HESSI Instrument Mass Budget

HIS_SYS_010H | 08/03/99 | David Pankow

UCB/GSFC SPECTROMETER (or cryostat)

	ICD Mass	current mass	Best Est.	Last Est.	contingency (kg)	contingency percent		ITEM CG (meters) X	Y	Z
		ITEM MASSES (kg)								
Cryostat Housing Components	**42.79**	**40.560**	**37.313**	**37.300**	**3.247**	**8%**		Z datum is bottom		
> Bottom Plate/Radiator for Cooler		10.950	9.630	9.630	1.320	12%	rd	0.005	0	0.008
> Cryocooler housing and interface		1.000	0.980	0.980	0.020	2%	ff	-0.08	0	0.070
> Cryostat lower preamp ring & flanges		5.000	4.562	4.560	0.438	9%	ef	0	0	0.086
> Cryostat upper detector ring & flanges		1.800	1.756	1.756	0.044	2%	ff	0	0	0.219
> Cryostat top plate w/ Be windows		4.400	4.310	4.310	0.090	2%	ff	0	0.002	0.306
> Cryostat Main Mounting Legs		3.600	3.260	3.260	0.340	9%	rd	0	0	0.076
> Cryocooler (Sun Power M77)		4.620	4.403	4.403	0.217	5%	ff	-0.07	0	0.061
> HV&CSA's (1eax9) boxes & 1 util box		3.400	3.200	3.200	0.200	6%	ef	0	0	0.064
> External MLI Blankets on Cryostat		0.800	0.681	0.681	0.119	15%	est	0	0	0.216
> Hi-Z Attenuators (Thin Shutter)		0.230	0.225	0.225	0.005	2%	ff	0	0.013	0.335
> Hi-Z Attenuators (Thick Shutter)		0.320	0.310	0.310	0.010	3%	ff	0	0.013	0.335
> Hi-Z Attenuators (non-moving supports)		1.040	0.985	0.985	0.055	5%	ff	0	0.013	0.335
> Graded-Z Shield, top only ..all sky science)		3.000	2.661	2.650	0.339	11%	ef	0	0	0.218
> External Vacuum Piping		0.400	0.350	0.350	0.050	13%	ef	0	0	0.137
Cryostat Suspended Components	**30.79**	**28.190**	**26.534**	**26.432**	**1.656**	**6%**				
> Cold Plate (internal)		2.800	2.683	2.590	0.117	4%	ef	0	0	0.161
> Thermal Mounts for Cold Plate		1.300	1.280	1.280	0.020	2%	ef	0	0	0.168
> Outer Thermal Shield ..for blankets		0.510	0.496	0.496	0.014	3%	ef	0	0	0.241
> ~12 MLI Layers on Outer Shield (taller)		0.280	0.253	0.253	0.027	10%	ef	0	0	0.241
> Inner GeD / Thermal Shield		0.430	0.413	0.413	0.017	4%	ef	0	0	0.246
> ~5 MLI layers on Inner Shield		0.260	0.227	0.227	0.033	13%	ef	0	0	0.246
> Bottom Thermal Shield		0.260	0.248	0.248	0.012	5%	ef	0	0	0.114
> ~12 MLI Layers on Bottom Shield		0.150	0.127	0.127	0.023	16%	ef	0	0	0.110
> Thermal Standoffs for Shields		0.050	0.045	0.045	0.005	9%	ef			0.194
> Cold Finger ..now includes sapphire		0.560	0.527	0.550	0.033	6%	ef	0	0	0.094
> LN2 piping & port to Dewar (flight parts)		0.600	0.567	0.567	0.033	5%	ef	0	0	0.187
> Cryosorb Capsule (2)		0.150	0.147	0.115	0.003	2%	ef	0	0	0.161
Ge Detectors Subset										
> GeD's basic 71ϕ x 85 Ge blanks only		15.740	14.650	14.650	1.090	7%	ef	0	0.011	0.207
> Detector Mounting ..Malone hardware		3.900	3.780	3.780	0.120	3%	ef	0	0	0.213
> Beryllium Scattering Target		0.080	0.080	0.080	0.000	0%	ef	0	0	0.203
> Detector shields & masks		1.000	0.910	0.910	0.090	9%	ef	0	0	0.257
> Internal Harness (flex prints +)		0.120	0.100	0.100	0.020	17%	ef	0	0	0.121

INSTRUMENT ELECTRONICS

	ICD Mass	current mass	Best Est.	Last Est.	Contingency (kg)	Contingency percent		ITEM CG (meters) X	Y	Z
		ITEM MASSES (kg)								
IDPU Subsystem	**13.97**	**13.970**	**9.480**	**9.480**	4.490	32%		0.135	0.145	0.097
> VME Chassis …13 slots by Spectrum		3.750	3.440	3.440	0.310	8%	ff			
> VME Backplane		0.370	0.300	0.300	0.070	19%	ff			
> 1/8" Covers for all Board Slots		0.500	0.400	0.400	0.100	20%	ef			
> Data Controller Card		0.750	0.420	0.420	0.330	44%	ef			
> Power Controller Card		0.750	0.420	0.420	0.330	44%	ef			
> Nine Analog Front End Boards		6.750	3.780	3.780	2.970	44%	ef			
> ADP Board by PSI		0.750	0.420	0.420	0.330	44%	ef			
> Particle Detector (flight SAA sensor)		0.350	0.300	0.300	0.050	14%		T.B.S.	T.B.S.	T.B.S.
> Power Converter/Controller & HVPS	**3.60**	**3.600**	3.000	3.000	0.600	17%	ef	0.133	0.057	0.057
> Cryocooler Power Converter	**3.60**	**3.600**	4.000	4.000	-0.400	-11%	ef	0.089	0.044	0.089
UCB Harnessing Allocations	**2.15**	**2.245**	**2.538**	**2.538**	-0.293	-13%				
> IDPU Analog to Spectrometer		1.100	1.075	1.075	0.025	2%	est			
> Misc IDPU To Spectrometer		0.390	0.468	0.468	-0.078	-20%	est			
> IDPU to LV/HV Supply		0.200	0.375	0.375	-0.175	-88%	est			
> IDPU to Cooler Supply		0.065	0.080	0.080	-0.015	-23%	est			
> Heavy power cables to Cooler		0.140	0.258	0.258	-0.118	-84%	est			
> IDPU to Particle Detector		0.100	0.082	0.082	0.018	18%	est			
> Harness clamps, ties. lacing		0.250	0.200	0.200	0.050	20%	est			

red only indicates that previous estimate was carried

PSI IMAGER ASSEMBLY

	ICD Mass	current mass	Best Est.	Last Est.	contingency (kg)	contingency percent		ITEM CG (meters) X	Y	Z
		ITEM MASSES (kg)								
TUBE ASSEMBLY	**24.20**	**18.060**	**17.295**	**16.787**	**0.765**	**4%**		datum is +lower tray		
> ~ 3mm GRE basic Tube		8.300	8.070	7.933	0.230	3%	ff	0	0	0.770
>Ti Tube End Ring (upper) & Conn Brkt		1.400	1.370	1.335	0.030	2%	ff	0	0	1.475
>Ti Tube End Ring (lower) & Conn Brkt		1.400	1.350	1.330	0.050	4%	ff	0	0	0.065
>Ti Center Ring		3.100	3.015	3.015	0.085	3%	ff	0	0	0.770
> Imager to S/C flex links & brackets		1.800	1.740	1.776	0.060	3%	ff	0	0	0.685
> S/C "Hard Point" Mounting & bolts		0.600	0.580	0.228	0.020	3%	ff	0	0	0.600
> Cylinder Thermal Blankets		1.460	1.170	1.170	0.290	20%	est	0	0	0.785
Upper Imager Tray Assembly	**18.07**	**14.330**	**13.785**	**13.779**	**0.545**	**4%**				
> Tray Structure		3.100	3.005	2.832	0.095	3%	ff	0	0	1.535
> 3 Tray Flex Link Mounts		0.370	0.354	0.260	0.016	4%	ff	0	0	1.510
> Grid Mounts (9 x 3 + 30 screws)		0.000	*combined*	1.270				0	0	1.570
> Imaging Grids & Mounts		9.500	9.222	8.090	0.278	3%	ff	0	0	1.590
> Tray heater, sensor & harness		0.330	0.300	0.300	0.030	9%	ef	0	0	1.515
> SAS Optics		0.500	0.477	0.600	0.023	5%	ef	0	0	1.600
>Blanket Scaffolding		0.230	0.197	0.197	0.033	14%	ef	0	0	1.600
> End Thermal Blanket		0.300	0.230	0.230	0.070	23%	est	0	0	1.580
> *Sun Sensor (SPECTRUM ..for ref only)*	0.500	0.500	0.403	0.403	0.097	19%		T.B.D	T.B.D	T.B.D
> *Fwd Antenna (SPECTRUM ..for ref only)*	0.570	0.570	0.195	0.195	0.375	66%		T.B.D	T.B.D	T.B.D.
> *Fwd Antenna (SPECTRUM ..for ref only)*	0.570	0.570	0.195	0.195	0.375	66%		T.B.D	T.B.D	T.B.D
Lower Imager Tray Assembly	**19.25**	**14.550**	**13.933**	**14.602**	**0.617**	**4%**				
> Tray Structure		2.900	2.744	2.832	0.156	5%	ff	0	0	-0.010
> 3 Tray Flex Link Mounts		0.370	0.354	0.260	0.016	4%	ff	0	0	0.035
> Grid Mounts (9 x 3 + 30 screws)		0.000	*combined*	1.270				0	0	0.020
> Imaging Grids & Mounts		9.500	9.238	8.090	0.262	3%	ff	0	0	0.040
> Tray heater, sensor & harness		0.330	0.300	0.300	0.030	9%	ef	0	0	-0.030
> SAS Sensors		0.920	0.870	1.500	0.050	5%	ef	0	0	0.040
>Blanket Scaffolding		0.230	0.197	0.120	0.033	14%	ef	0	0	-0.025
> End Thermal Blanket		0.300	0.230	0.230	0.070	23%	est	0	0	-0.005

	ICD Mass	current mass	Best Est.	Last Est.	(kg)	percent		X	Y	Z
ROLL ANGLE SENSOR (RAS)	**2.99**	**2.250**	**1.800**	**1.800**	**0.450**	**20%**				
> Lens and CCD Housing		1.000	0.750	0.750	0.250	25%	ff	-0.02	-0.01	-0.010
> Sun / Earth Shade		0.550	0.500	0.500	0.050	9%	ff	0.12	0	0.030
> RAS Isolation mount & MLI		0.700	0.550	0.550	0.150	21%	est	0	0	0.000

	ICD Mass	current mass	Best Est.	Last Est.	(kg)	percent	
PSI Harnessing Allocations	**1.10**	**1.100**	**1.105**	**1.105**	**-0.005**	**0%**	
> RAS to IDPU Data Cabling		**0.110**	0.265	0.265	-0.155	-141%	est
> SAS to IDPU Data Cabling		**0.480**	0.514	0.514	-0.034	-7%	est
> Imager Houskeeping (heaters & sensors)		**0.380**	0.226	0.226	0.154	41%	est
> Harness clamps, ties. lacing		**0.130**	0.100	0.100	0.030	23%	est

Mass Basis Legend

est	*dist/sqft estimate*
rd	*released drawing*
ef	*EM fab value*
ff	*FM fab value*

ACCUMULATED SUBSYSTEM TOTALS

	ICD Mass	current mass	Best Est.	Last Est.	contingency (kg)	contingency percent	Additional Margin for Impliementation
		ITEM MASSES (kg)					
> UCB/GSFC Cryostat Housing	42.790	40.560	37.313	37.300	3.247	8%	5%
> UCB Cryostat Suspended Components	30.790	28.190	26.534	26.432	1.656	6%	8%
> IDPU Assembly in VME Chassis	13.970	13.970	9.480	9.480	4.490	32%	0%
> Instrument Power controller (IPC)	3.600	3.600	3.000	3.000	0.600	17%	0%
> Cryocooler Power converter (CPC)	3.600	3.600	4.000	4.000	-0.400	-11%	0%
> Collected UCB Harnessing	2.150	2.245	2.538	2.538	-0.293	-13%	-4%
> PSI Imager Tube Assembly	24.200	18.060	17.295	16.787	0.765	4%	25%
> PSI Upper Imager Tray Assembly	18.070	14.330	13.785	13.779	0.545	4%	21%
> PSI Lower Imager Tray Assembly	19.250	14.550	13.933	14.602	0.617	4%	24%
> PSI Roll Angle Sensor (RAS)	2.990	2.250	1.800	1.800	0.450	20%	25%
> Collected PSI Harnessing	1.100	1.100	1.105	1.105	-0.005	0%	0%
INSTRUMENT TOTALS	**162.510**	**142.455**	**130.783**	**130.823**	**11.672**	**8%**	12%
Spacecraft Items (for reference only)	1.640	1.640	0.793	0.793	0.847	52%	

NOTES

1. ICD controlled masses such as the Imager Upper and Lower Tray Assemblies are listed seperately to also define the mass moments.
2. C.G. information (in spacecraft or instrument coordinates) is also provided to better define the mass moments.
3. Contingencies are listed at the component level. Additional subsystem impliementation margins are listed in italics with the ICD masses.
4. Subsystem mounting hardware is included in the mass listings, if not seperately identified.