Systems Engineering

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Overview

- Science Requirements
- Other System Requirements
- Block Diagram
- ICD Status
- Resource Utilization
- Configuration Management
- Conclusions

Science and Mission Requirements

- System architecture responsive to Science Requirements in IRD 32-01205 as presented during the SRR
- System implementation responsive to Interface Control Documents between CRaTER and the Spacecraft

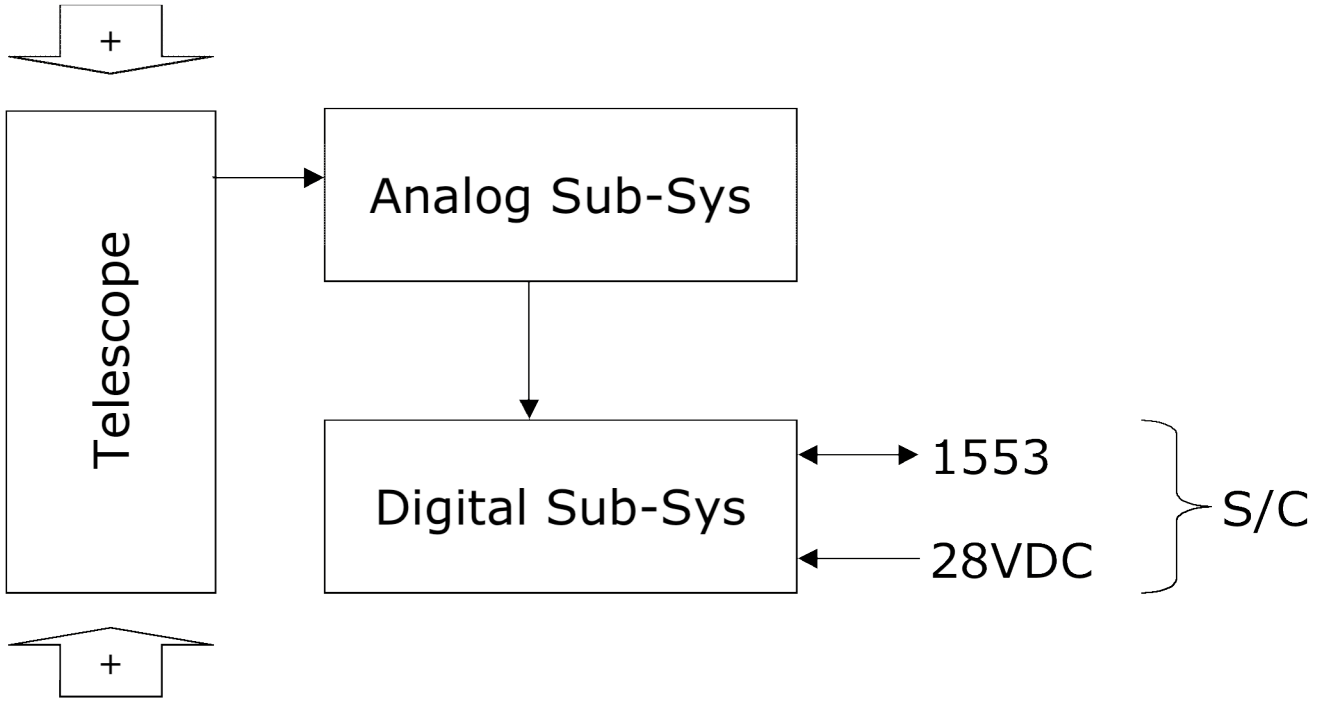
Miscellaneous System Requirements

- Contamination Control (32-01203 Rev 06)
  - Our internal requirements are modest; waiting to see Project requirements
  - Detectors could develop surface leakage if particulates accumulate on surface
  - Exposed electrical connections to detectors could lose conductivity if attacked by (primarily) salt atmosphere
- Purge
  - This is a precaution against air borne contamination, esp. during I&T
- Handling
  - At 5Kg total mass, we are in the "pick up and carry" class

ICD Status

Data ICD	32-02001	431-ICD-000104	In GSFC CM Process
Electrical ICD	32-02002	431-ICD-000094	Released
Mechanical ICD	32-02003	431-ICD-000085	In GSFC CM Process
Thermal ICD	32-02004	431-ICD-000118	In GSFC CM Process
Resource Allocations	32-02005	431-RQMT-000112	In GSFC CM Process

System Block Diagram



System Resources

	Mass	Power	Data Rate
CBE	5.2 Kg	5.1 w	515bps / 89.0Kbps
Allocation	6.4 Kg	9.0 w	89.0Kbps
Margin	23%	77%	n/a

CURRENT BEST ESTIMATE, MASS PROPERTIES

Electronics Assembly	grams	lbs
Analog CCA	480	1.05
Digital CCA	540	1.19
Interconnect Cable, A/D	52	0.11
Internal E-box Cables	122	0.27
Mechanical Enclosure	1800	3.96
Top Cover	250	0.55
Bottom Cover	225	0.49
Hardware	166	0.36
Purge system	178	0.39
Electronics Assembly Sub-Total	***3813***	***8.38***
Detector Assembly		
Circuit Board	138	0.30
Telescope Sub-Assy	*1398*	*.87*
Detector Mechanical Enclosure	*525*	*1.15*
Detector Assembly Sub- Total	***1061***	**2.32**
MLI and TPS Sub-Total	***250***	***.55***
Mounting Hardware Sub-Total	***40***	***.09***
CRaTER CBE Total	**5164**	**11.34**

Power CBE and Worst Case Details

Contingency for unknown components	1.3				***Worst case from manufacturer***		
Allocation (watts)	9						
		Nominal				Maximum	
	+5VDC	+6VDC	-6VDC		+5VDC	+6VDC	-6VDC
Single Analog Chain (ma)							
Front End		4.50					
Video Chain	0.20	10.30	7.00				
Sum of 6 Chains	1.2	88.8	42		1.56	115.44	54.6
Support (ma)							
Bias supply		20	20				
Sum of 2 supplies	0	40	40		0	52	52
Amptek PH300	0.1	2.4	2.4				
Sum of 6 peak stretchers	0.6	14.4	14.4		0.78	18.72	18.72
Maxim 145AEUA	2						
Sum of 3 A/D	6	0	0		7.8	0	0
Digital (ma)							
DDC 63705X3 (25% active)	220				***345***		
FPGA	40				52		
16MHz plus buffers	10				13		
Sum of Power (watts)	1.39	0.86	0.58		2.10	1.12	0.75
Coverters (watts)							
AdvancedAnalog 2805S							
Standby power	0.56				***1.40***		
Conversion loss (80%/70%)	0.35				0.90		
AdvancedAnalog 2806D							
Standby power		0.98				***1.68***	
Conversion loss (80%/70%)		0.36				0.80	
Totals (watts)							
Per Power Supply	2.30	2.78			4.40	4.35	
Grand		**5.07**				**8.75**	
Calculated Contingency	77%						

Telemetry Bandwidth & Storage

	GCR	SEP	Unit	
Primary Science	312	88800	bits/second	
Secondary Science	176	176		
Housekeeping	27	27		
Totals	515	89003	bits/second	
	6	961	MegaBytes/day	

Thermal Requirements

- Instrument as Proposed

Survival	50 C	-40 C
Operational	35 C	-30 C

- Rationale for Operational Requirements
  - Detector <40C for noise performance
  - Instrument >-30C for ease of testing and minimizing component stress

Configuration Management and Peer Review Process

- Process documented in 32-01201 Rev A
- We maintain reference, Bookmark, and Controlled documentation
  - Reference: GSFC project documents, vendor data sheets
  - Bookmark: what most folks call DRAFT
  - Controlled: must go through Configuration Management Board
- **All** revisions of **all** documentation are maintained on public web site http://snebulos.mit.edu/projects/crater/
- Peer reviews are an incremental process run in parallel with the ECO process
  - Peer review validate the proposed initial or changed design
  - ECO process controls the documentation
  - Review board meets in public every Wednesday

Conclusions

- System design is responsive to requirements
- Margins are adequate for PDR
- Need to track evolution of
  - Circuit design as it affects power
  - Mechanical design as it affects mass
  - Contamination requirements as they affect manufacturing and test