NIRST Calibration, scheduling & operating plan

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Workteam

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<table>
<thead>
<tr>
<th></th>
<th>MWIR2 (Band 1)</th>
<th>LWIR2 (Band 2)</th>
<th>LWIR3 (Band 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central wavelength</td>
<td>3.8 µm</td>
<td>10.85 µm</td>
<td>11.85 µm</td>
</tr>
<tr>
<td>Band Limits</td>
<td>3.4 – 4.2 µm</td>
<td>10.4 – 11.3 µm</td>
<td>11.4 – 12.3 µm</td>
</tr>
<tr>
<td>Temperatures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min.</td>
<td>400K</td>
<td>250K</td>
<td></td>
</tr>
<tr>
<td>Max.</td>
<td>1000K</td>
<td>500K</td>
<td></td>
</tr>
<tr>
<td>NEΔT</td>
<td>&lt;1.5K @ 400K</td>
<td>&lt;0.8K @ 300K</td>
<td>&lt;0.4K @ 300K</td>
</tr>
<tr>
<td>Temp. accuracy</td>
<td>2.5K @ 400K</td>
<td>1.5K @ 300K</td>
<td>&lt;2K @ 300K</td>
</tr>
<tr>
<td>Detectable size of fire event</td>
<td>200m² @ 1000K</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Observing window covered with orange plexiglass

Transporting legs

Power connector

Data connector

Thermal radiator

Survival connector
Scans at the optical lab
What we measure

Voltage across μbolometer is an almost linear result of its temperature change which is proportional to incident power.
The whole process receives the name of responsivity and is a characteristic of each pixel. A typical value of responsivity is $4.4 \times 10^4 \text{ V/W}$.

$\Phi(T) = \int \Omega A L(\lambda,T) \Psi(\lambda) \lambda \ d\lambda$
Where:
- $\Omega$ solid angle of optics as seen from earth
- $\Psi$ filters + optics + atmosphere transmission
- $L$ Planck’s law
- $A$ area of pixel on earth
- $\Phi$ power radiance

DO: the almost linear response of voltage across μbolometer. It is affected by an offset and a gain that are fixed in the electronics but are slightly different from pixel to pixel.
Pixel variety

6th Aquarius/SAC-D Science Meeting
Seattle. NIRST. Marraco et al.
System Transfer Function

\[ \text{SITF} = \frac{\Delta \text{count}}{\Delta T} = 0.8 \]

- \( \text{SITF} @ 600K = 1.33 \)
- \( \text{SITF} @ 373K = 0.4 \)

\[ \langle \text{SITF} \rangle = \frac{\Delta \text{count}}{\Delta T} = 2 \]

- \( \text{SITF} @ 500K = 3.8 \)
- \( \text{SITF} @ 300K = 1.15 \)
Power vs counts

Pixel 255 NVIR Line 2 Beta 45 Counts vs Power with fit

Pixel 255 LWR Line 2 Beta 45 Counts vs Power with fit
Pixel variety
Active and reference (blind) pixels
Signal level as one illuminating spot of a size equal to a pixel is moved perpendicular to the array line.

| BAND   | |\text{Signal}@C| / |\text{signal}@B| [%] |
|--------|-----------------|--------------------|
| MWIR   | 51\%±18\%       |                    |
| LWIR   | 13\%±2\%        |                    |
Blind pixel (MWIR)

Position “A”

Position “B”

Position “C”

Position “D”
Pixels alongtrack (nadir)

\[
\begin{align*}
\text{59ms @ 6.9 km/s } & \approx 410 \text{ m} \quad \star \quad 0.53 \text{ mrad @ 657 km } \approx 350 \text{ m}
\end{align*}
\]
1. Emergencies
2. Instrument Health Care
3. Science Group & AOs
4. Common Users
## Revisit Scenario

### Virtual (1000 km swath)

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Example location</th>
<th>Average revisit interval (days)</th>
<th>Maximum missing days</th>
</tr>
</thead>
<tbody>
<tr>
<td>±67°</td>
<td>Northern Canada</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>±55°</td>
<td>Tierra del Fuego, mid Canada</td>
<td>0.7</td>
<td>1</td>
</tr>
<tr>
<td>±23°</td>
<td>Jujuy</td>
<td>1.2</td>
<td>2</td>
</tr>
</tbody>
</table>

### Nadir pointing (182 km swath)

![Nadir pointing shaded area map]

*Maximum Response Time (days):*
- N/C
- ≥7
- 6-7
- 5-6
- 4-5
- 3-4
- 2-3
- 1-2
- ≤1
Heaters off
Cameras on

TECs on
(stabilization in less than 2m)

Move mirror
0s to 30s

Acquire data
26s to XXs

Repeat as necessary

TECs off
Cameras off
Heaters on

timeline

-4m

0m

~+10m
NIRST over Argentina & Canada
Inland waters
Data acquisition rate: 53 kbytes/sec

Weekly (103 rev.) statistics:

29 downloads when SAC-D is 5° over horizon at Córdoba Ground station.
92 virtual overflights of Canada and Italy.
185 possible inland waters acquisitions (only those necessary to get weekly complete data).

Assumptions:

1. All acquisitions over Argentina and inland waters in neighboring countries are downloaded in real time.
2. Data stored in mass memory is downloaded at 130 kbytes/sec.
3. Canada and Italy are covered in a TBD%.
4. Inland waters are covered in a TBD%.
Weekly memory budget

Memory budget

Canada + Italy 100%
Lakes 100%

Weekly memory budget

days within cycle

megabytes

0 50 100 150 200 250

memory
next week BU
Weekly memory budget

Canada + Italy 100%
Lakes 80%
Back up slides
DVF (power)

DVF in POWER (MWIR2)

NEP@400k

pixel