



Lunar Reconnaissance Orbiter (LRO) PER Thermal July 23, 2008

Thermal Design

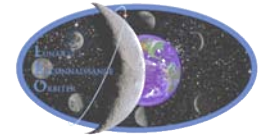
Charles Baker/545

charles.baker@nasa.gov

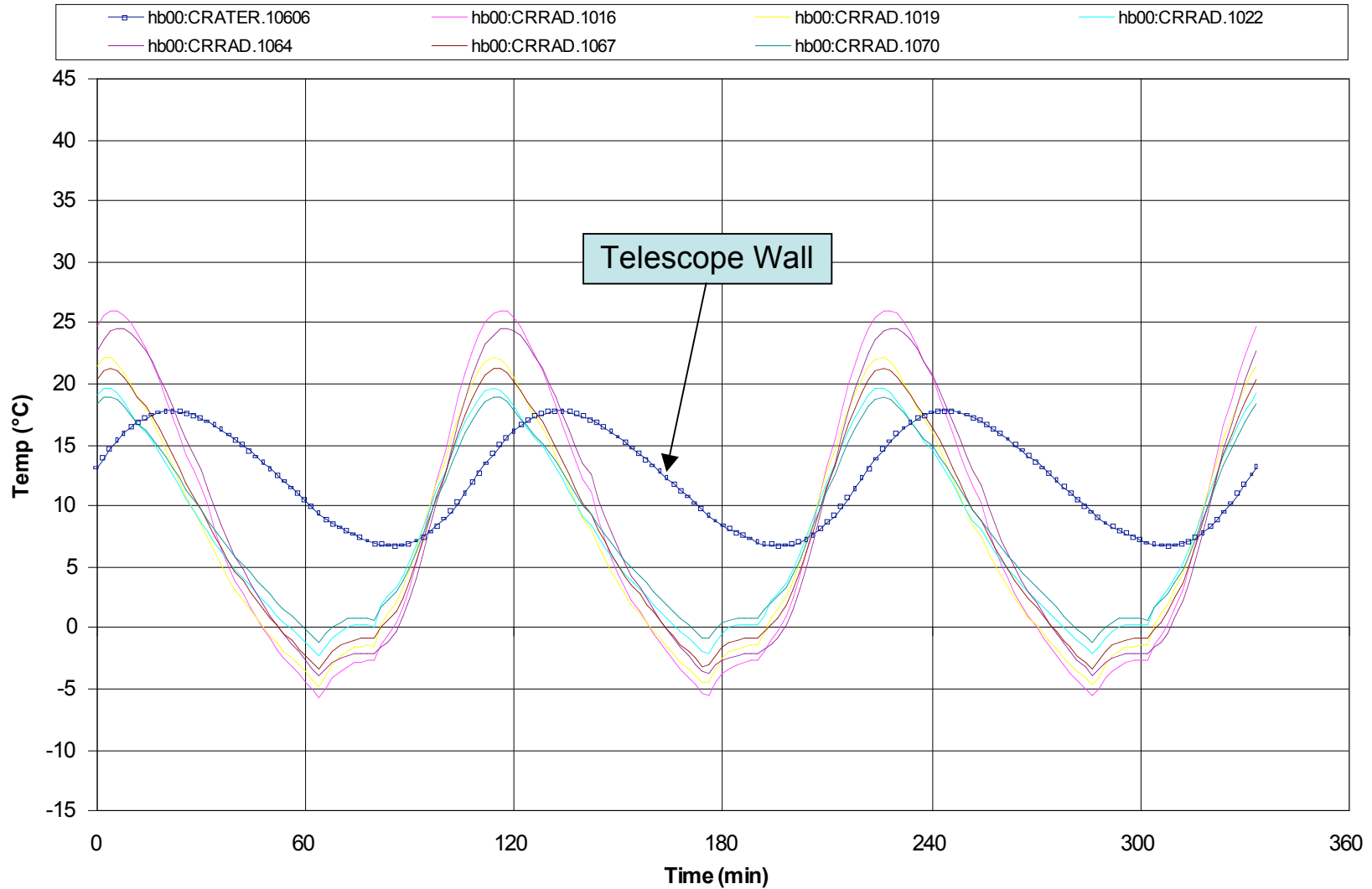
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Hot Transient Predicts



CRaTER Telescope Wall and Radiator I/Fs - Hot Beta 0°





Radiator Area



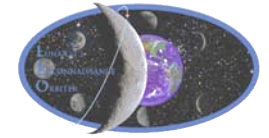
- Most radiators have >25% of potential area available
 - LOLA OTA has 19%
 - LROC Instruments have 0%

Component	Total		Used		Available		% Available
	m_	in_	m_	in_	m_	in_	
ITP/Avionics	2.54	3933	1.88	2912	0.66	1021	26.0
Battery	0.26	403	0.10	155	0.16	248	61.5
Star Camera 1	0.08	120	0.04	58	0.04	62	51.6
Star Camera 2	0.07	108	0.03	51	0.04	57	52.8
CRaTER	0.18	282	0.09	133	0.10	150	53.1
LEND	0.17	256	0.05	77	0.12	179	69.9
LOLA MEB	0.09	134	0.06	99	0.02	35	26.3
LOLA OTA	0.14	216	0.11	176	0.03	40	18.5
LAMP	0.03	45	0.02	29	0.01	17	36.8
LROC SCS	0.02	25	0.02	25	0.00	0	0.0
LROC WAC	0.02	25	0.02	25	0.00	0	0.0
LROC NACU	0.05	74	0.05	74	0.00	0	0.0
LROC NAFL	0.05	74	0.05	74	0.00	0	0.0





Correlated Models Status



Component	Test Correlated	Delivered to LRO	Integrated into Orbiter Model
CRaTER	yes	yes	yes
LEND	yes	yes	yes
LOLA MEB	yes	yes	yes
LOLA OTA	yes	yes	yes
LAMP	yes	yes	yes
LROC SCS	yes	yes	yes
LROC WAC	yes	yes	no
LROC NACU	yes	yes	no
LROC NAACL	yes	yes	no
Mini RF - Antenna	yes	yes	yes
Mini RF - Electronics	yes	yes	no
Diviner	yes	yes	yes
Star Camera +X	yes	yes	yes
Star Camera -X	yes	yes	yes
Battery	yes	yes	no
PSE	yes	yes	yes
PDE	yes	yes	yes
C&DH	no	no	no
SA Controller	yes	yes	no
HGA Controller	yes	yes	no
IMU	yes	yes	yes
RWA	yes	yes	yes
S-Band Transponder	yes	yes	yes
Ka-Band TWTA	no	no	no
Ka-Band Modulator	no	no	no
Actuators	yes	yes	yes (HGAS/SAS)





Pending Flight Model Updates/Analyses



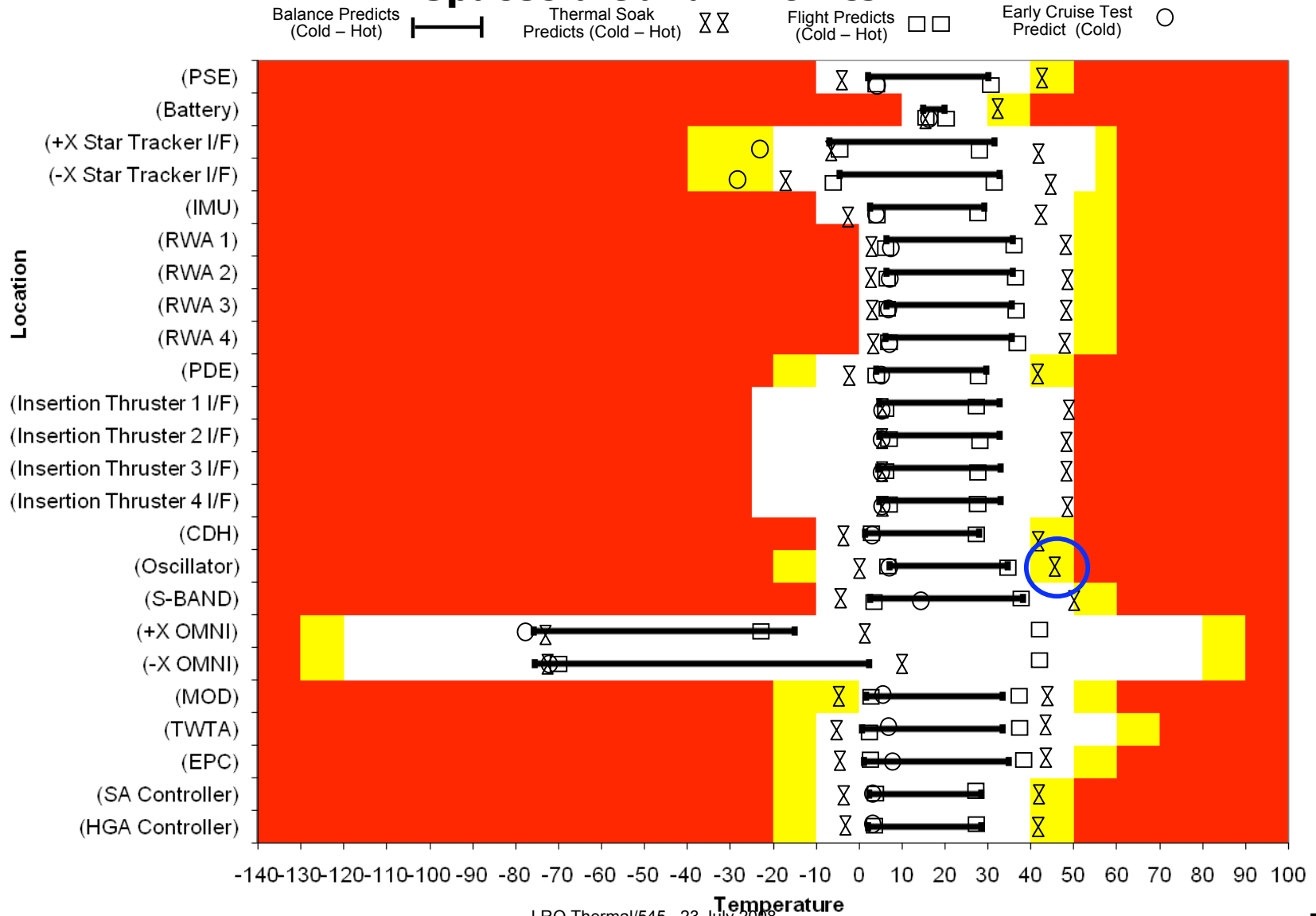
- Assess off nadir pointing, roll about the X axis ($\pm 20^\circ$) for 20 minutes at Beta 0°
- Incorporation of correlated LROC NAC & WAC instrument models
- Creation and incorporation of reduced battery model





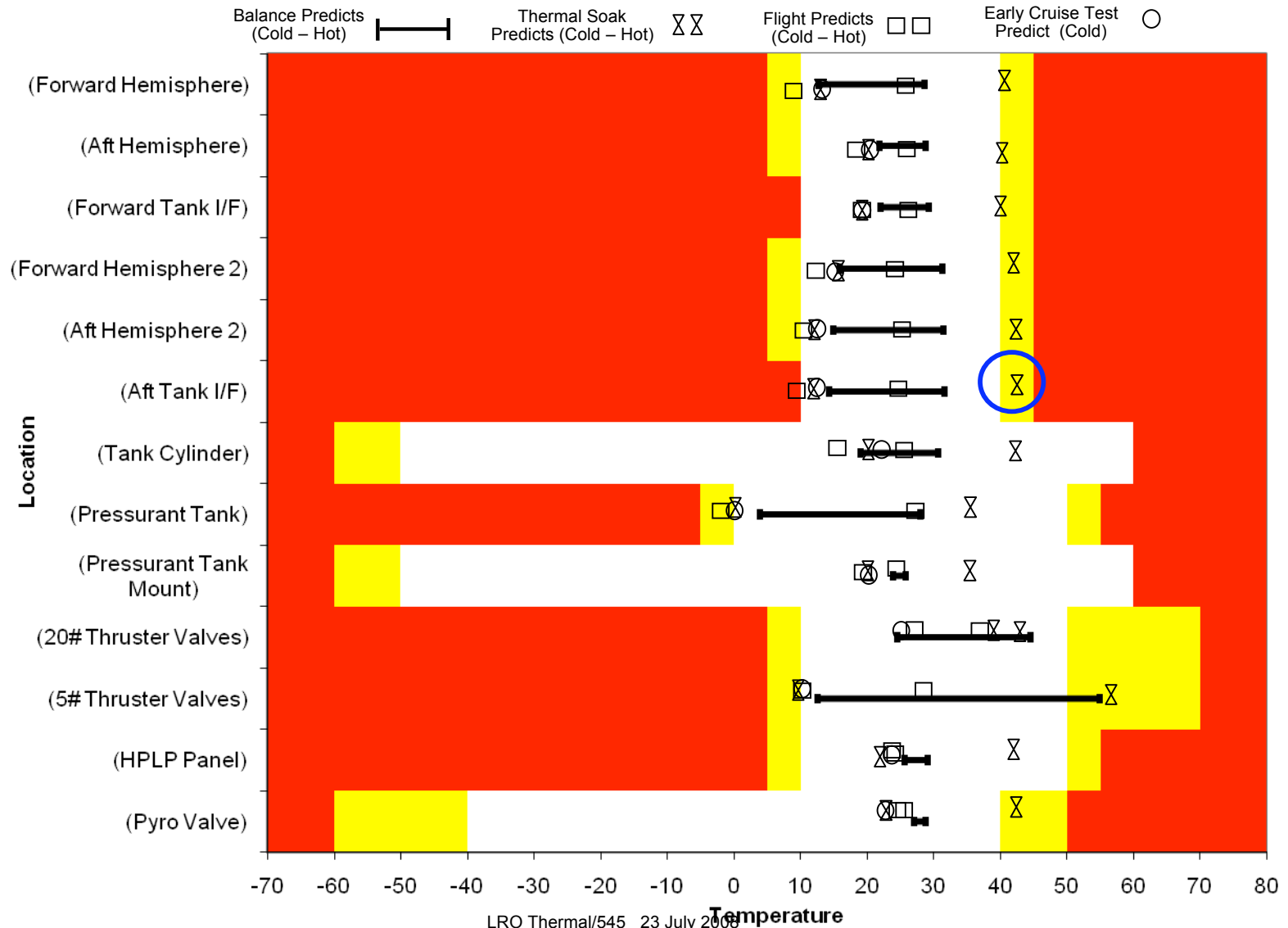
Test Predicts – Thermal Balance

Spacecraft and Avionics



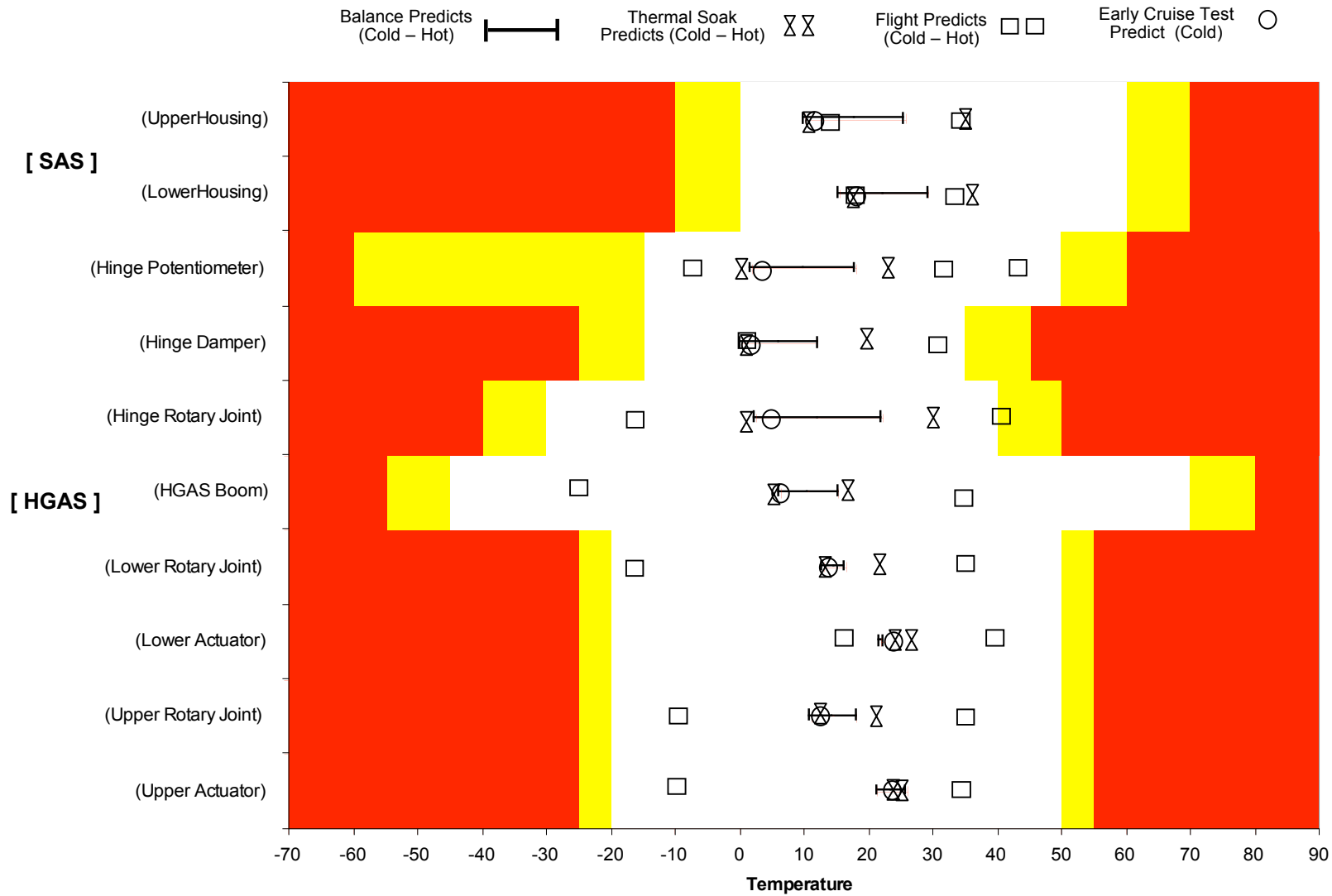
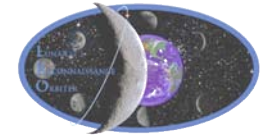


Test Predicts – Thermal Balance Propulsion



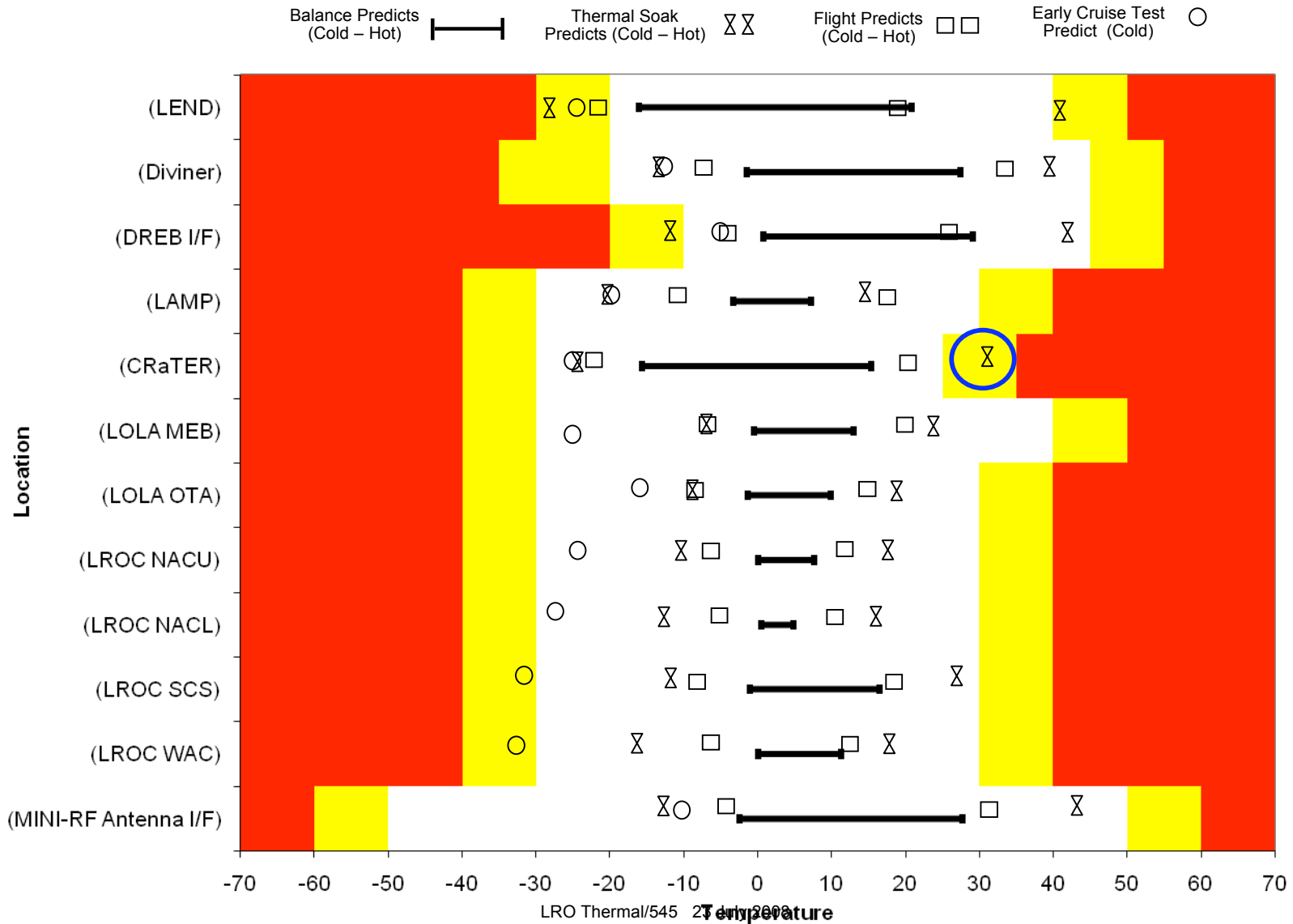


Test Predicts – Thermal Balance Deployables





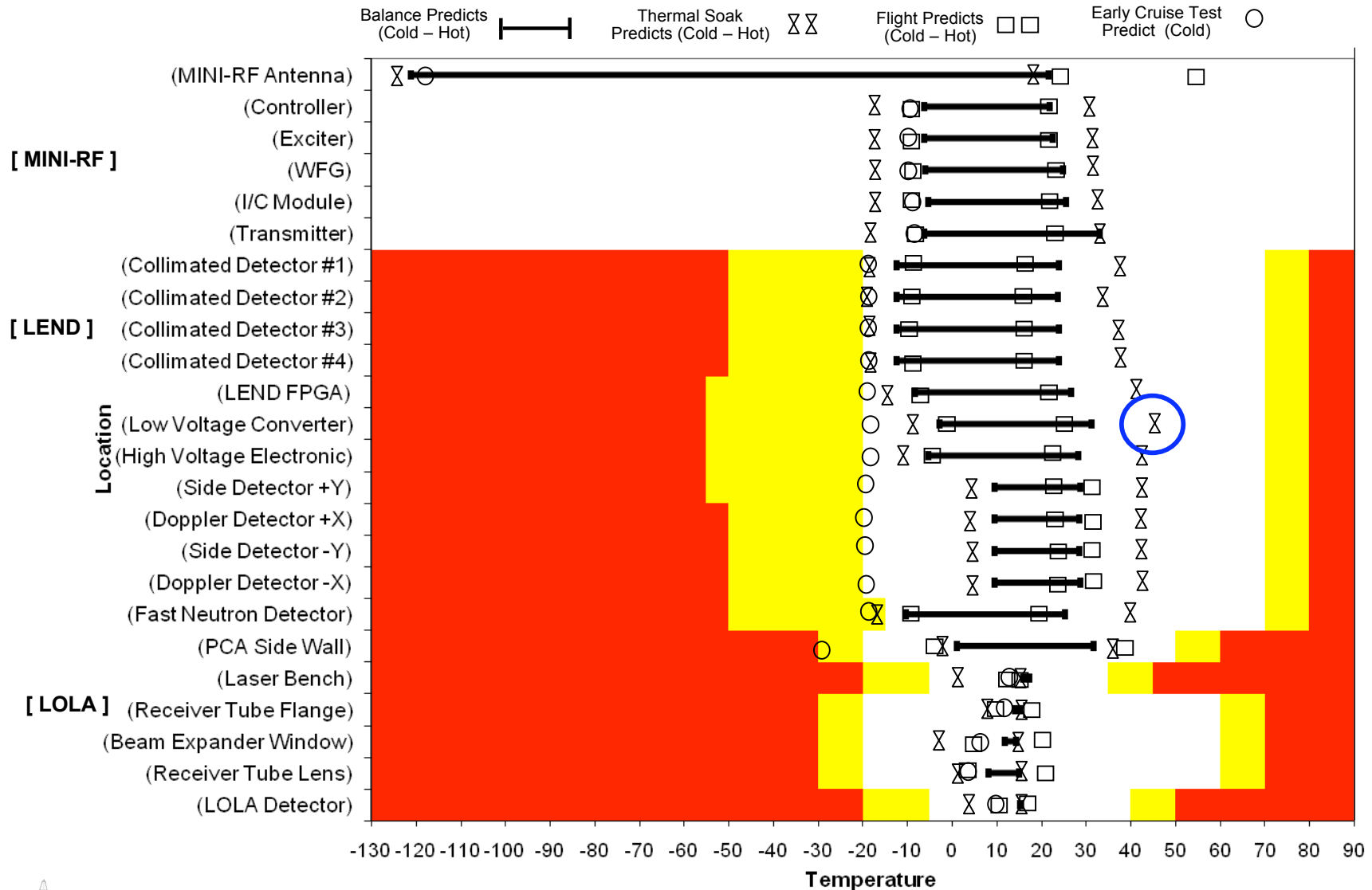
Test Predicts – Thermal Balance Instrument Interfaces





Test Predicts – Thermal Balance

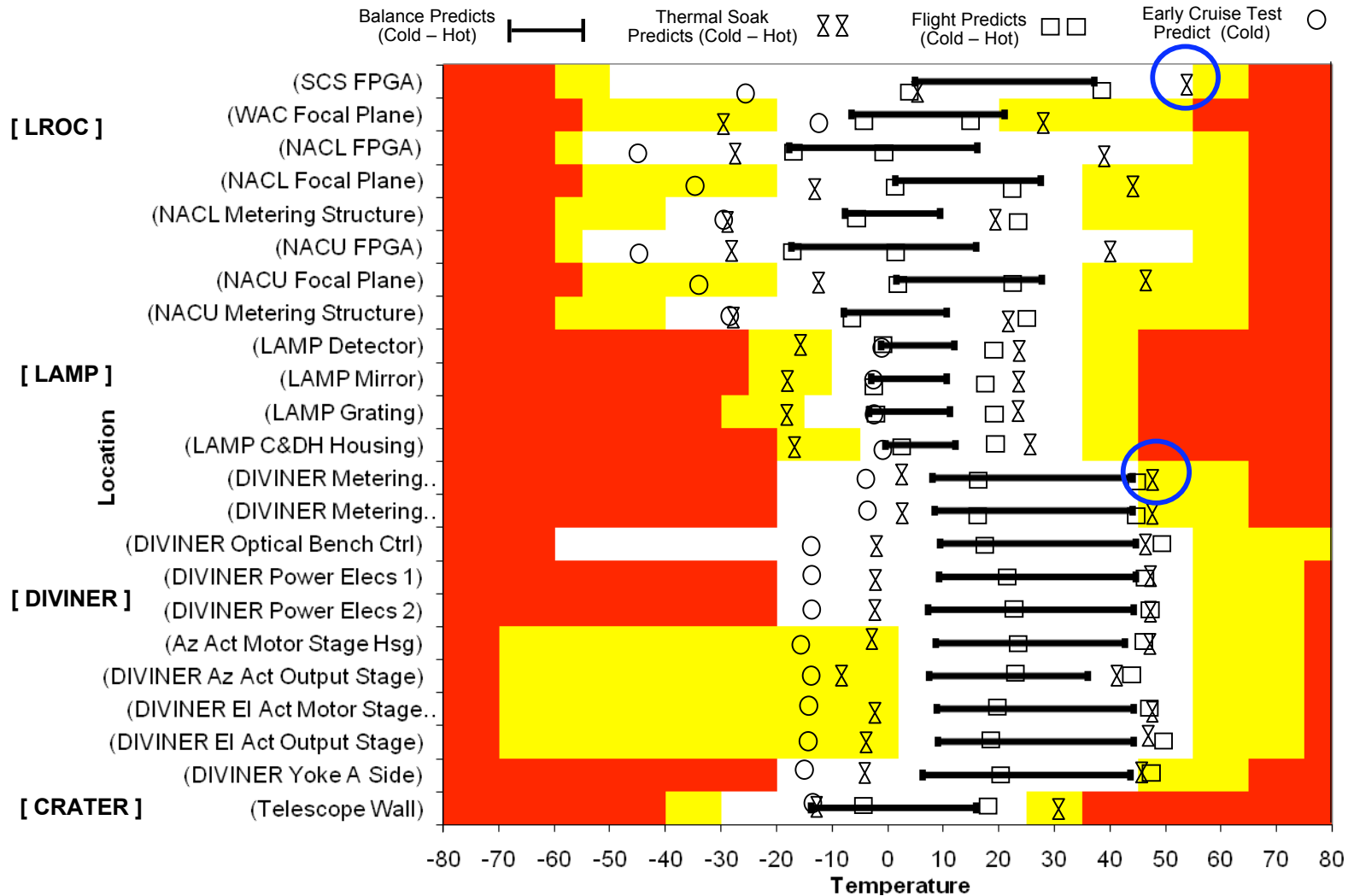
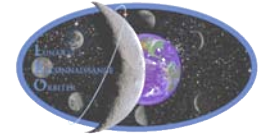
Instruments – Internal Telemetry





Test Predicts – Thermal Balance

Instruments – Internal Telemetry

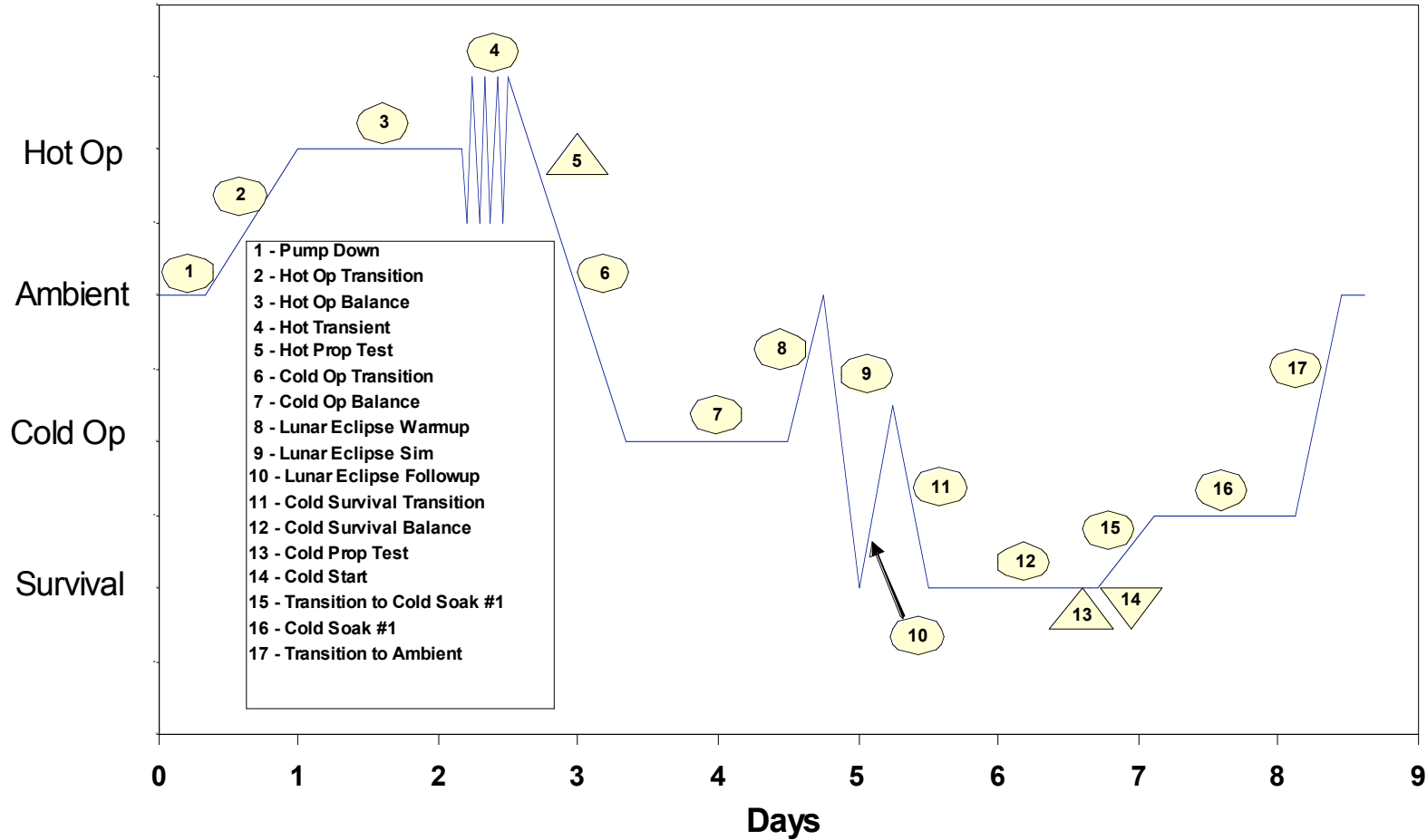


- **DIVINER cold case beta angle differs from spacecraft cold case beta angle**



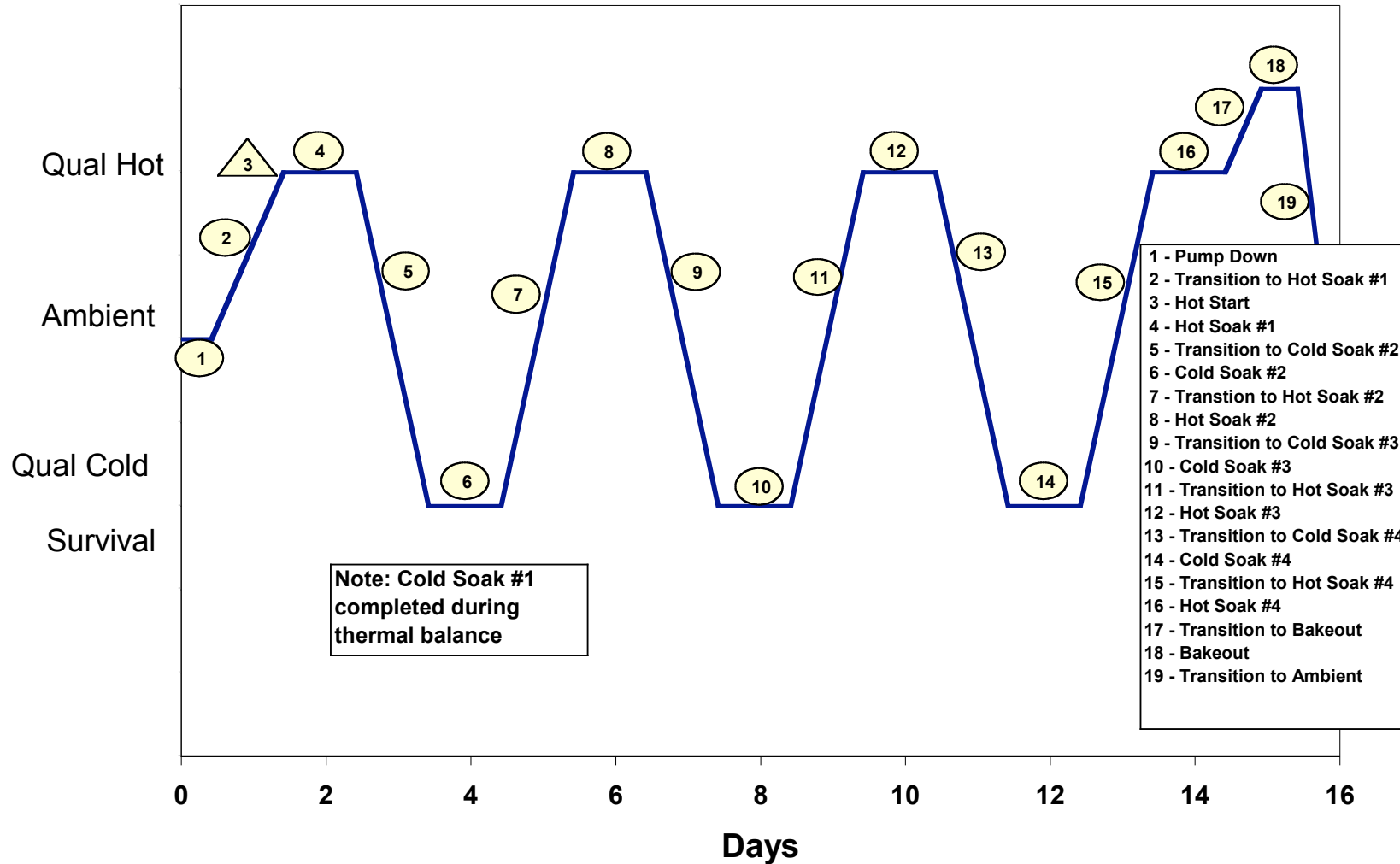


Thermal Balance Test Profile





Thermal Cycling Test Profile





Conclusions



- Test Plan and Test Fixture Build in good shape
- All lifts have been dry run
- Test Analysis is complete, though will be tweaked thru TRR
- Thermal Balance test plan is adequate to demonstrate LRO thermal performance and correlate the thermal model
- LRO Thermal is on Track for an LRO Orbiter test in mid September

