Corner Raft Conceptual Design

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Each board for a Wave Front Sensor is the same (206mm) length and ~1/3 the width of a board for the Science Rafts.

The single rail has 1/2 the thermal contact with the cage, but 1/3 the heat load, compared to a Science Raft double rail board pair.

A WFS FEE board pair has 2x51-pin low-profile Micro-D connectors (compared to 2x69-pin and 2x51-pin standard profile Micro-D connectors on a Science Raft board pair).
Guider SIDECAR ASIC Package

from Don Figer, RIT

- SIDECAR ASIC interfaces directly to analog readout circuits
- Low power, high performance
- Integrated circuit contains microprocessor, bias generators, clocks, plus 36 input video channels, 36 parallel ADCs (12 bit /10 MHz, 16 bit /500 kHz)
- SIDECAR is being used for three JWST instruments (4 port readout, 11 mW)
- SIDECAR is key to Hubble Space Telescope ACS Repair – operates CCDs

Estimated 37mm x 15mm x 100mm size of JWST package is the size of the Guide sensor FEE clearance volumes in the CAD model shown in following slides
Corner with new GRID and Raft hold-downs

same spacing between cage and Grid bay walls as in Science Raft/Towers for new raft hold-downs

17.0 mm

103 mm
New Corner cage and FEE layout in GRID

Cage side “pushed out” here to fit 3 board pairs inside cage with minimum 5mm clearance in GRID Corner bays.
end view of new Corner Raft/Tower

Relative alignment of connections between sensor module, flex cable and FEE is the same in both Guide sensor locations.

Guider FEE in contact with corner posts fastened to cage walls for cooling.

Thermal straps to Corner Raft (cooling plate fastened to cage wall on hypotenuse side).

Single Rail Board Pair for WFS
Heat of WFS FEE conducted through single rail to cage wall.
Corner Raft Tower concept

- V-block kinematic mounts based on Science Raft design
- Clearance volumes for Guider FEEs
- Single Rail Double Board for WFS FEE
- Cooling plate / thermal strap to Corner Raft
- Triangular Tower fits inside GRID corner bays and mounts to Cryoplate
- Guide sensors
- WFS module
Raft hold-downs (similar to new design for Science Rafts)

Threaded holes for fastening to cryoplate

Raft hold-downs (similar to new design for Science Rafts)
Corner Raft/Towers in GRID/Cryoplate

A single Corner Raft-Tower design in all corners of GRID/Cryoplate

→ Corner Raft-Towers are interchangeable

→ Sensor, FEE and raft-hold-down orientation w.r.t. GRID/Cryoplate/Camera are rotated 4x 90 degrees
view through openings in Cryoplate
Items for Mechanical Development

• Assembly sequence
• Tool for insertion into the GRID (temporarily fastened to FEE cage)
• Mechanical analysis
  – Refine raft hold-down mechanism
  – Raft-to-Tower interface detail (prior to insertion into the GRID)
• Thermal analysis
  – Match delta T of science raft-to-cryoplate
  – Temperature stability – fluctuations due to varying power of Guider electronics?
• Accuracy/stability needed for sensors with respect to focal plane
  – Height location accuracy of each sensor compared to science focal plane?
  – Need for co-planarity of the 8 guide sensors?
  – X-Y-Theta position accuracy and stability?
  – Required offset from focal plane for WFS: +/- 1 mm or ?
  – Required parallelism of one split surface with respect to the other for WFS?
  – Required parallelism of each WFS with respect to the science focal plane?
• Electronics form factor and schematic
  – What FEE connectors are needed? Number of pins?
  – What FEE-to-BEE cables and cable folding scheme are needed?
  – How are Guider signals ganged in BE to reduce number of Cryostat feedthroughs needed
Backup slides
# Draft Development schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Start Date</th>
<th>Duration</th>
<th>Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual mechanical design finalized</td>
<td>Nov-08</td>
<td>milestone</td>
<td></td>
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<tr>
<td>Mechanical and Thermal analysis</td>
<td>Dec-08</td>
<td>3 months</td>
<td></td>
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<tr>
<td>Sensor/Raft/Grid/Cryoplate interface definitions</td>
<td>Feb-09</td>
<td>milestone</td>
<td></td>
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<tr>
<td>Mechanical prototype construction</td>
<td>Mar-09</td>
<td>3 months</td>
<td></td>
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<tr>
<td>Electrical grade components</td>
<td>Nov-08</td>
<td>7 months</td>
<td>mini-OTA</td>
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<tr>
<td>integration w/ mech prototype and testing</td>
<td>May-09</td>
<td>6 months</td>
<td></td>
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<tr>
<td>2nd version mechanical prototype</td>
<td>Oct-09</td>
<td>6 months</td>
<td></td>
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<tr>
<td>system integration and testing</td>
<td>May-10</td>
<td>6 months</td>
<td>CCD from prototype order (unlikely), mOTA or engineering grade CCD, prototype CMOS</td>
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<tr>
<td>Final version prototype</td>
<td>Oct-10</td>
<td>6 months</td>
<td></td>
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<tr>
<td>system integration and testing</td>
<td>May-11</td>
<td>6 months</td>
<td>prototype WFS format CCD, prototype CMOS</td>
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</table>
Simplified Thermal Models

1-D model (electrical analog) for first-order calculation of thermal gradients
- Ignore lateral heat flows
- $R_n = \text{bulk + interface thermal impedance of component}$
- Tower cold mass = cooling plates + housing sidewalls
- Strategy: make $R_4$ dominant, keep $R_5$ minimum
- Makeup heater may be necessary to compensate for time variation of $L_3$ and cryoplate temperatures, and for controlled warm-up

### Science Raft Tower

- $Q_2$ (11.5 W, FEE power dissipation)
- $Q_1$ (4.1 W, Radiation from $L_3$ + CCD source follower dissipation)
- $\Delta T = 6.4$

### Corner Raft Tower

- $Q_2$ (3.3 W, FEE power dissipation)
- $Q_1$ (1.1 W, Radiation from $L_3$ + CCD source follower dissipation + CMOS dissipation)
- $\Delta T = 6.4$