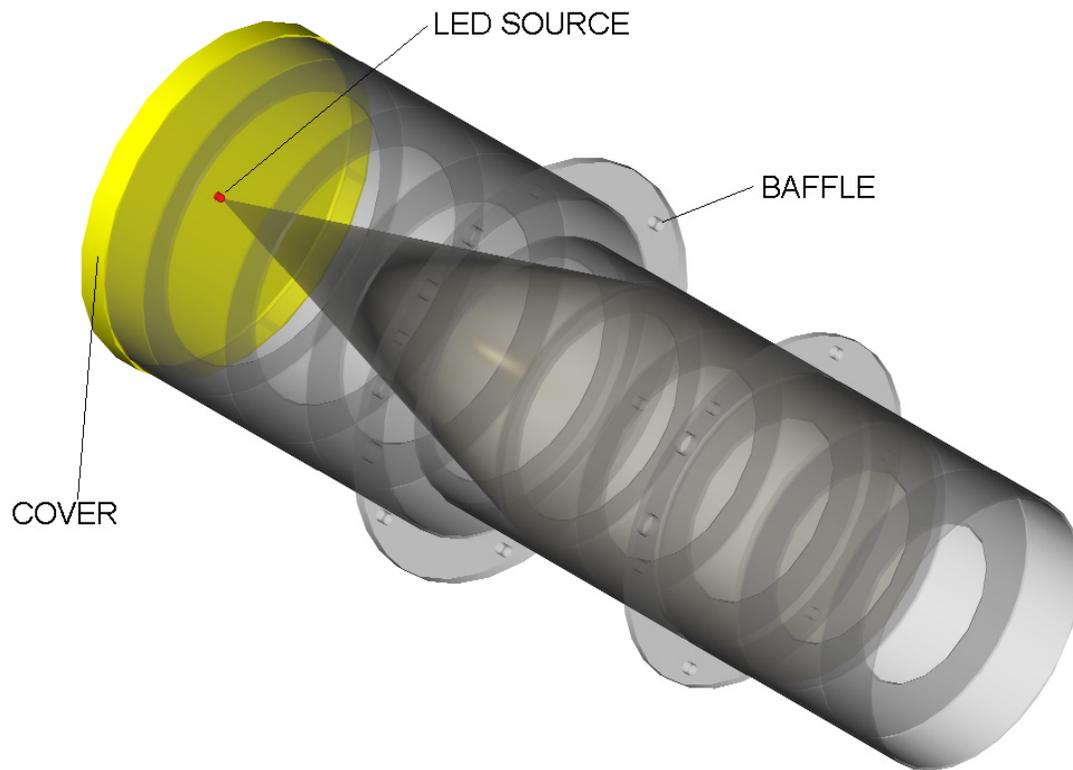
AMS ELECTRICAL EQUIPMENT MATRIX

Location	Item	Manufacturer	Model Number	Commercial Yes/No	Electrical Code	3-Phase Yes/No	KSC Facilities	Batteries Yes/No Commercial/Custom	Functions
<u>E-CGSE</u> (electronics associated with CGSE, located nearby in 5 enclosed 19" racks, ~2fx2fx5ft, e.g. on floor of SSPF or in PCR)									
	34	APC	2200UX Smart UPS	Yes	UL	No	No	Yes, Commercial	UPS for CGSE
	35	Le Guan	Lead-Acid Battery Pack	Yes	UNK	No	No	Yes, Commercial	UPS for CGSE
	36	ADVANTECH	610H	Yes	CE	No	No	Yes, Commercial	Industrial PC for CGSE
	37	ADVANTECH	AWS-8259TP-T	Yes	CE	No	No	Yes, Commercial	Industrial PC Display
	38	SIEMENS	PanelPC 557	Yes	CE	No	No	Yes, Commercial	Industrial PC for CGSE
	39	SIEMENS	FieldBus Modules	Yes	UL	No	No	No	PLC crates for CGSE
	40	Scientific Instruments	9350-1	Yes	UL	No	No	No	Temperature Indicator
	41	Yudain	UNK	Yes	CE	No	No	No	Alarm MUX?
	42	TPLink	UNK	Yes	CCC	No	No	No	Ethernet hub
	43	AMI	135-2K	Yes	CE	No	No	No	Liquid He level probe
	44	Shanghai YunJie Vacuum Equip.	2DF-1B	Yes	UNK	No	No	No	"Complex Vacuum Meter"
	45	TBD	Transformer	Yes	UL	No	No	No	110-220V transformer
	46	AMS	EPPCAN	No		No	No	No	EEPCAN interface, 5V
<u>E-CGSE</u> (electronics associated with CGSE, mounted onto the CGSE elements themselves)									
	47	SIEMENS	FieldBus IO Modules	Yes	UL	No	No	No	CGSE Monitoring & Control
	48	TBD	FieldBus IO Modules	Yes	UL	No	No	No	CGSE Monitoring & Control
<u>Offices/POCC</u> (wherever people can find to sit and work)									
	49	Various	Laptop computers	Yes	UL	No	No	Yes, Commercial	Laptop computer
	50	Hewlett-Packard	Laserjet printer	Yes	UL	No	No	No	Network printer

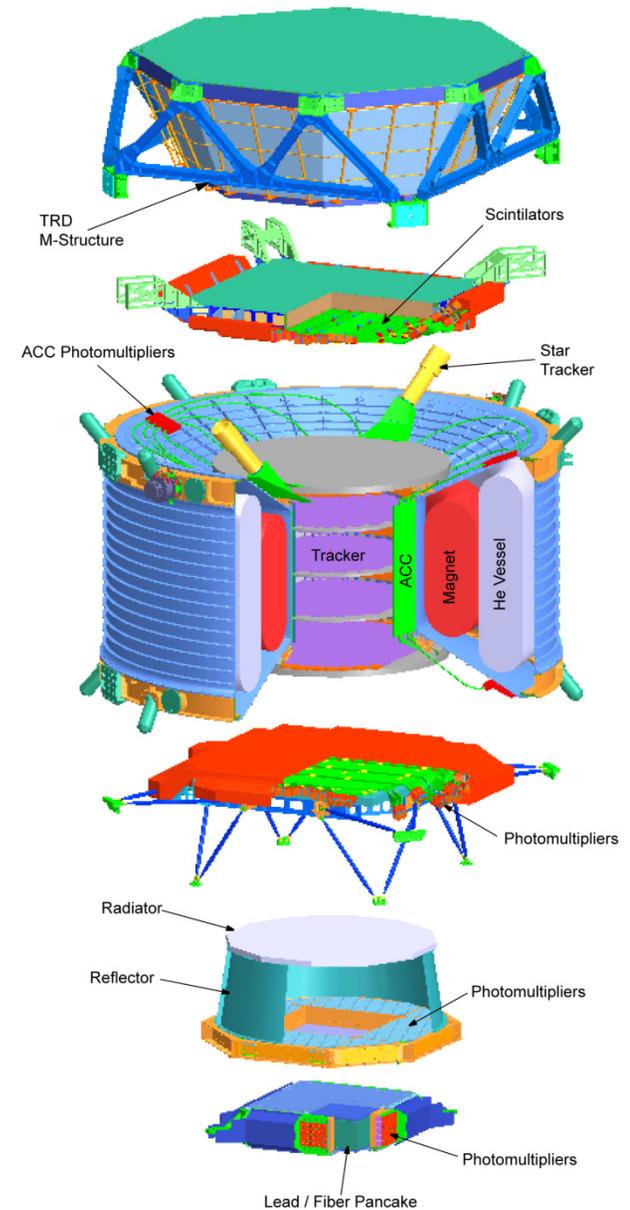
The UPS (Item 34) in the E-CGSE ensures that all valves can be closed, etc., and the Cryogenic system put into a stable condition in case of unexpected power outage. Without supplementary batteries, UPS good for >30min.

Item 35 will not be shipped to KSC.

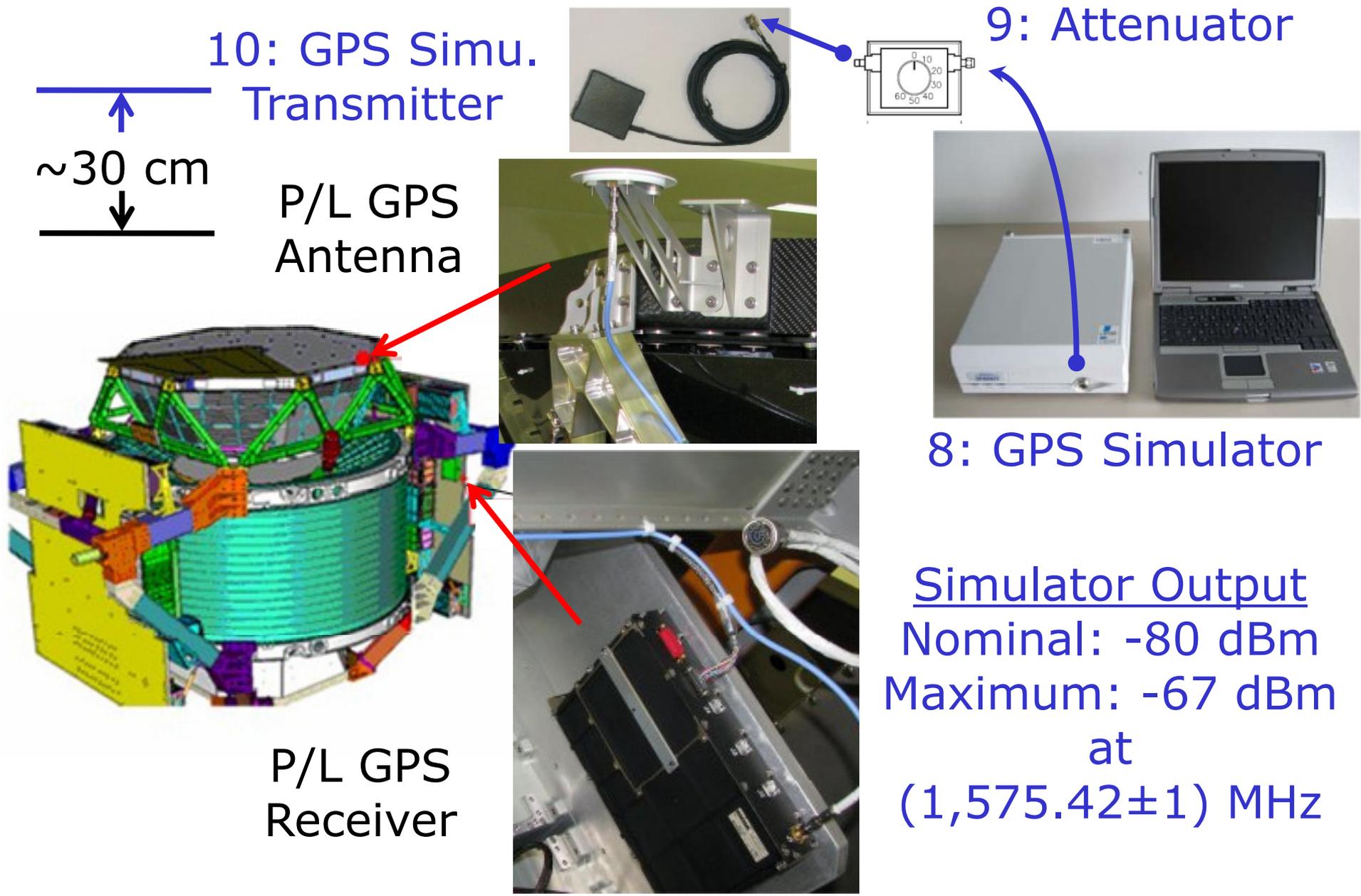
7. AST (Star Tracker) LED



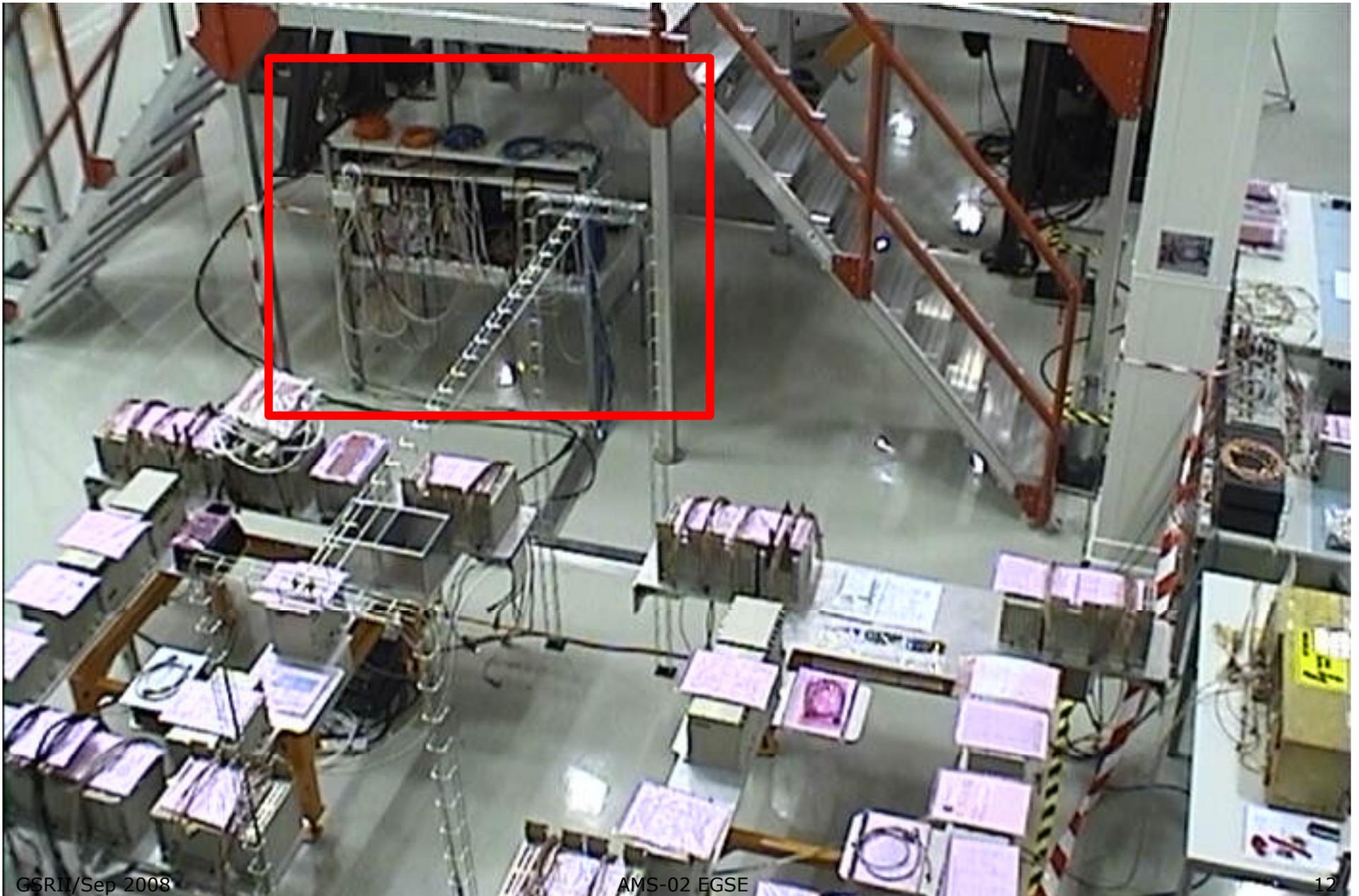
Optical output < 1mW
(n.b., AST saturates at magnitude 1)



8-10: GPS Checkout



11-20: Ground Support Computers



Electrical Ground Handling

All payload electrical mates are dead faced.

All HV sources are insulated and buried within the payload.

When charging or discharging the magnet there is a large current ($\sim 400\text{A}$) but at a low voltage ($< 10\text{V}$).

The payload UPSes (2 on payload, 2 in store) are potential high current sources (also, the UPSes in store need a refrigerator).

Grounding

P/L must be grounded before power is applied.

During offline processing and test the bond path is the third wire to the PDS plus a drag on braid which attaches to a trunnion.

During online processing the bond paths are the third wire plus the CAS or trunnions.

GSE has only usual (UL) grounding requirements.