GUVI Thermal Design

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Agenda

- Action Item Status
- Changes Since PDR
- Temperature Requirements
- Design Overview
- Results
- Conclusions

Thermal Action Item Status

- PDR AI 08 Closed
- PDR AI 09 Closed
- PDR AI 12 Closed
- PDR AI 13 Closed

Changes Since PDR

- Additional radiator area added to SIS housing:
  - increased from 25 to 52 sqin to improve detector hot operation
- Scan motor thermally strapped to +Z deck
  - accomplished by using flexible copper straps and a 4x4 aluminum interface plate
- Orbit average heater power has increased
  - sunsafe (survival condition) has now been analyzed
  - operational has increased by 2 watts

Operational Temperature Requirements

Component	Thermal Design Range	Flight Range	Test Range
Scan Motor Interface	-24 to +55	N/A	-24 to +55
Detectors	-10 to +15	-20 to +25	-25 to +30
SIS Housing*	-10 to +20	-20 to +30	-29 to +50
Electronic Box Interface	-24 to +55	N/A	-24 to +55

*will be tested at SSG before detectors are installed

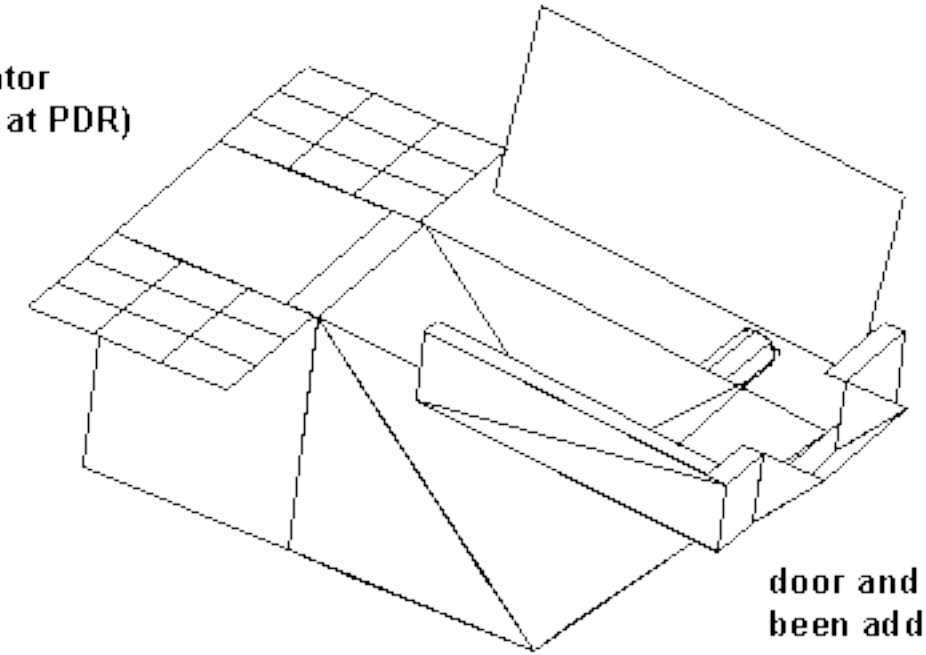
Survival Temperature Requirements

Component	Thermal Design Range	Flight Range	Test Range
Scan Motor Interface	-29 to +60	N/A	-29 to +60
Detectors	-20 to +40	-25 to +45	-30 to +50
SIS Housing*	-19 to +40	-24 to +45	-29 to +50
Electronic Box Interface	-29 to +60	N/A	-29 to +60

*will be tested at SSG before detectors are installed

Thermal Geometry Model

radiator now
52 sqin radiator
(was 22 sqin at PDR)



scan motor now thermally
strapped to aft deck
(was coupled to SIS)

door and sunshade have
been added since PDR

Thermal Design Overview

- Survival Temperatures maintained by survival heater circuit during non-operation mode
- Heaters and thermostats maintain temperatures during cold operating conditions
- Flexible copper thermal strap couples scan motor case to +Z deck (8-9 °C/W assumed thermal resistance)
- Spectrograph is hard mounted to +Z deck but is thermally isolated due to titanium feet
- Black kapton MLI to cover designated areas on spectrograph
  - atomic oxygen effects will be mitigated by overcoating external kapton with 1300 angstroms of SiO_2 (GUVI-PDR-AI13)
    - Sheldahl standard process

Analysis Parameters

Parameter	Hot Case	Cold Case
Solar Constant	450.0*	408.0*
Albedo Constant	0.4	0.2
Earth Constant	85.0*	60.0*
+Z Deck Temperature	+55 C	-29 C
Blanket Thru-Emittance	0.01	0.04

Notes: * Units are BTU/Hr-SqFt

Analysis Parameters (2)

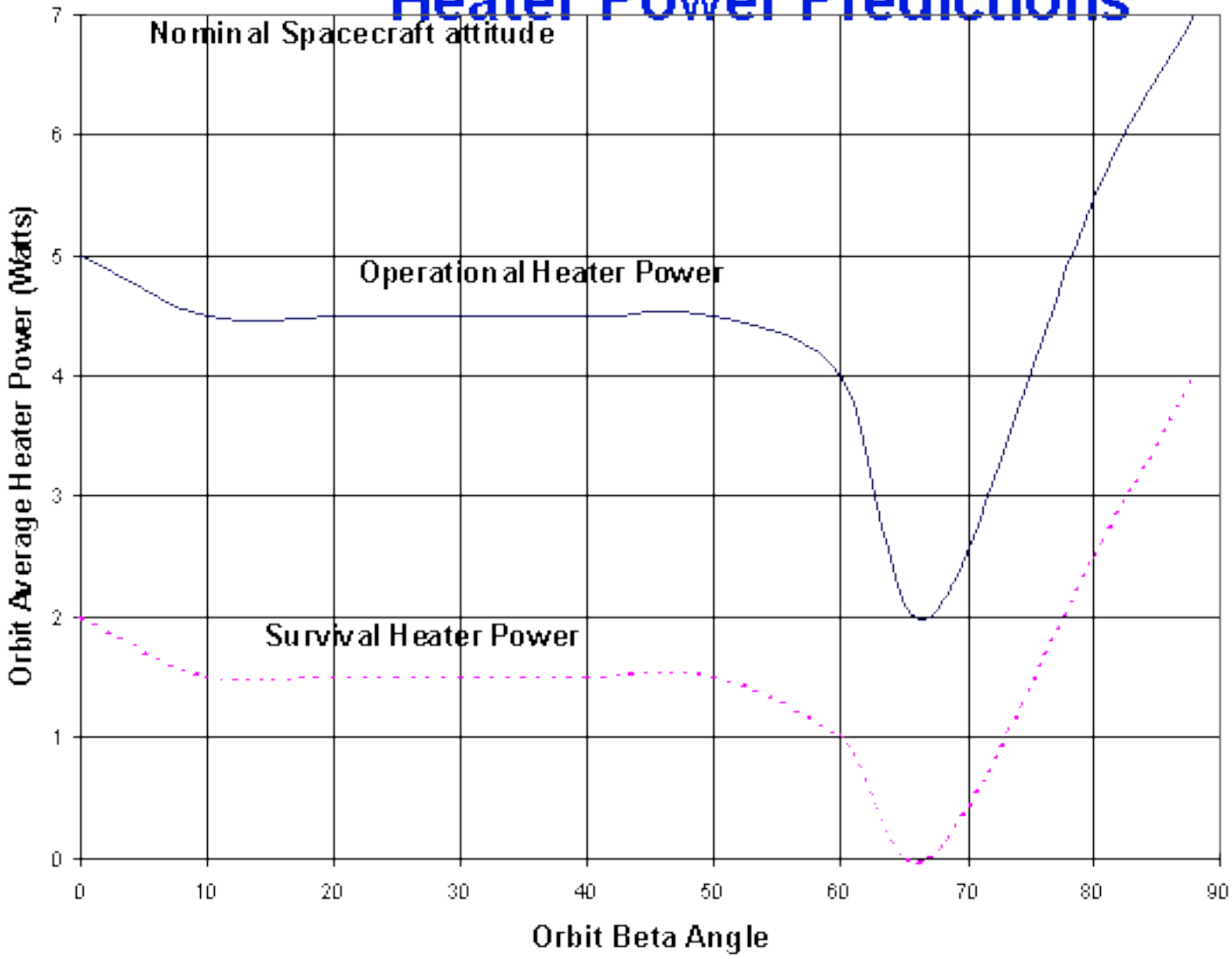
Component	Hot Operation Power (W)	Cold Operation Power (W)	Survival Power (W)
Scan Motor	4.000 *	2.000 *	0.0
Detector #1	0.100	0.000	0.0
Detector #2	0.100	0.000	0.0
Total:	4.20	2.000	0.0

Notes: * Scan Motor Hot Case assumes 100% Duty Cycle with peak power of 4.0 W ; Cold Case assumes a 50% Duty Cycle.

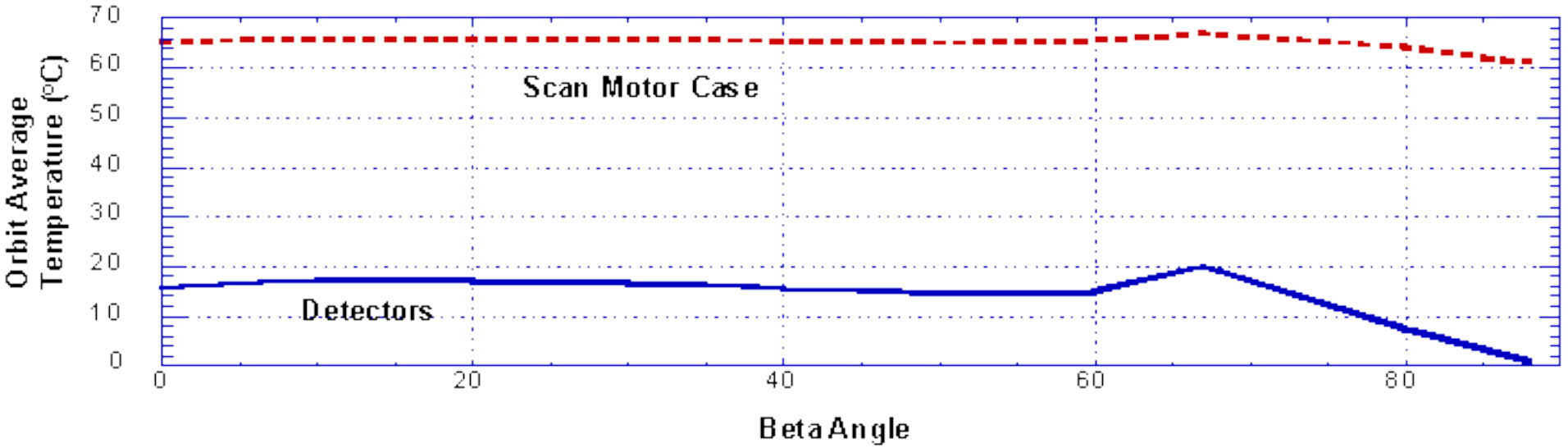
Results Summary

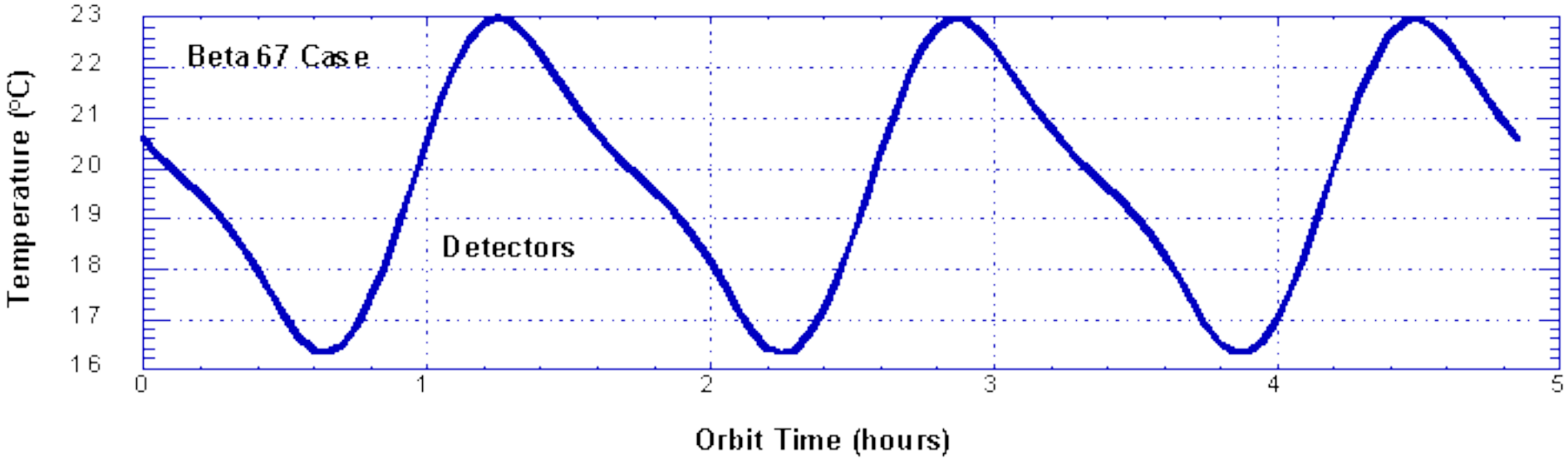
- Maximum predicted SIS housing gradient:
  - 14 °C transient
  - 10 °C orbit average
- All operational and survival temperature predictions are within upper and lower limits
- Maximum orbit average heater power predictions
  - survival:
    - 11 watts sunsafe
    - 4 watts nominal spacecraft attitude
  - 7 watts operational

Heater Power Predictions

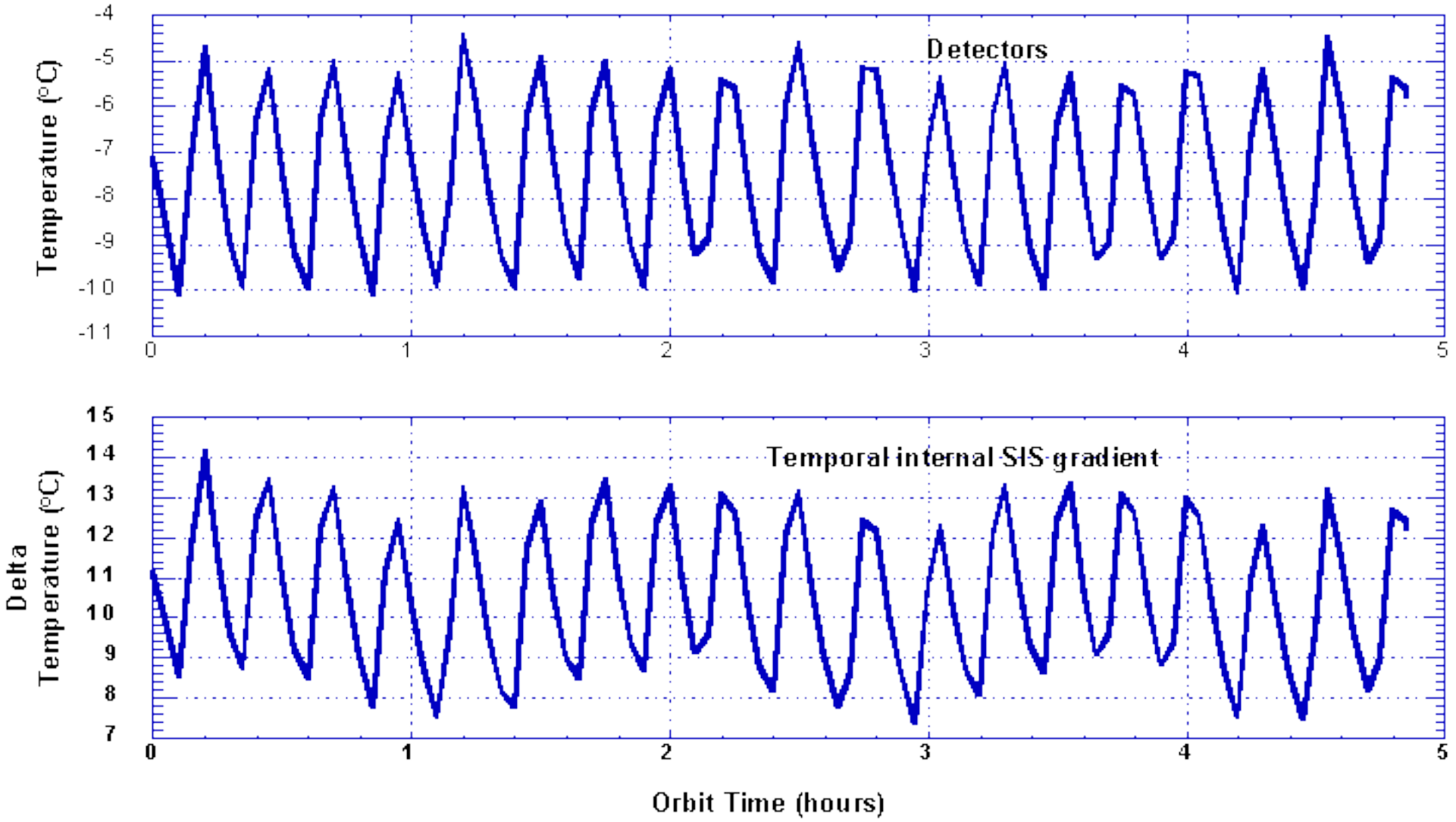


Hot Analysis Results





Cold Analysis Results at Beta 88 Orbit Conditions



Heater Circuit Summary

- Survival heater and thermostat:
  - single heater on SIS housing under detector #1 controlled by a thermostat near detector #2
  - maximum 11 watts orbit average; 26.6 watt peak at 35 V
  - 46.1 ohms
  - nominal thermostat range: close @ -28 °C / open @ -24 °C
  - heater and thermostat to be supplied and integrated by SSG
- Operational heaters and thermostats:
  - separate heater/thermostat on each tube
  - maximum 7 watts orbit average; 17 watts peak power at 35 V
  - parallel circuit resistance is 72 ohm; 144 ohm each heater
  - going to use NEAR spares for the thermostats (PI10709-6)
    - SN 00003: close @ -10.5 °C / open @ -5.8 °C
    - SN 00004: close @ -10.7 °C / open @ -5.9 °C

Conclusions

- Testing
  - fully integrated thermal design and workmanship testing to start in October - November 1998 time frame
- Material Purchases
  - using NEAR spares for operational thermostats
  - purchase operational heaters and black kapton coated with SiO_2
- Reduced Thermal Models
  - completed and will be delivered after CDR