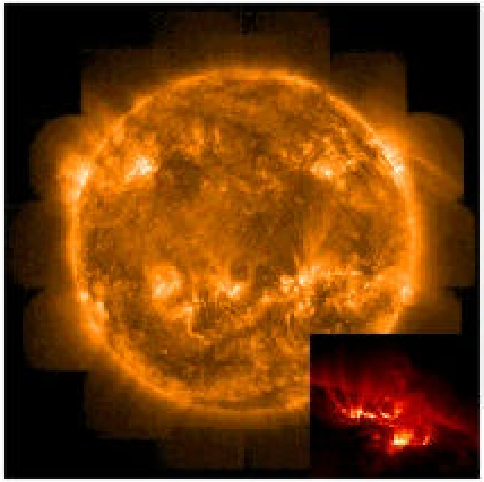
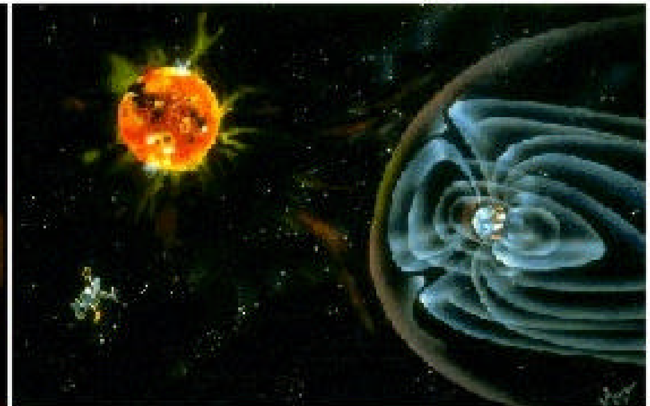
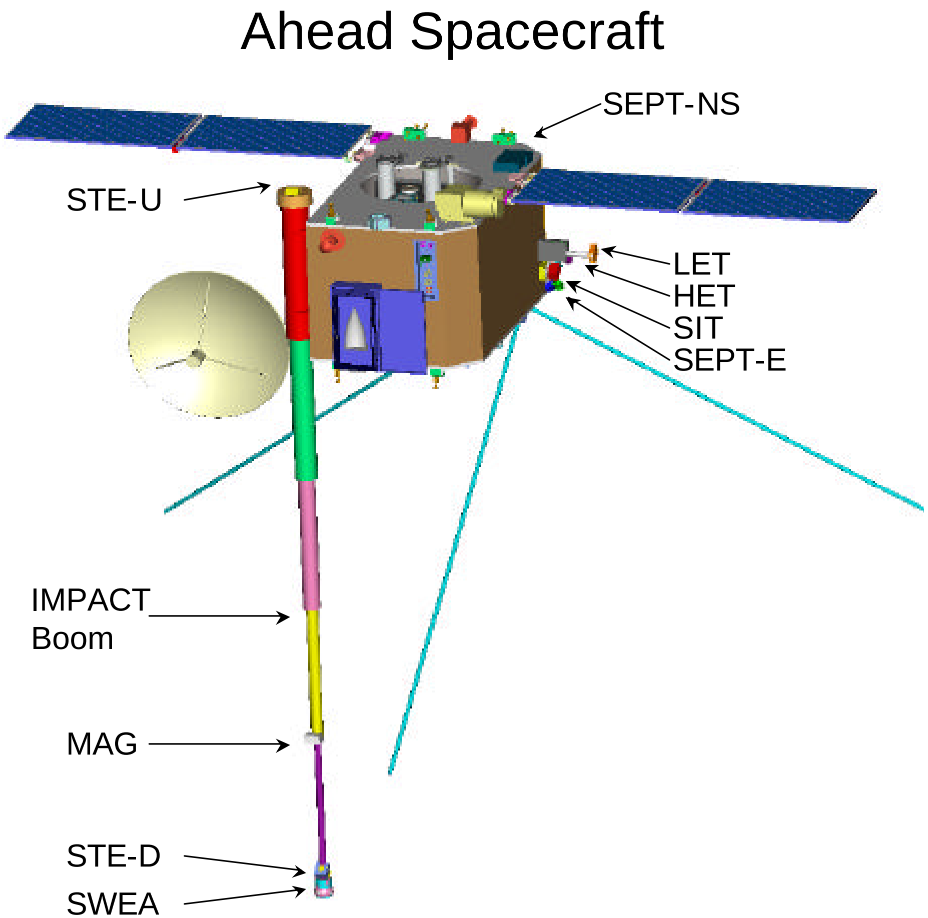


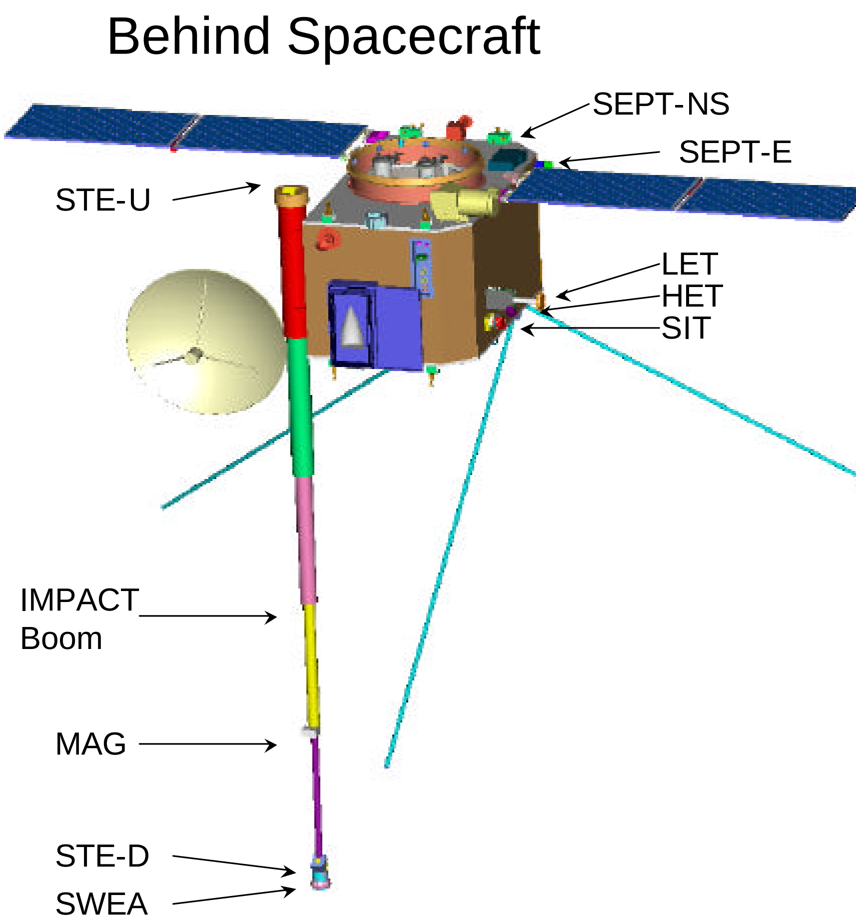


IMPACT

measures the invisible particles and fields that reach across interplanetary space from the Sun to affect the Earth

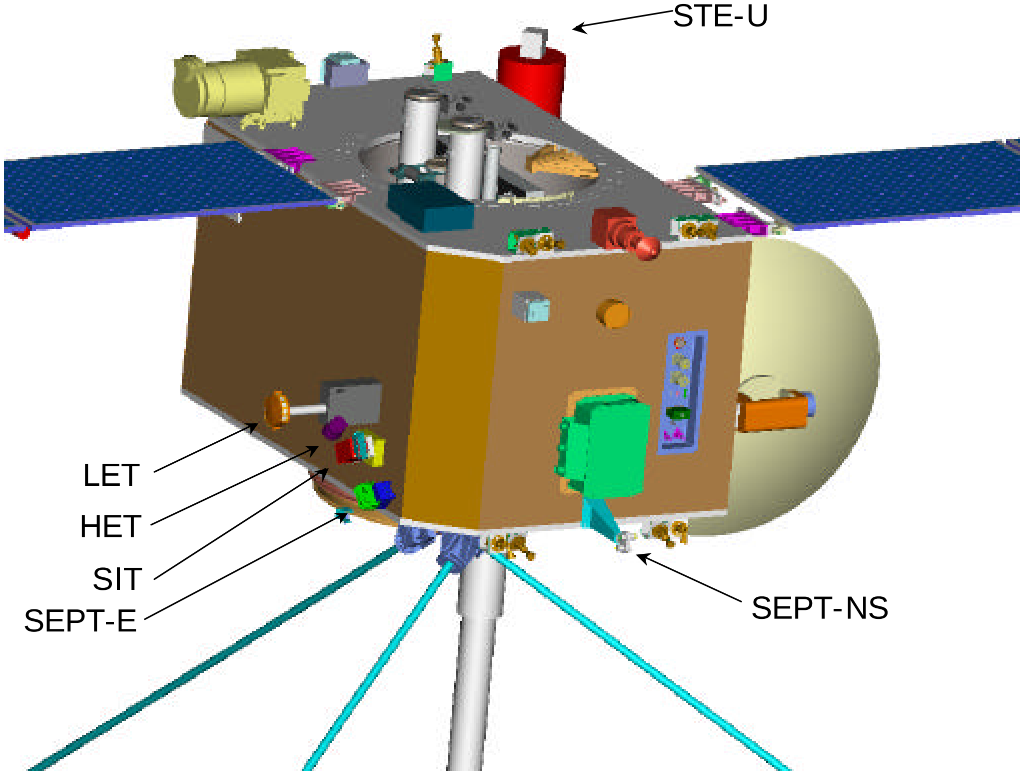
IMPACT Instrument Locations on the Spacecraft



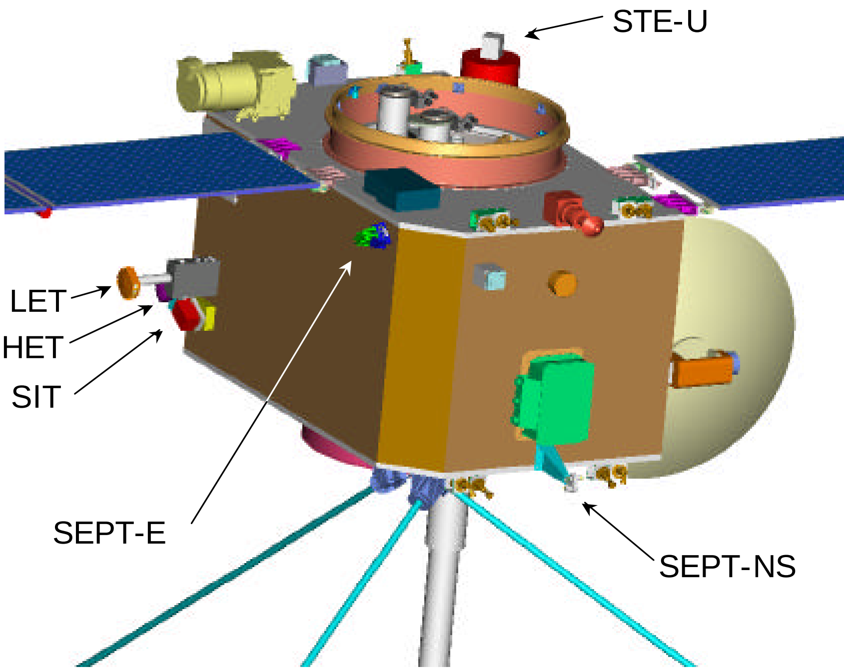


IMPACT Instrument Locations on the Spacecraft

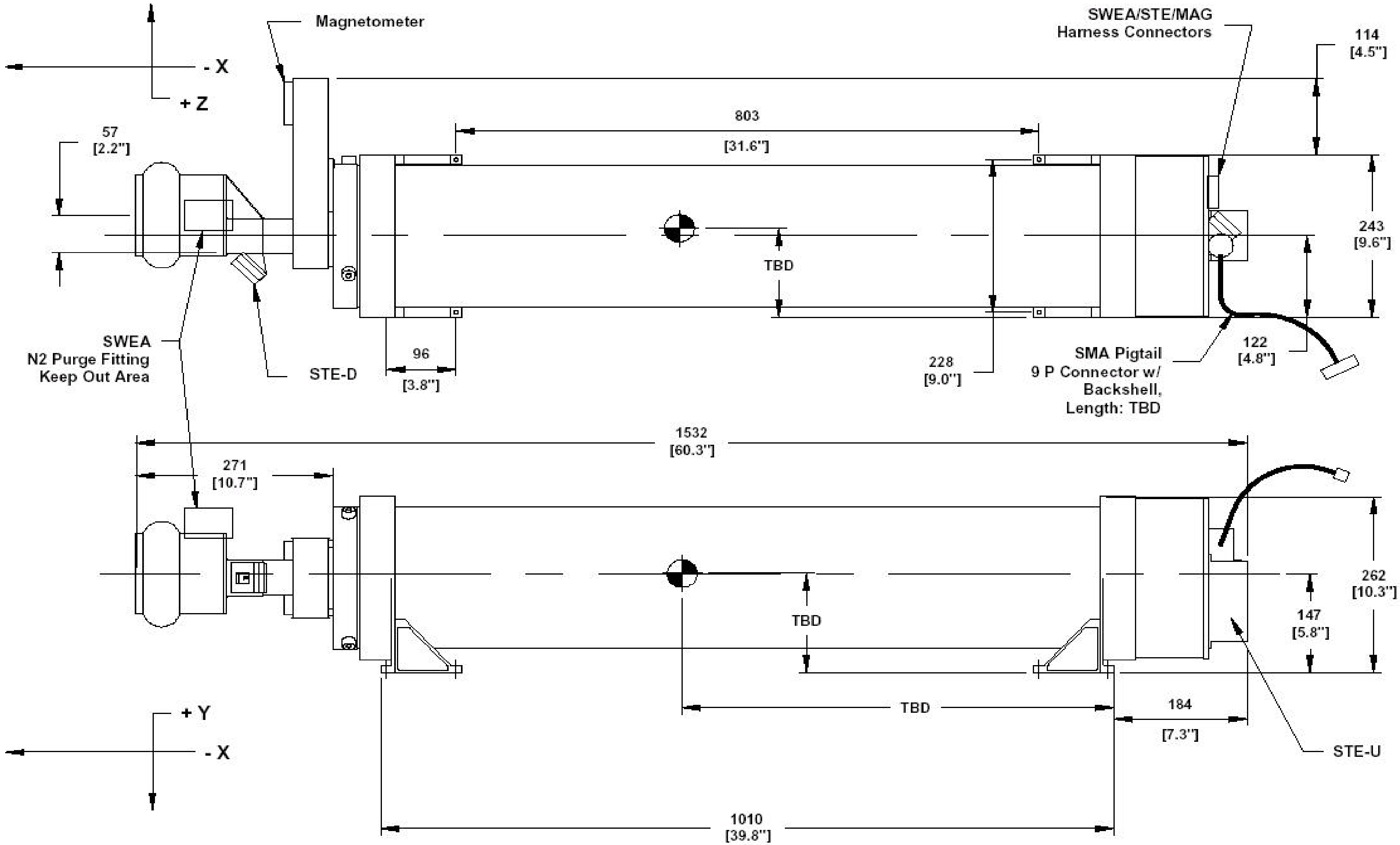
Ahead Spacecraft



Behind Spacecraft

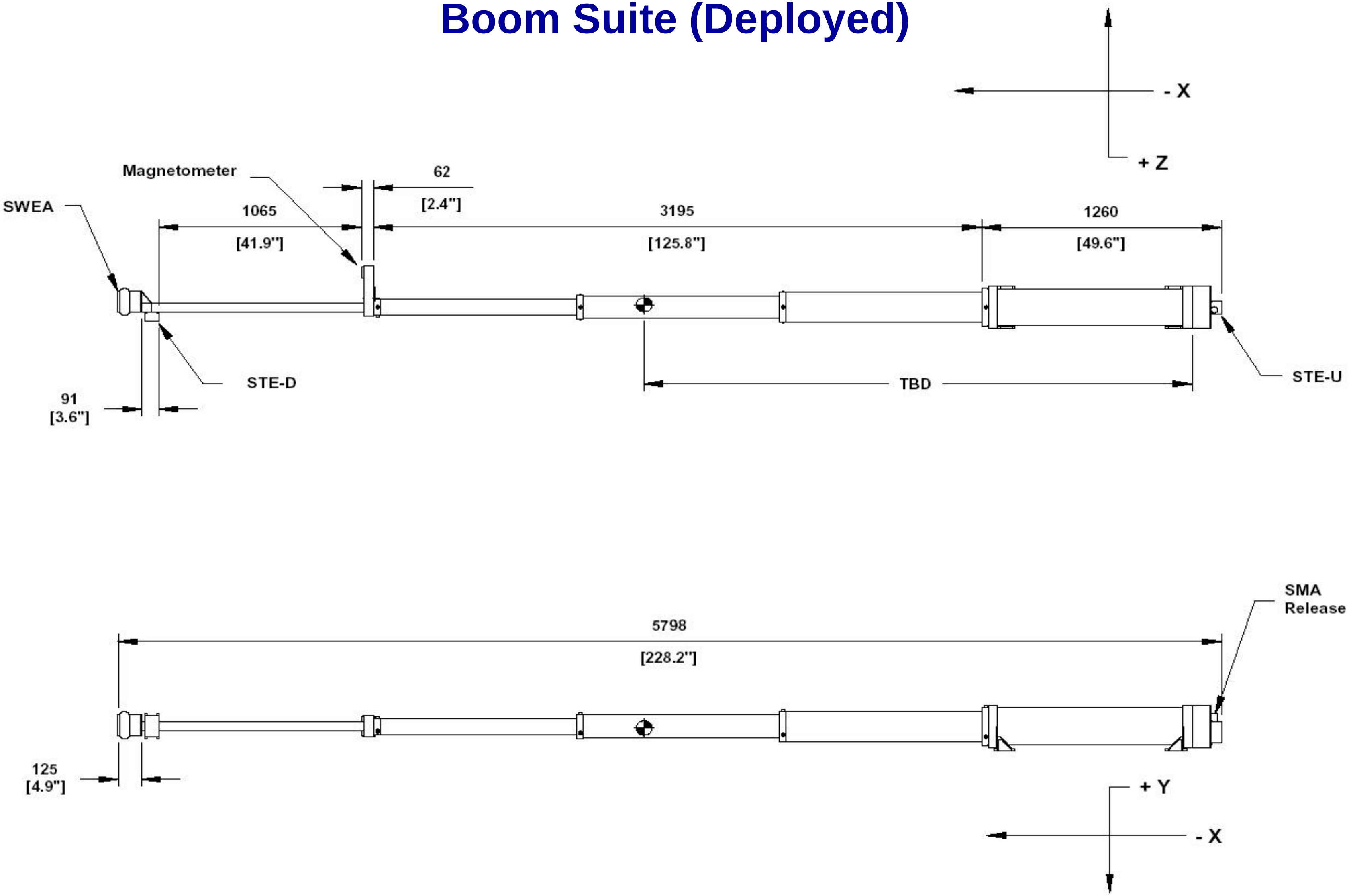


Boom Suite (Stowed)



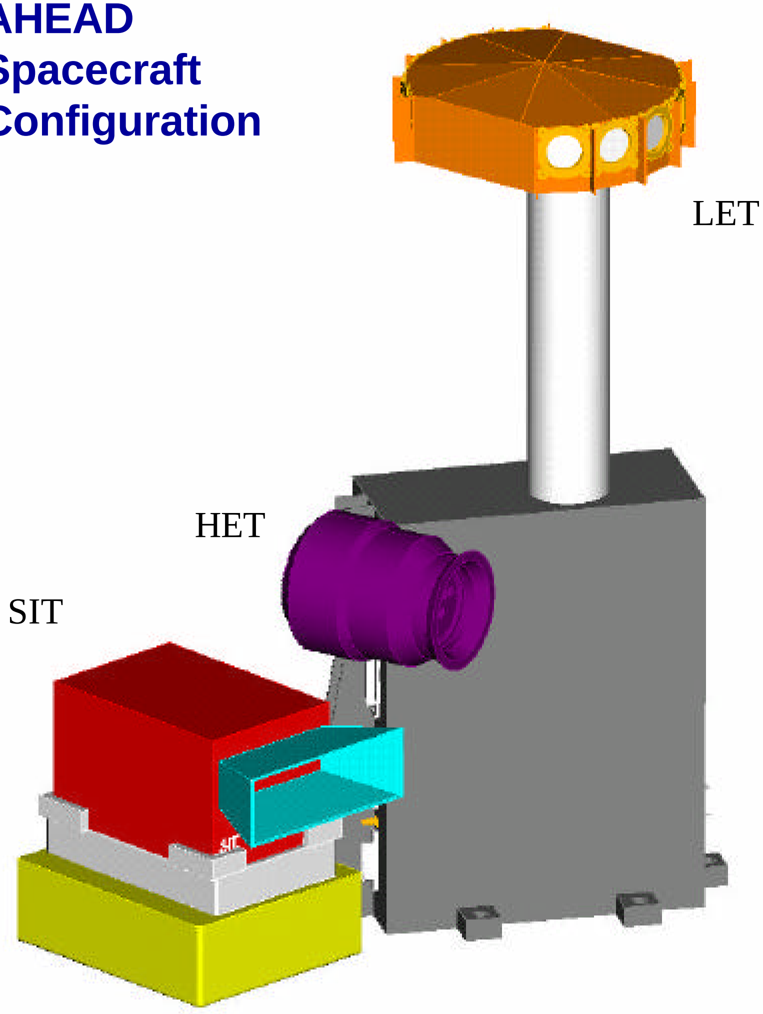
David Curtis

Boom Suite (Deployed)

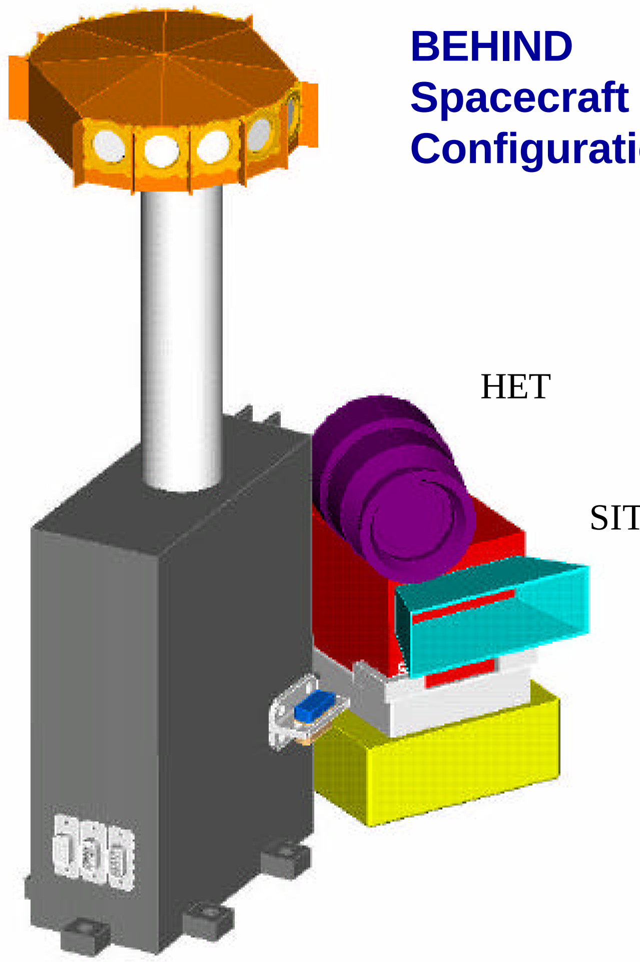


SEP HET/LET/SIT/Common Electronics

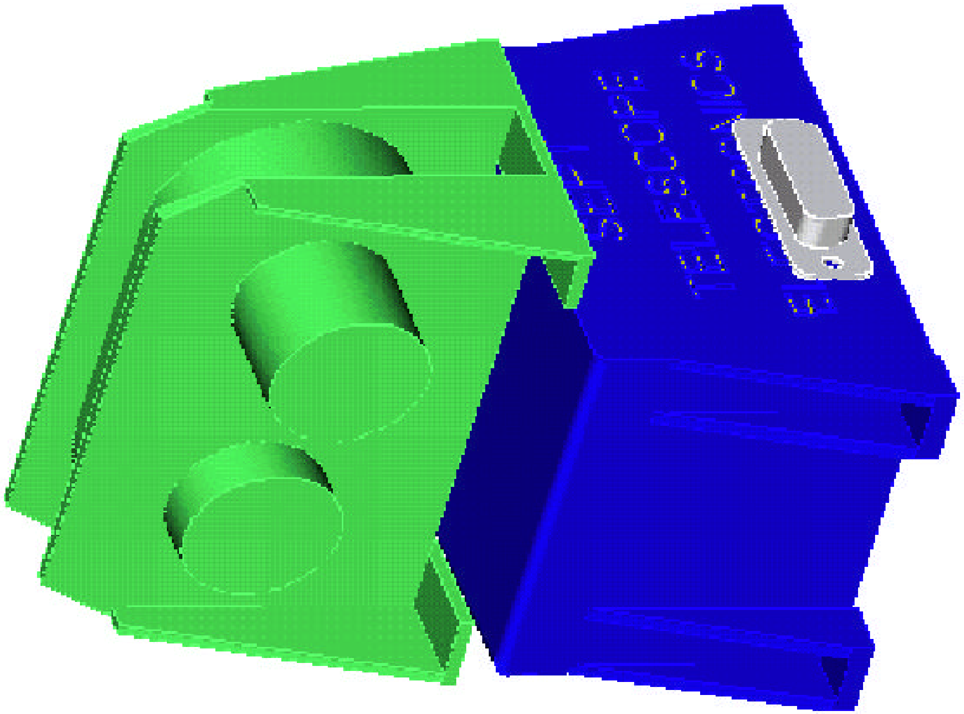
AHEAD Spacecraft Configuration



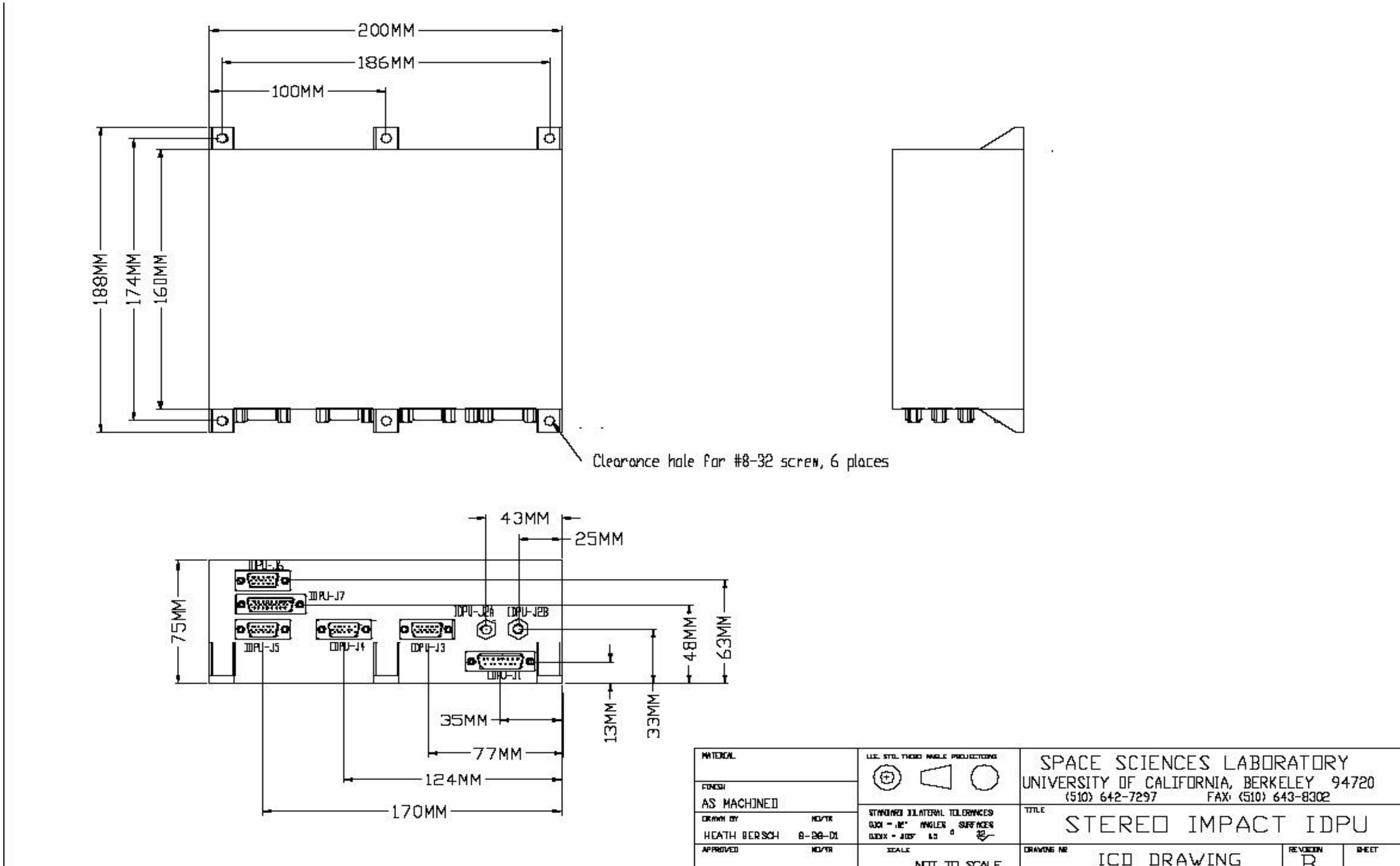
BEHIND Spacecraft Configuration



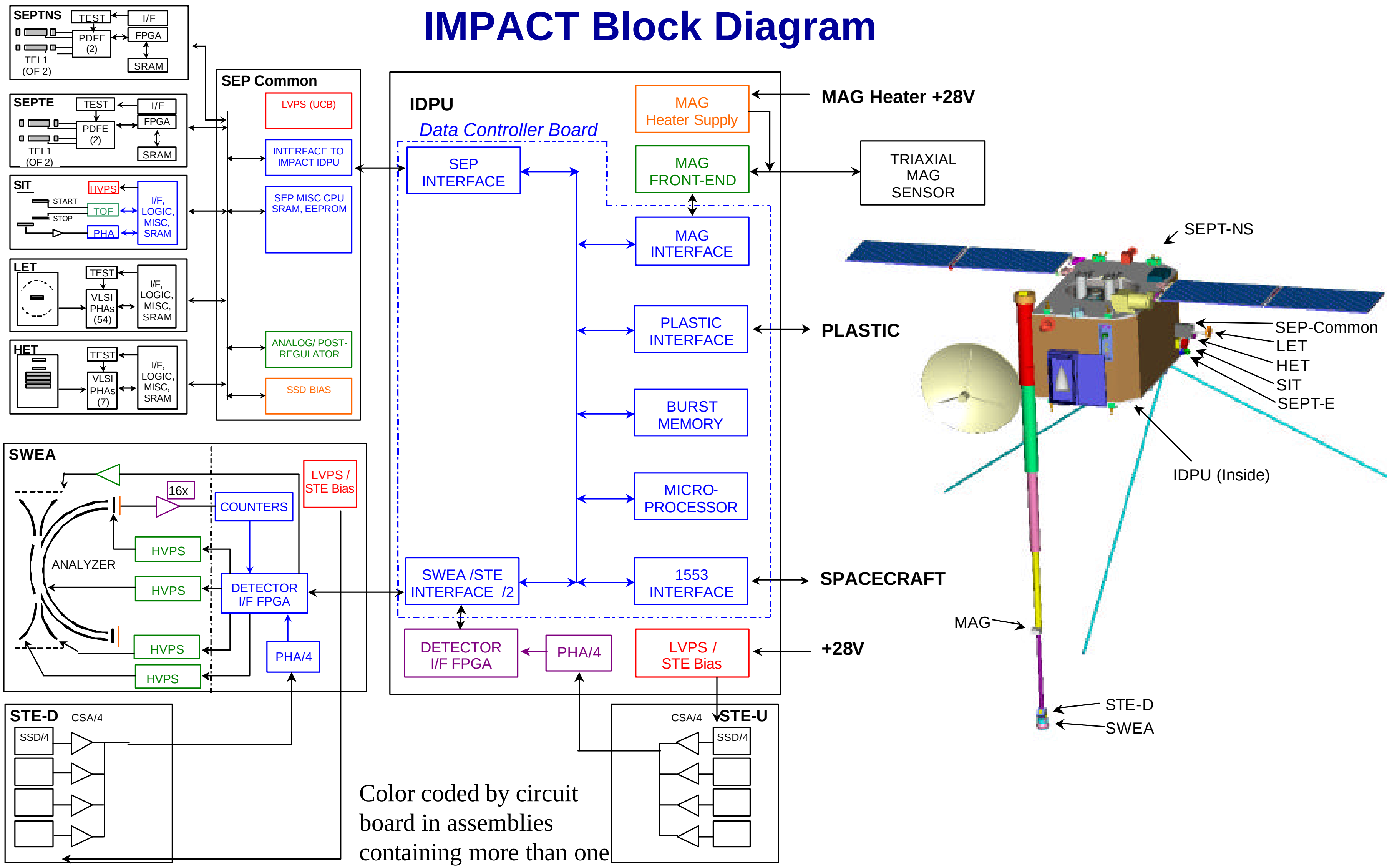
SEP/SEPT



IDPU


200MM
186MM
100MM
188MM
174MM
160MM
Clearance hole for #8-32 screw, 6 places
43MM
25MM
75MM
48MM
63MM
35MM
77MM
124MM
170MM
13MM
33MM
IDPU-J7
IDPU-J2A
IDPU-J2B
IDPU-J5
IDPU-J4
IDPU-J3
IDPU-J1
MATERIAL
FINISH
AS MACHINED
DRAWN BY
HEATH BERSCH
APPROVED
SCALE
NOT TO SCALE
SPACE SCIENCES LABORATORY
UNIVERSITY OF CALIFORNIA, BERKELEY 94720
(510) 642-7297 FAX: (510) 643-8302
TITLE
STEREO IMPACT IDPU
DRAWING NR
ICD DRAWING
REVISION
B
SHEET

IMPACT Block Diagram



Color coded by circuit board in assemblies containing more than one board.

Resource Utilization

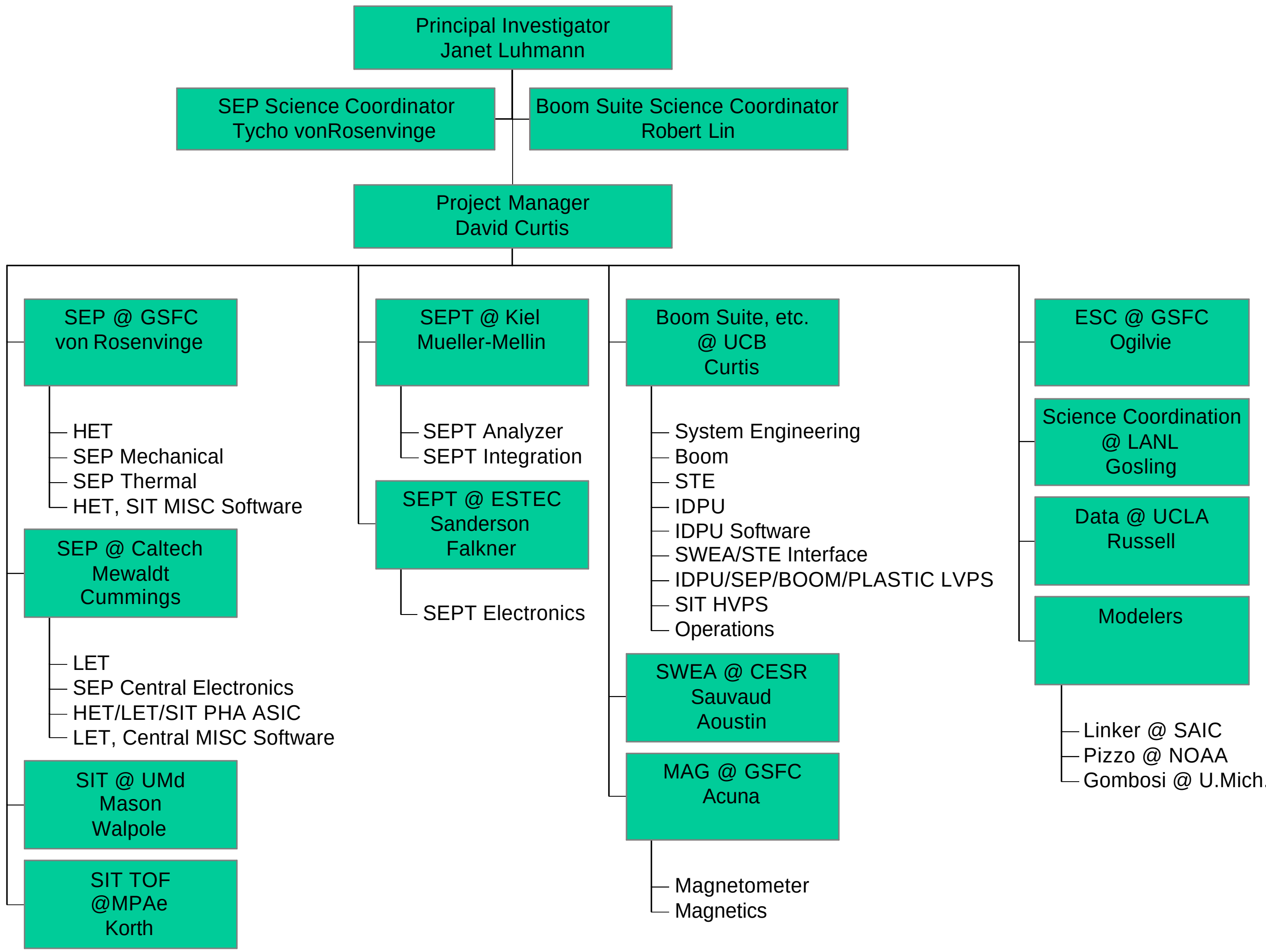
Resource	Current	Max	Margin	Max PDR	Max CDR
Mass	22.0 kg	26.3 kg	16%	22.4 kg	23.7 kg
Power	12.0 W	15.2 W	21%	13.0 W	13.7 W
IDPU Processor					
CPU Utilization	55%	100%	45%		
RAM Utilization	1455 kB	2048 kB	30%		
ROM Utilization	18 kB	32 kB	44 %		
SEP Processors					
CPU Utilization	37%	100%	63%		
RAM Utilization	54 kW	128 kB	58%		
EEPROM Utilization	127 kW	256 kW	51 %		

- Mass and Power Margin requirements: 15% at PDR, 10% at CDR
- Power does not include TBD SEP Operational Heater power – see SEP thermal presentation

Heritage

Instrument	Institution	Heritage
MAG	GSFC	Wind, MGS, ACE, LP
SWEA	CESR / UCB	MGS, Cluster, Giotto, Wind, FAST, LP
STE	UCB	Wind, HESSI
Boom	UCB	FAST, LP, POLAR, HESSI, MGS
SEPT	Kiel / ESTEC	Helios, ISEE, Phobos, VEGA, Galileo, SOHO, Wind, Equator-S
SIT	UMd / GSFC	ACE, Wind, SAMPEX
HET	GSFC / Caltech	ACE, Wind
LET	Caltech / GSFC	ACE, Wind, Geotail
IDPU	UCB	HESSI, FAST, LP, Cluster, Wind, Polar

IMPACT Organization Chart

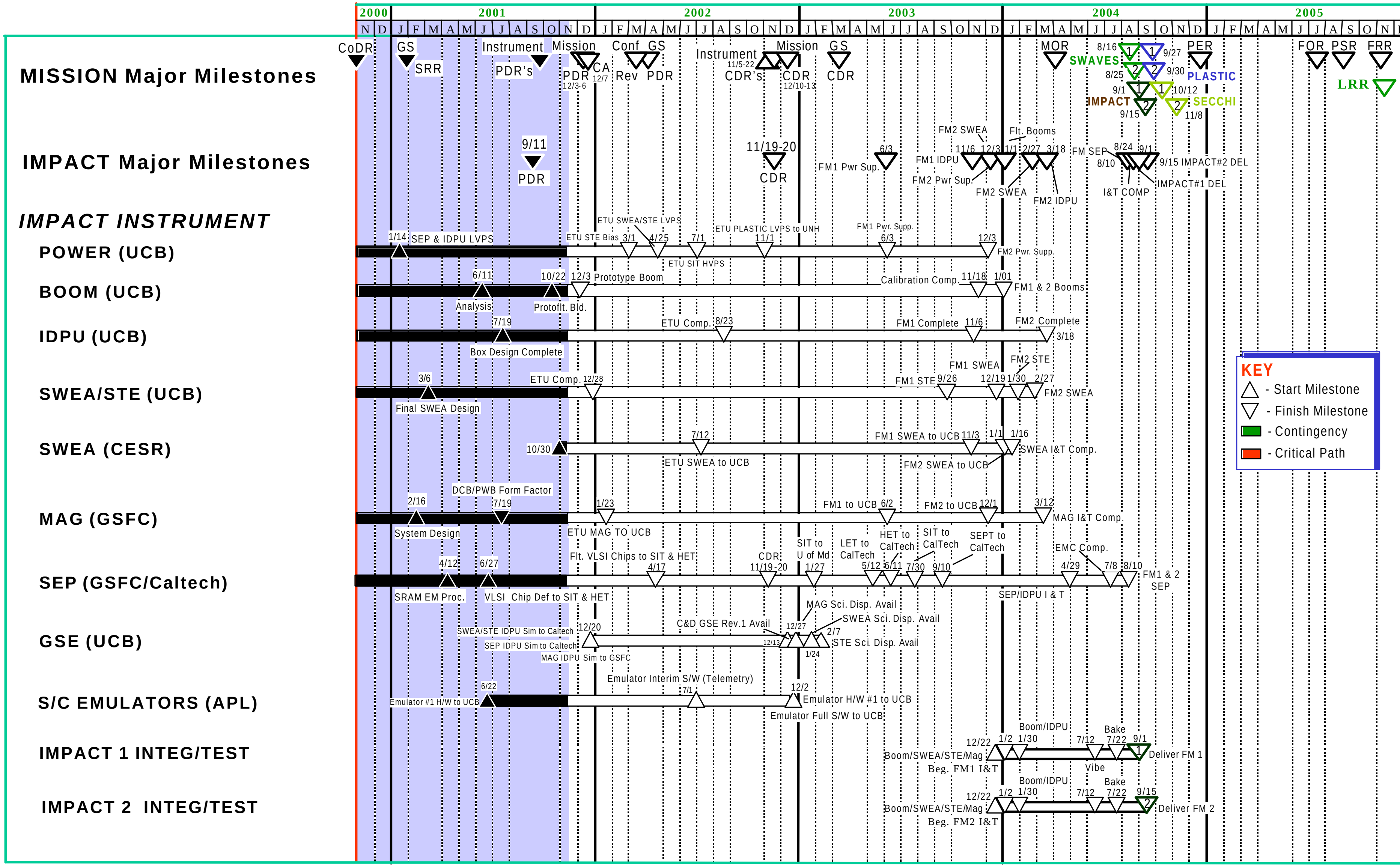


STEREO IMPACT

Mission Preliminary Design Review
2001-December 3-6

STEREO IMPACT INSTRUMENT MASTER SCHEDULE

Status As Of: 11/15/01



Changes Since IMPACT PDR

- SEP Thermal Analysis has progressed, and a thermal model has been provided to APL.
- STE door design has matured
- SEP schedule has been reworked to add time to ASIC development and identify the schedule slack
- Have instigated a parallel purchase of LET L1 detectors which meet minimum requirements to mitigate risk in thin L1 detector development.
- Grounding plan (remote power converter grounding) has been reworked with the EMC committee. The new plan does not put currents into the spacecraft chassis, but still requires a waiver.

SEP Thermal Status

Environmental Heat Inputs

- **Incident Solar Flux Determined by Spacecraft Perihelion and Aphelion**
  - **Solar Flux at 1 AU: 1366.5 W/m^2**

Ahead S/C	Extreme	Solar Flux
Perihelion	0.879 AU	1768.6 W/m^2
Aphelion	1.040 AU	1263.4 W/m^2

Behind S/C	Extreme	Solar Flux
Perihelion	0.960 AU	1482.7 W/m^2
Aphelion	1.131 AU	1068.3 W/m^2

- **MLI Blanket Outer Layer:**
  - **ITO Silver Conductive Composite Coating**

Optical Properties				Effective Emittance (ε^*)
$a_{(bol)}$	$\varepsilon_{(bol)}$	$a_{(eol)}$	$\varepsilon_{(eol)}$	0.03 - 0.01
0.1	0.68	0.2	0.64	

- **Radiators**
  - **ITO Silver Conductive Composite Coating**
    - **Deposited on Kapton and Bonded to Aluminum or Deposited Directly on the Aluminum**

OPERATIONAL HEATER POWER

-23C to 55C		20.0 C/W
Component	Operating Temp	Heater Power
	C	watts
HET		0.56
Detectors	-25 T0 +10	
Electronics	-25 T0 +10	
LET		0.47
Detectors	-25 T0 +10	
Electronics	-25 T0 +10	
SIT		1.53
Detectors	-25 T0 +10	
Electronics	-25 T0 +10	
SEPT/E		0.97
Detectors	-25 T0 +10	
Electronics	-25 T0 +10	
SEPT/NS		1.10
Detectors	-25 T0 +10	
Electronics	-25 T0 +10	
Central Electroni	-25 T0 +10	0.90
TOTAL		**5.53**

Current Efforts to Reduce Operational Heater Power

- **Use Updated Spacecraft Interface Temperatures**
  - **Instrument Thermal Interface Parameters in Requirements Documents would need to be Revised**
- **Relax Operating Temperature Limits**
  - **Internal Operating Limits in Requirements Documents would need to be Revised**
- **Increase Interface Resistance**
- **Demonstrate Reduced End of Life Heater Power Requirements**

Mission Operations

IMPACT Mission Operations Facilities

- **The IMPACT team shall use the EGSE as the basis of the IMPACT POC for commanding and real time telemetry**
  - **The same EGSE that was used throughout Instrument and Observatory testing**
  - **Command scripting capability allows for semi-automated operations**
  - **Automated state of health monitoring warns of any out-of-limit conditions**
  - **The EGSE shall be directly connected to the MOC via TCP/IP sockets as described in the MOC/POC ICD.**
  - **The EGSE shall be co-located with the MOC during Commissioning phases, and shall be left there in case needed for any later real-time diagnostics**
  - **A remote copy of this EGSE at UCB shall be used for submitting commands during normal operations.**

- **A suite of data reduction and analysis software shall be added to the POC to perform the offline data processing.**
  - **This software shall run on distributed systems, using data FTPed from the STEREO MOC as described in the MOC/POC ICD.**
  - **UCLA shall provide web-accessible Summary Data Product**

Commissioning

- During Commissioning, and any other Real Time operations, IMPACT personnel shall be at APL during contacts, commanding the instrument suite and looking at real-time data products on the EGSE
  - Using the same tools that will have been used throughout I&T to verify instrument functionality
- At least two workstations shall be used per spacecraft; one for command and state of health monitoring, and one for Science displays
  - Allows instrument operator to function independently of science team
- IDPU software is sufficiently modular to allow PLASTIC to command their instrument independently of IMPACT for most operations.
  - PLASTIC has a similar but independent EGSE/POC setup

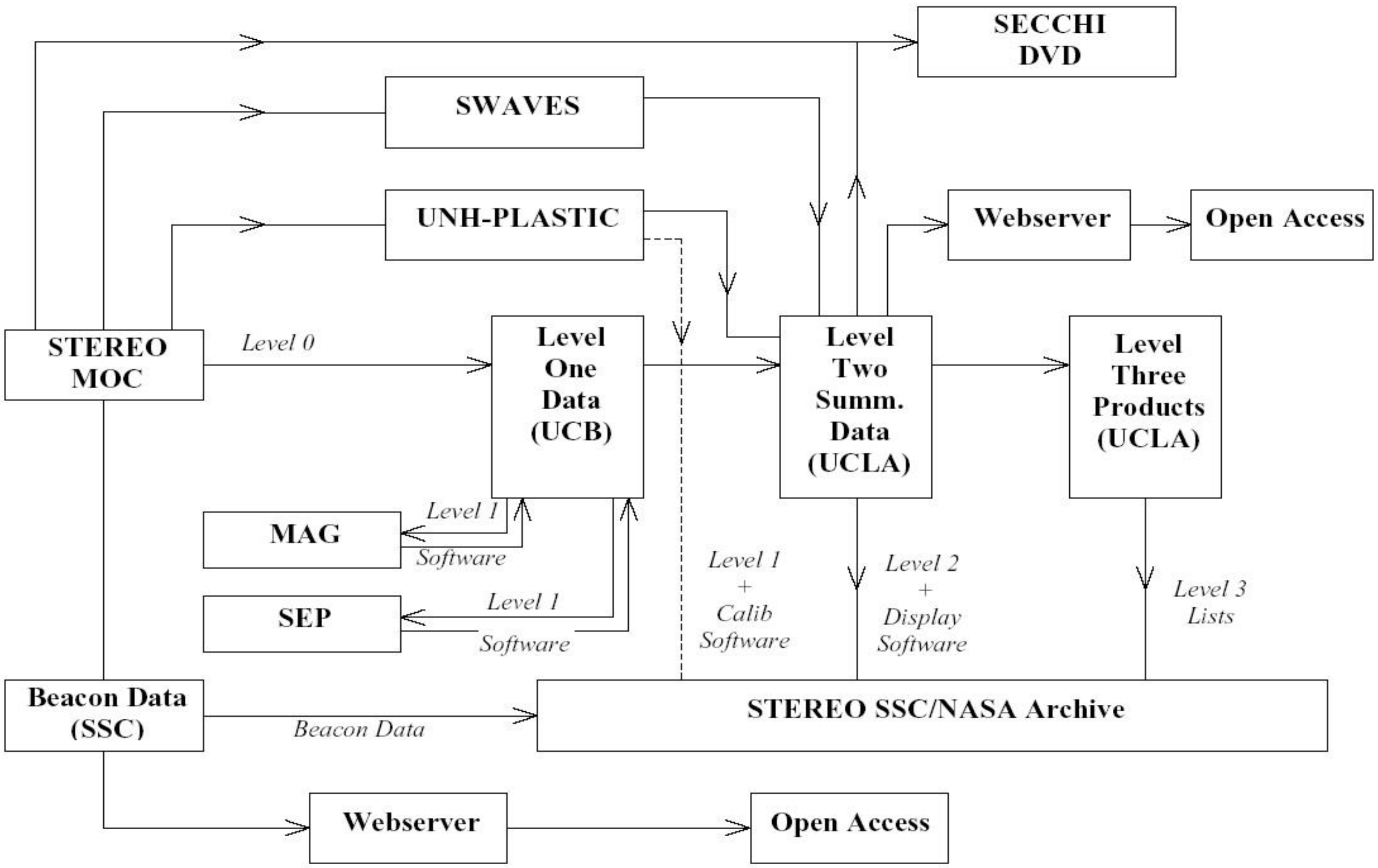
Operational Constraints

- IMPACT Suite would like to be powered on as soon as possible, subject to spacecraft and other IMPACT constraints
- MAG would like to be powered on before IMPACT boom deployment
- MAG would like boom deployed as soon as possible to get calibration data in the magnetosphere
- MAG requires periodic calibration rolls
- SWEA, STE, SEPT, and SIT covers cannot be opened for at least 24 hours (TBR) after launch to allow spacecraft outgassing
- SWEA and SIT have High Voltage which cannot be operated sooner than 24 hours (TBR) after their doors open
- SIT and SEPT have sunlight avoidance constraints that may delay their cover opening until heliocentric orbit (after the insertion burns are complete and attitude is stable)
- STE cover must be re-closed for off-nominal orientations and thruster firings
- IDPU should be powered on if either SEP or Boom Suite is on.

Normal Operations

- **During Normal Operations, IMPACT will be commanded and monitored from Berkeley**
  - **Using a copy of the EGSE setup**
  - **Limited commanding required; instruments run fairly autonomously**
  - **Routine limit checking and trending run automatically post-pass, with an alarm system to notify an operator (via a pager)**

IMPACT Data Analysis Flow



IMPACT PDR RFA Status

IMPACT PDR RFA Status Summary (1 of 4)

RFA #	RFA Summary	Response Summary
1	Provide C&T GSE Documentation and Maintenance Plan	Sufficient documentation shall be provided to allow continued maintenance, including Users Manual and Design Documentation. Post-launch, maintenance personnel available on an as-needed basis (see GSE SDP).
2	IDPU Software Development Plan, insufficient manpower.	We believe that there is sufficient manpower, but have a backup plan for adding more to be triggered based on the development status as of 5/02.
3	IDPU Software development plan; concerns about development schedule, review schedule, lack of design detail in PDR.	Basic requirements have been in place for several months, and design work has been proceeding. Will include Preliminary Design material in December Requirements Review.
4	Boom Failure Modes (Unlocked), analyze risk to ACS pointing requirements	Preliminary estimates of worst case “unlocked” stiffness provided to APL, to be augmented by test data in near future. APL needs to ascertain effects on ACS.
5	Science Minimum Mission Requirements unclear	Project developing a better requirements flowdown and reworked reliability assessment, to be presented at Observatory PDR.
6	Consider a boom cold survival test	Will perform cold case boom deployment test and LN2 immersion joint test. Post-deployment temperatures are so low that a cold case thermal vacuum test is impractical
7	Request MAG thermal model	MAG Thermal model to be provided to boom thermal engineer

IMPACT PDR RFA Status Summary (2 of 4)

RFA #	RFA Summary	Response Summary
8	IDPU Thermal Analysis and Test	IDPU Thermal Analysis Plan submitted to Project. IDPU Thermal Vacuum Tests to meet GEVS & Environmental Test Plan Requirements.
9	IMPACT Boom: Concern about stacer buckling	Stacer buckling is possible follow-on to failure mode (see RFA 4). Stacer buckling moment: 35N-m (26ft-lb). Bending travel limited by hard stop of boom lock rings at 5^0. Not enough travel for buckling. If tube integrity fails, spacecraft must provide 7N thrust about failed joint to buckle Stacer.
10	IMPACT Boom: Deployment test recommendations	Test sequences are TBC, but recommended numbers of deployments for EM and Flight models are in line with test plans.
11	PHA ASIC Development Schedule	SEP Schedule has been reworked to provide more time for ASIC development. Total slack is about 30 weeks.
12	SIT Internal Grounding Compatibility	Detailed SIT Grounding specification in work
13	SEPT Magnetics Requirement	SEPT Magnetic analytical model provided to MAG PI. A series of verification tests have been specified.
14	Level 1 requirements flowdown	Project developing a better requirements flowdown, to be presented at Observatory PDR.
15	Locate limiting resistor for boom actuator	Has been located on the spacecraft side
16	Protect SEP suite from a short in one instrument	Developing a plan for adding protection; will submit resource cost to Project for disposition

IMPACT PDR RFA Status Summary (3 of 4)

RFA #	RFA Summary	Response Summary
17	Secondary power grounding violates EMC requirements	Worked out a solution with the EMC committee. Will submit a corresponding waiver request shortly.
18	Boom Stiffness Analysis and Test Plan	UCB and APL are developing an analysis and test plan to verify the boom stiffness and its interaction with the spacecraft
19	SIT Foil Breakage concern	This unit is identical to the Wind instrument which met the same requirement, and survived launch
20	L1 detector thickness uniformity	Have instigated a parallel procurement of fallback L1 detectors which meet minimum requirements
21	Perform a "Radiation Hard by Design" review of SEP ASIC Design prior to fabrication	Have fit this into the schedule.
22	SEP EEPROM allocations	Included in Observatory PDR materials
23	SEP Instrument test GSE	Interface test GSE to be developed by each instrumenter (Caltech, GSFC, Kiel); interfaces to be verified with ETU and/or breadboards.
24	SEP FMEA: Concern about single EEPROM	Project shall develop a system-wide FMEA based on instrument input. EEPROM is a non-issue, since the SEP central processor which contains this EEPROM is already a single-point failure.

IMPACT PDR RFA Status Summary (4 of 4)

RFA #	RFA Summary	Response Summary
25	Avoid multiple windings on a single core in LVPS to reduce coupling between secondaries	Done.
26	SEP Processor margins	Included in Observatory PDR materials
27	Time Tagging Requirements	Spacecraft time tagging plan meets IMPACT's requirements. Project to provide a more general response to this RFA
28	SEP Survival Heaters	SEP thermal model provided to APL. Survival heater sizing will result from the combined spacecraft/instrument analysis.
29	SEPT glint sensitivity	Have selected detectors to minimize glint sensitivity (Ohmic side out). Design meets current requirements.