Gemini Observatory: Current Operations and Future Plans

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Andy Adamson
Gemini: twin 8-meter telescopes with coverage of both hemispheres

FP: Full Participant (NGO)
Host: Access to local site (NGO)
LTC: Limited-term Collaborator
EX: Exchange Partner
We support four facility instruments + AO at each site. Up to three + AO active at a time.

**Gemini North**
- GMOS-N
- GNIRS
- NIFS
- NIRI
- AO: ALTAIR
- LGS

**Gemini South**
- GMOS-S
- FLAMINGOS-2
- GPI
- GSAOI
- AO: GeMS (MCAO)
- LGS (5)

Optical, Infrared, AO
Proposal idea? We accept all sizes on a variety of timescales.

**Director’s Time:** *any time*
- Chief scientist/Director approval
- For short, urgent projects

**Poor Weather:** *any time*
- Head of Science Operations approval
- For the worst conditions, bright targets

**Fast Turnaround:** *once per month*
- Peer reviewed, no TAC
- For short, immediate, trial, and/or follow-up proposals
  (oversubscription: ~3)

**Regular Proposals:** *once per semester*, through the
- National Time Allocation Committees (TAC)
- For regular proposals
  (oversubscription: ~2)

**Large & Long Programs:** *once per year*, through the
- Large Program TAC
- For large and/or long ambitious proposals (up to 6 sem)
  (oversubscription: >5)
And you can observe in the most appropriate mode.

**Queue mode:** (time domain, special conditions)
You submit your observations, we observe for you
You can look over our shoulders by *Eavesdropping!* 🎧

**Classical mode:** (special configurations, real-time decisions)
You visit the observatory and conduct your observations

**Priority Visitor Observing:** come during a block, pick & choose the best time for your observations!

**Queue backup**

**Base Facility Operations:** most observing is from the sea level facilities.
Remote observing by PIs is not currently planned.
Data is distributed via the new Gemini Observatory Archive.

Operational in 2015, it is hosted on AWS.

For our ~8TB (bz2) of data, the cost is <$10K per year.

New files are ingested within 20-60 sec.

Contains mostly raw data. We can ingest processed data.

Queries via the web interface or an API (URL query).

Calibration association finds all baseline calibrations.
Gemini has undertaken a strategic planning exercise to prepare for the coming decade.

Gemini Board Strategic Vision working group
Community survey had ~200 contributions

The main recommendations are:
• Gemini North and South could diverge, if needed, in priorities and operations
• Consider specialization, larger projects (e.g. 20-30% for specialized surveys)
• Maintain at least 50% PI science
• Build on current strengths (queue, AO)
• Become a premier facility for transient follow-up (esp. LSST)
We will continue a strong visitor instrument program to provide new capabilities and prototype new techniques.

IGRINS (2018, GS, H+K, R~45,000)

MAROON-X (2019, GN, optical, R~40,000, PRV)

GIRMOS (~2020, GS, NIR IFUs w/GeMS)
The next facility instrument for Gemini South, GHOST, is under construction.

High-resolution optical echelle spectrograph:
• $R = 50,000$ and $75,000$
• Will support a PRV mode (10 m/s)
• 370 – 950 nm coverage
• Two deployable IFUs (image slicers)
• Fiber-feed to pier lab

To be commissioned in 2019

AAO, ANU, NRC/CNRC
The following facility instrument (Gen4#3/OCTOCAM) will be a LSST follow-up machine.

- $g-K_s$ coverage using 7 dichroics
- Simultaneous 8-band imaging over 3’ x 3’ field
- Single-object longslit, IFU upgrade option
- $R \sim 4000$
- Must be operational by 2023

Team:
- PI: A. van der Horst (acting)  
  George Washington University
- Project Manager, Co-PI: P. Roming  
  Southwest Research Institute
- Project Scientist: A. van der Horst  
  George Washington University
Gemini North may focus on improving on and specializing in AO capabilities. Options include:

- Upgrade and then try to replace Altair (GLAO, MCAO, ??)
- Replace NIFS with upgraded IFUs for GNIRS
- Transfer an upgraded GPI to Gemini North
Major improvements to operational modes, user software, and data reduction in order to excel at LSST follow-up

New data rights and sharing policies for ToOs are being developed

Participation in a Follow-up Network (see talk by Allen)
Gemini’s observation planning/scheduling tools must be improved to handle a higher ToO rate and any new follow-up modes.

Currently:
- Daily plans are created manually.
- Night-time observers switch plans as conditions change.
- Standard ToOs are planned in.
- Rapid ToOs are not.

Weaknesses:
- rToOs disrupt the plan
- Managing timing windows
- It is difficult to support complicated cadences (e.g. observe every N days, logarithmic cadences)

With more ToOs & follow-up this will become unmanageable!

Improvements being made under the **OCS Upgrades Program**, including a new Observing Tool!

See Oct 2017 Gemini Focus & contact **bmiller@gemini.edu** if you’d like to contribute ideas.
Automated scheduling is needed to increase flexibility and reduce workloads.

The schedule will adapt as new ToOs arrive or conditions change.

We are experimenting with algorithms.

Will hopefully be handled by a follow-up network scheduler (see Allen’s presentation).
The main goal of Gemini data reduction efforts is to provide tools for science quality reduction.

• The Gemini reduction package is transitioning from IRAF to Python.
  • A pure python imaging package will be released in 2018
  • Work on spectroscopy reduction in python to start in 2018 - in collaboration with SOAR
• New instruments must come with reduction tools that work within our pipeline environment.
• Automated processing is a goal, not a short-term priority.
In summary… Gemini is working hard to remain on the cutting edge in the 2020s

Gemini’s proposal types and modes accommodate the scope and timescales for a wide array of projects.

Several workhorse instruments are “always on” and visitor instruments are encouraged. New instruments are designed for follow-up.

Adaptive Optics system upgrades are being considered, especially at Gemini North.

The observing systems are being upgraded to improve a flexible queue system that is a natural for ToO follow-up.
Reference slides
Summary of issues and questions

• Time allocation for the follow-up network
• New operational modes
• Scheduling of follow-up time, especially time on a ToO network
  • Blocks of dedicated nights?
    • External, network scheduler
    • What if not enough triggers?
  • Incorporate triggers into the queue (as now)?
    • Internal scheduler
  • All of the above

• Standard data reduction tools (python)
• Real-time reduction, especially for spectroscopy
## Gemini Instrumentation Specifications

<table>
<thead>
<tr>
<th>Site</th>
<th>Instrument</th>
<th>FoV, Mode, Resolution</th>
<th>AO Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gemini-N</td>
<td>GMOS-N</td>
<td>360-940 nm</td>
<td>ALTAIR</td>
</tr>
<tr>
<td>up to 2018</td>
<td>NIRI</td>
<td>1-5 µm</td>
<td>ALTAIR</td>
</tr>
<tr>
<td></td>
<td>NIFS</td>
<td>950-2400 nm</td>
<td>ALTAIR</td>
</tr>
<tr>
<td></td>
<td>GNIRS</td>
<td>1-5 µm</td>
<td>ALTAIR</td>
</tr>
<tr>
<td>Gemini-S</td>
<td>GMOS-S</td>
<td>360-940 nm</td>
<td>GeMS</td>
</tr>
<tr>
<td></td>
<td>GSAOI</td>
<td>950-2400 nm</td>
<td>(GeMS)</td>
</tr>
<tr>
<td></td>
<td>FLAMINGOS-2</td>
<td>950-2400 nm</td>
<td>GeMS</td>
</tr>
<tr>
<td>GN in 2018</td>
<td>GPI</td>
<td>900-2400 nm</td>
<td>XAO</td>
</tr>
<tr>
<td>~2018</td>
<td>GHOST (GS)</td>
<td>360-1000 nm</td>
<td>(None)</td>
</tr>
<tr>
<td>~2022</td>
<td>OCTOCAM (GS)</td>
<td>Visible + NIR</td>
<td></td>
</tr>
<tr>
<td>Visitor INS</td>
<td>TEXES (GN)</td>
<td>5-25 µm</td>
<td>no AO</td>
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<tr>
<td></td>
<td>DSSI (GN/GS)</td>
<td>400-1000 nm</td>
<td>speckle</td>
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<tr>
<td></td>
<td>GRACES (GN)</td>
<td>~500-1000 nm</td>
<td>no AO</td>
</tr>
<tr>
<td></td>
<td>Phoenix (GS)</td>
<td>1-5 µm</td>
<td>no AO</td>
</tr>
<tr>
<td>2016</td>
<td>POLISH2 (GN)</td>
<td>optical</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>HIPP (TBC)</td>
<td>optical</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>IGRINS (GS)</td>
<td>optical</td>
<td></td>
</tr>
<tr>
<td>2018 (TBC)</td>
<td>TIKI (GS)</td>
<td>mid-IR</td>
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<tr>
<td>2019 (TBC)</td>
<td>MAROON-X (TBC)</td>
<td>500-1000 nm</td>
<td>GeMS</td>
</tr>
<tr>
<td>2020 (TBC)</td>
<td>G-IRMOS (GS)</td>
<td>IR</td>
<td></td>
</tr>
</tbody>
</table>
Gemini Instrumentation Parameter Space