



Integrated Design Capability / Instrument Design Laboratory

Ocean Color Experiment Ver. 2 (OCE2)

Delta Study

~ Concept Presentations ~

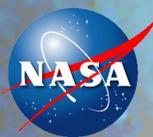
Electrical

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April 27, 2011

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N A S A G O D D A R D S P A C E F L I G H T C E N T E R

Electrical Subsystem Presentation



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Document electrical architecture

- Functional requirements
- Electrical block diagram
- **NO redundancy (DELTA configuration)**
- Estimate instrument power needs for average, peak, and survival cases
- Document electrical interface assumptions and estimate harness mass
- Estimate telemetry rates and the required S/C data storage



Electrical Subsystem Functions



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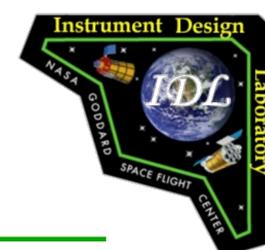
Realize an electrical architecture and instrument processing capability consistent with the mission class and lifetime

- Class C Mission
- 3 year minimum operation, 5 year goal

Control all hardware

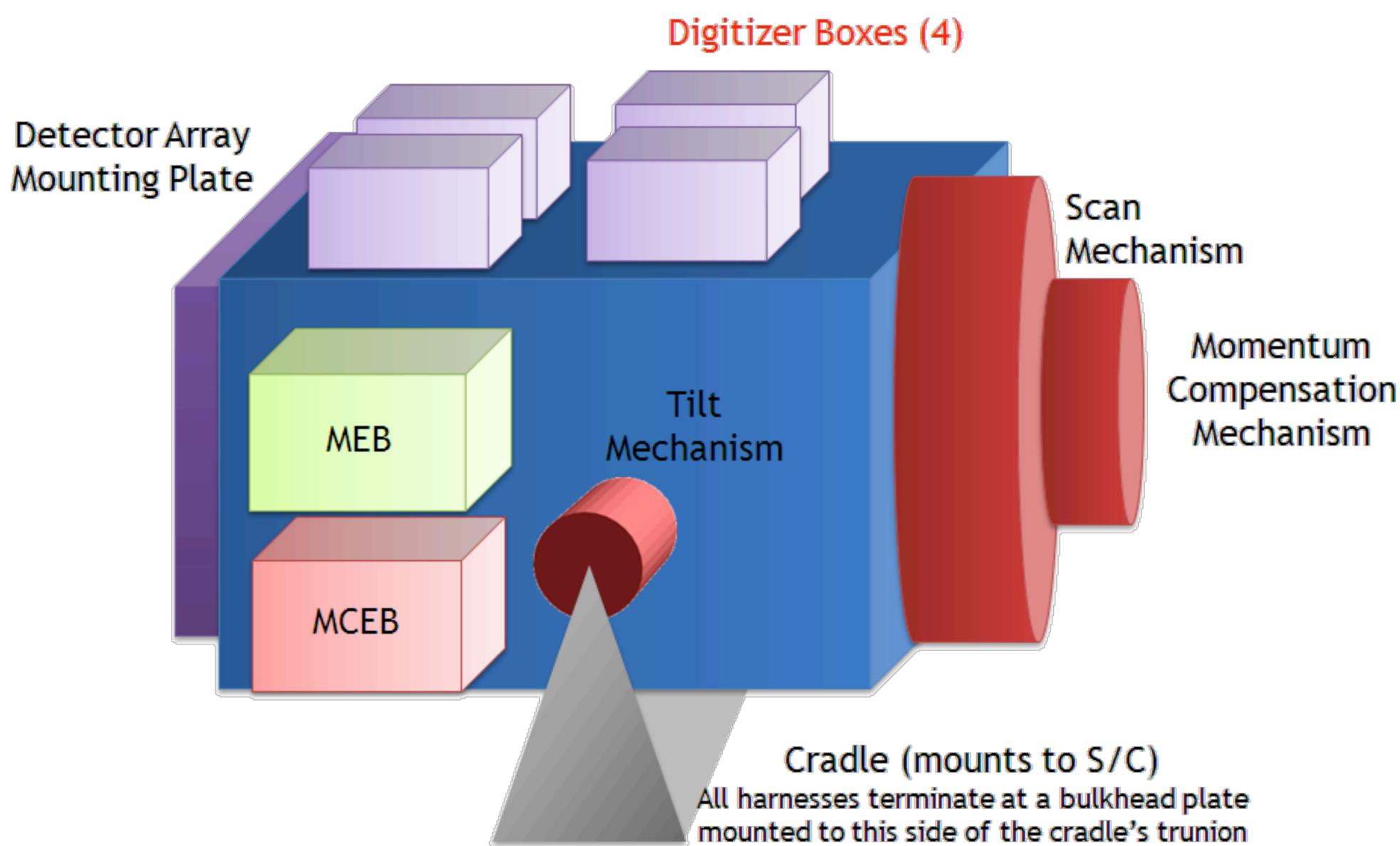
- Realize electrical hardware and processing capability to control all instrument functions: instrument modes, housekeeping monitoring, power conditioning, telemetry packetization
 - Switching between redundancy is commanded from the ground
- Readout detectors: process raw data, control CDS readout, compress raw data
- Perform integration control algorithm
- Control all mechanisms (5): scan, half angle mirror, momentum compensation, tilt, and calibration
 - Launch lock mechanisms are controlled by S/C
- Control all thermal hardware





Electrical Boxes Arrangement

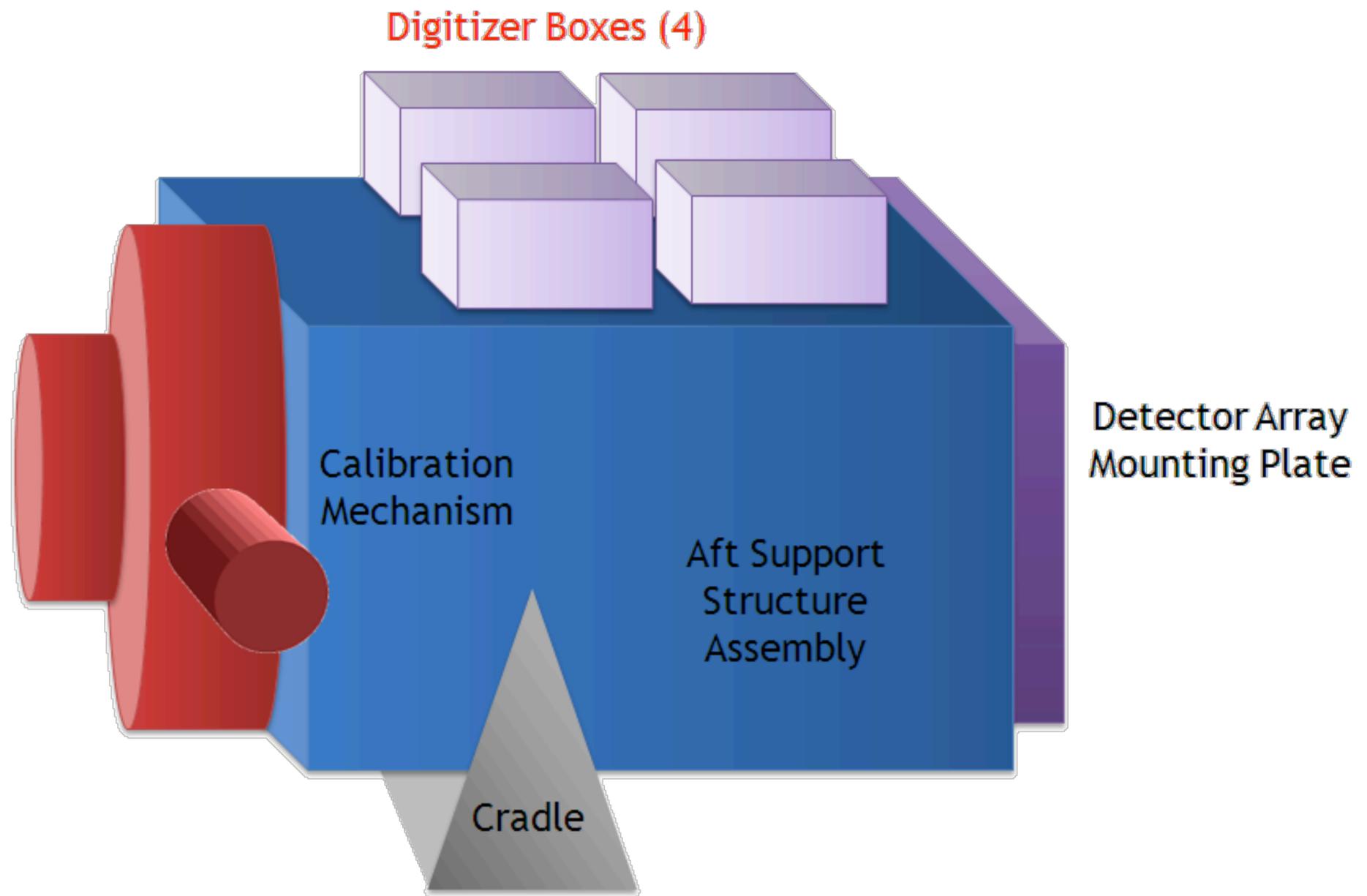
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Electrical Boxes Arrangement

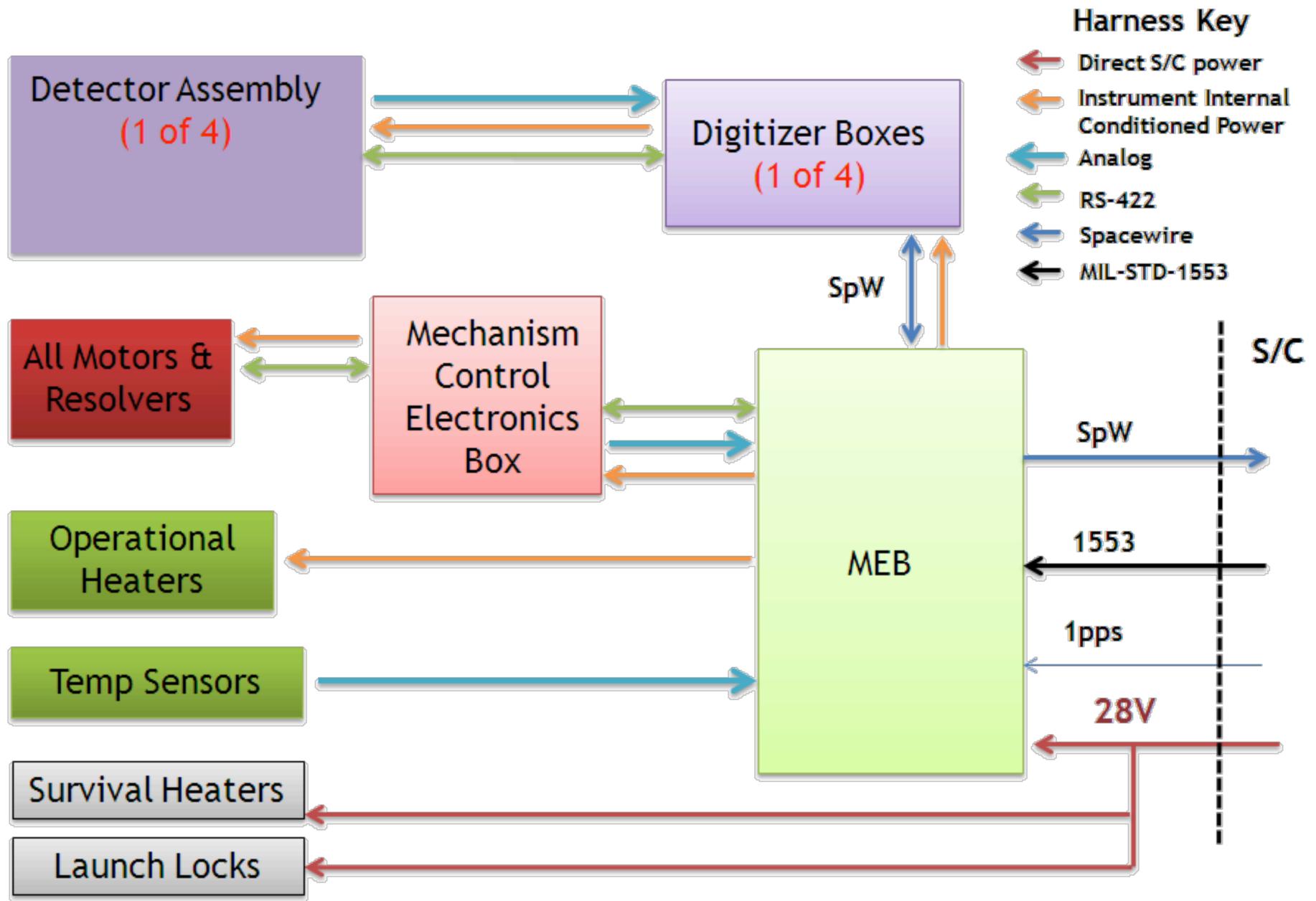
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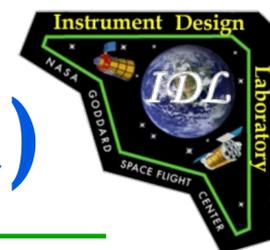


Electrical Interfaces

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Electrical Board/Box Summary (Delta)



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| Box* | Boards | Board Mass* | Chassis Mass Dimensions | Total Mass |
|--|---|--------------------------------|--|--------------------------------|
| Main Electronics Box (MEB) | 5 6U Cards: <ul style="list-style-type: none"> • CPU • Housekeeping • Thermal Control (2) • LVPS | 0.59kg/each 3.4kg Total | 1.5kg 10x7.3x6" 25.4x18.5x15.2cm | 5.0kg |
| Detector Digitizer Boxes** (2) | 7 6U Cards**: <ul style="list-style-type: none"> • Digitizer boards (5) • Compression and Spacewire Merge • LVPS | 0.59kg/each 4.9kg Total | 2kg 10x7.3x9" 25.4x18.5x22.9cm | 6.9kg/each 13.8kg Total |
| Detector Digitizer Boxes** (2) | 8 6U Cards**: <ul style="list-style-type: none"> • Digitizer boards (6) • Compression and Spacewire Merge • LVPS | 0.59kg/each 5.5kg Total | 2kg 10x7.3x9" 25.4x18.5x22.9cm | 7.5kg/each 15kg Total |
| Mechanism Control Electronics Box (MCEB) | 6 6U Cards: <ul style="list-style-type: none"> • Scan Control • HAM Control • Mom Control • Tilt Control • Cal Control • LVPS | 0.59kg/each 4.1kg Total | 1.7kg 10x7.3x7" 25.4x18.5x17.8cm | 5.8kg |

*Each box also includes a backplane
 **All digitizer boxes will be the same size, but 2 (of 4) will have 1 fewer boards





Power Summary (Delta)

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| OCE2 DELTA Configuration | Peak | Average |
|--|-------------|-------------|
| Scan Drum Assembly | 70 | 14.8 |
| Motor/Inductosyn | 50 | 12 |
| Half Angle Motor/Inductosyn | 20 | 2.8 |
| Launch Locks for Scan (powered by S/C) | 4.5 | 0 |
| Momentum Compensation Assembly | 50 | 47 |
| Cradle Assembly | 30 | 0 |
| Tilt Mechanism Motor 1/Resolver | 15 | 15 |
| Tilt Mechanism Motor 2/Resolver | 15 | 15 |
| Launch Locks for Tilt (powered by S/C) | 4.5 | 0 |
| Aft Optics Assembly | 458 | 442 |
| Preamp, FET switches, FET driver (1W each) | 174 | 174 |
| Digitizer Electronics Box (30W each) | 110 | 110 |
| Main Electronics Box | 143 | 143 |
| Mechanism Control Electronics Box | 31 | 15 |
| Operational Heater Power (shown on next page) | 99 | 69 |
| Instrument Total | 707W | 573W |



Operating Mode Heater Power (Delta)



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| Assembly | Average Heater Power (W) | Peak Heater Power (W) |
|----------------------------------|--------------------------|-----------------------|
| Silicon PIN & Preamp Thermal Box | 39 | 56 |
| InGaAs PIN & Preamp Thermal Box | 2 | 3 |
| Fiber Optics Enclosure | 18 | 26 |
| Optics Housing | 10 | 14 |
| Total | 69 | 99 |

Operating mode heater power is sized in worst cold operating case





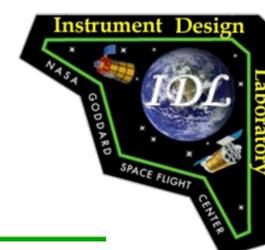
Survival Heater Power (Delta)

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| Assembly | Average Heater Power (W) | Peak Heater Power (W) |
|------------------------|--------------------------|-----------------------|
| MEB | 66 | 77 |
| MCEB | 17 | 21 |
| Digitizers | 59 | 74 |
| Silicon PIN & Preamp | 76 | 84 |
| InGaAs PIN & Preamp | 5 | 7 |
| Fiber Optics Enclosure | 14 | 20 |
| Optics | 10 | 14 |
| Mechanisms | 35 | 50 |
| Total | 282 | 403 |

Radiators are sized for the worst hot operating case





Data Rates (DELTA)

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Instrument Detector Readout Data Rate: instrument does not discard any data

- Assume 174 channels per scan
- 30 μ s Integration Period
- Digitizing 16-bits, transmitting 14-bits each channel
- ⇒ **Raw digitized detector data: 81.2Mbps**
- ⇒ **2:1 compression implement in digitizer electronics (USES chip): 40.6Mbps**

Additional Instrument Data that is included in the Instrument Data, but is negligible:

- Housekeeping data (thermal, voltage, current, etc)
- Integration period measurements (taken for 12 detectors in both the baseline and delta instrument configurations)
- Dark current calibration images (possibly once per revolution)

Instrument Packetization: instrument data rate to the S/C

- ⇒ **There is 2% additional CCSDS overhead for packet headers: 41.4Mbps**
- ⇒ **Daily instrument data rate to S/C: 3577Gbits/day**

Effective Instrument Downlink Data Rate from S/C: the S/C may discard unuseful data for these considerations

- ⇒ **Discarding information beyond 102degrees**
- ⇒ **Discarding data beyond 70 degrees latitude**
- ⇒ **Discarding data taken over unlit Earth**





Harness Estimate (Delta)

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| OCE2 Harness | Type | Backup | Primary | Flt Qty | Mass (ea) | Total Mass |
|---|----------------------|--------|---------|---------|-----------|------------|
| Detector to Digitizer Box 1 (0.5m) | RS-422/analog | 0 | 1 | 1 | 2.1 | 2.1 |
| Detector to Digitizer Box 2 (0.5m) | RS-422/analog | 0 | 1 | 1 | 2.1 | 2.1 |
| Detector to Digitizer Box 3 (0.5m) | RS-422/analog | 0 | 1 | 1 | 2.1 | 2.1 |
| Detector to Digitizer Box 4 (0.5m) | RS-422/analog | 0 | 1 | 1 | 2.1 | 2.1 |
| Digitizer Box 1 to MEB (0.46m) | SpW | 0 | 1 | 1 | 0.2 | 0.2 |
| Digitizer Box 2 to MEB (0.59m) | SpW | 0 | 1 | 1 | 0.2 | 0.2 |
| Digitizer Box 3 to MEB (0.72m) | SpW | 0 | 1 | 1 | 0.3 | 0.3 |
| Digitizer Box 4 to MEB (0.85m) | SpW | 0 | 1 | 1 | 0.3 | 0.3 |
| Scan Motor & Inductosyn® Absolute rotary resolver to Mechanism Control Box (1.6m) | Power, Cmd, and Telm | 0 | 1 | 1 | 1.3 | 1.3 |
| Half Angle Motor & Inductosyn® Absolute rotary resolver to Mechanism Control Box (1.4m) | Power, Cmd, and Telm | 0 | 1 | 1 | 1.2 | 1.2 |
| Momentum Compensation Mechanism & Resolver to Mechanism Control Box (1.6m) | Power, Cmd, and Telm | 0 | 1 | 1 | 1.3 | 1.3 |
| Calibration Mechanism & Resolver to Mechanism Control Box (2m) | Power, Cmd, and Telm | 0 | 1 | 1 | 1.7 | 1.7 |
| Tilt Stepper Motor & Resolver to MEB (.5m) | Power, Cmd, and Telm | 0 | 2 | 2 | 0.4 | 0.8 |
| Scan Launch Lock to S/C Bulk Head (.7m) | Power | 0 | 1 | 1 | 0.1 | 0.1 |
| Tilt Launch Lock to S/C Bulk Head (.3m) | Power | 0 | 1 | 1 | 0.1 | 0.1 |
| Ops Heaters to MEB (1m) | Power | 1 | 1 | 2 | 1.3 | 2.5 |
| Op Temp Sensors to MEB (1m) | Analog | 1 | 1 | 2 | 0.8 | 1.7 |
| MEB to Mechanism Control Box (0.2m) | Power, Cmd, and Telm | 0 | 1 | 1 | 0.2 | 0.2 |
| MEB to S/C Bulk Head (1m) | 1553 | 0 | 1 | 1 | 0.1 | 0.1 |
| MEB to S/C Bulk Head (1m) | SpW + 1pps | 0 | 1 | 1 | 0.5 | 0.5 |
| MEB to S/C Bulk Head (1m) | Power | 0 | 1 | 1 | 0.2 | 0.2 |
| Survival Heaters & Mechanical Thermostats to S/C (.7m) | Power | 1 | 1 | 2 | 3.4 | 6.8 |

Total 27.82

