



THE AEROSPACE
CORPORATION



UT



Systems Engineering

Bob Goeke

Cosmic RAY Telescope for the Effects of Radiation



Overview

- System Requirements
- Block Diagram
- Current Resource Utilization
- Conclusions

Cosmic RAY Telescope for the Effects of Radiation

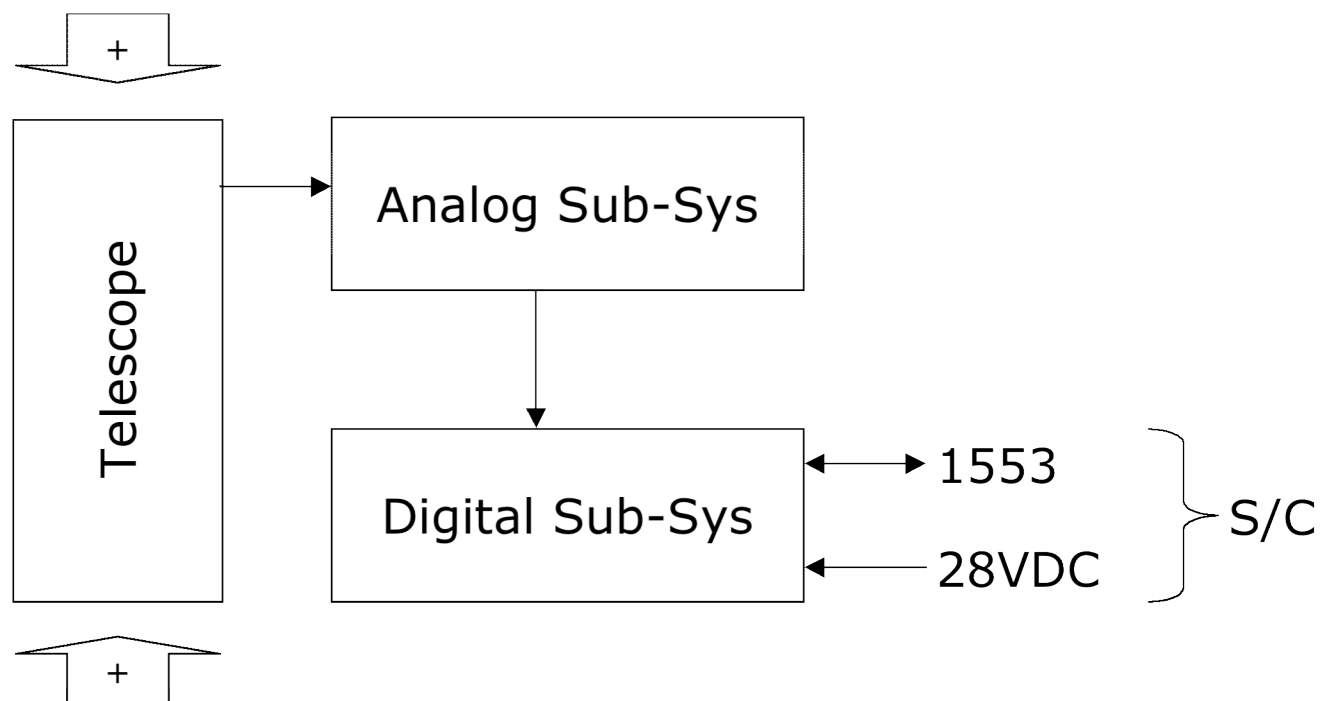


System Requirements

- No changes to science or mission requirements since PDR
- Contamination Control (32-01203 Rev 06)
 - There has been some escalation of requirements; they still appear to be modest, though a TQCM cert is now required.
- ICDs (data, electrical, thermal, mechanical) are all stable.

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System Block Diagram





System Resources

	Mass	Power	Data Rate
PDR	5.2 Kg	5.1 w	515 bps / 89.0 Kbps
CBE	5.46 Kg	8.07 w	616 bps / 89.1 Kbps
Allocation	6.36 Kg	9.00 w	89.1 Kbps
Margin	16.4%	11.5%	n/a

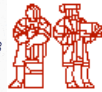
- Growth in mass due to increases in digital board and enclosure.
- Growth in power due to FPGA going from Xilinx to rad-hard Actel (1w); moving away from Amptek parts in video chains (1.5w); and adding radiation detector (0.5w).
- Growth in data rate due to the addition of extra housekeeping data.



Mass Properties Details

MASS PROPERTIES, CBE			
	Design		comments
	grams	lbs	
Electronics Assembly			
Analog board	340	0.75	estimate
Digital board	453	1.00	estimate
dc/dc's and emi filter	100	0.22	actual
...interconnect cables A/D	91	0.20	estimate
Mechanical enclosure	1948	4.30	actual
top cover	195	0.43	actual
bottom cover	240	0.53	actual
connector access cover	32	0.07	actual
hardware	163	0.36	estimate
purge system	113	0.25	estimate
Internal E-Box wire, thermistats, heater connectors	227	0.50	estimate
Total	3900	8.61	
Telescope Assembly			
Structure	699	1.54	estimate
Circuit Board	145	0.32	estimate
Telescope Assembly	430	0.95	estimate
Total	1274	2.81	
Crater mtg Hardware	41	0.09	estimate
MLI	249	0.55	estimate
Crater Total	5464	12.06	

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Power Calculation Details

Standard Contingency	1.3			Worst case from manufacturer		
	Nominal Volts DC			Nominal Volts DC		
	5	5	-5	5	5	-5
Single Analog Chain (ma)						
Front End		4.2	1.2			
Video Chain	8.6	41.0	27.0			
Sum of 6 Chains	51.6	271.2	169.2	67.1	352.6	220.0
Support (ma)						
Bias supply		30.0			39.0	
Amptek PH300	0.1	2.0	2.0			
Sum of 6 peak stretchers	0.6	12.0	12.0	0.8	15.6	15.6
Maxim 145AEUA		1.0				
Sum of 8 A/D		8.0			0.8	
General Op Amp Circuits -- 20		40.0	40.0		52.0	52.0
Digital (ma)						
DDC 63705X3 (25% active)	220			345		
FPGA	100			130		
SRAM	40			52		
Receiver (26C32)	16			21		
16MHz oscillator	10			13		
Sum of Currents (ma)	438.2	365.4	222.4	628.9	459.9	287.6
Sum of Power (watts)	2.19	1.83	1.11	3.14	2.30	1.44
Converters (watts)						
AdvancedAnalog AMA2805S						
Standby power	0.56			1.40		
Conversion loss (80%/70%)	0.55			1.35		
AdvancedAnalog AMF2806D						
Standby power		0.98			1.68	
Conversion loss (80%/70%)		0.73			1.60	
Totals (watts)						
Per Power Supply	3.30	4.65		5.89	7.02	
Power-reversal Diode loss (nominal: 31VDC; w		0.12			0.29	
Grand		8.07			13.20	



Telemetry Bandwidth & Storage

	GCR	SEP	Unit
Primary Science	312	88800	bits/second
Secondary Science	272	272	
Housekeeping	32	32	
Totals	616	89104	bits/second
	7	962	MegaBytes/day

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Thermal Requirements

- Instrument at Telescope Wall

Survival	50 C	-40 C
Operational	30 C	-30 C
Interface	25 C	-30 C

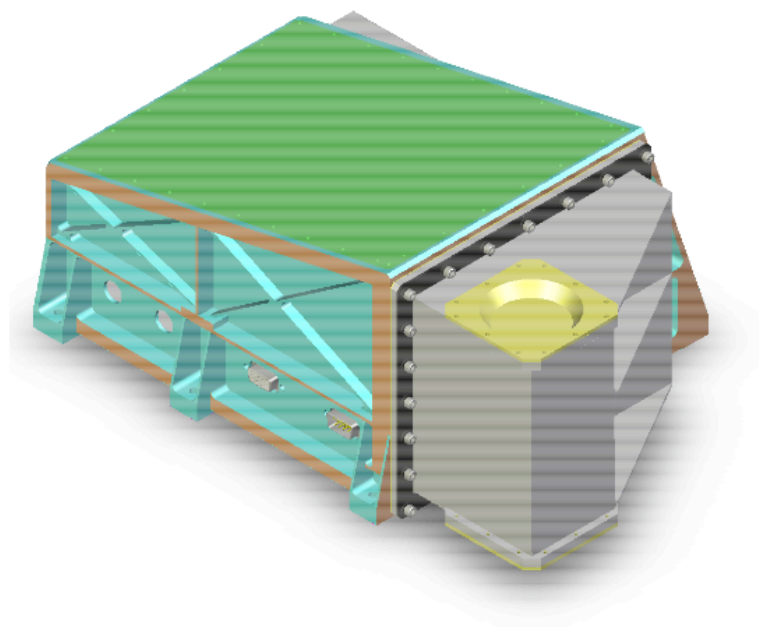
- Change since PDR is to lower Operational hot temp by 5C simply to gain margin on detector performance.
- This change, plus the release of Thermal ICD documents, answers two of the RFAs collected during PDR.



Conclusions

- Margins are adequate for CDR
 - Recognize that Power margin is “marginal”, but we need to wait for full-up Engineering Unit test before taking action.
- Requirements and Performance Margins have been stable since PDR.

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