

The Gemini Rapid Response Mode

Tom Matheson

There are many types of astronomical objects that change over time, often in a regular and predictable fashion. There are events, however, that can be expected (249 supernovae discovered during 2004), but not predicted (when Betelgeuse will explode, for example). For objects such as supernovae or gamma-ray bursts, the times for observation are unknown until they occur. If a gamma-ray burst is detected on October 12, and your night at the telescope was the 11th, this can be a problem. The queue mode of operation at Gemini provides a solution to this.

For several semesters, Gemini has offered a Quick Response mode for targets that are not specified in advance, but have a well-defined trigger event for activation. These are distinct from unexpected events, for which Director's Discretionary time is the mechanism for obtaining observations. During the proposal process for the expected events, a set of criteria for triggering is specified, and a template observation is designed for eventual activation.

The instruments accessible for Quick Response are the Gemini Multi-Object Spectrograph (GMOS) North and South, the Near-Infrared Imager (NIRI), and the Gemini Near-Infrared Spectrograph (GNIRS). Once a target does appear, the principal investigator (PI) can notify Gemini staff and the object will be added to the queue planning for observation within 24–48 hours, as long as the requested instrument configuration is available.

For some objects, notably gamma-ray bursts, this may not be fast enough. For example, in order to catch the still-elusive afterglow of

short-duration bursts or to see signatures of the immediate stellar environment in early spectra of long-duration burst afterglows, the exposures need to begin within minutes. The recently launched Swift satellite will not only increase the number of gamma-ray bursts detected, but also provide quick and accurate localizations. The cutting-edge for gamma-ray burst follow-up observations will be those that take place as early as possible after detection. To address this need, Gemini developed a Rapid Response mode that aims to be on a target within about fifteen minutes of activation. The same set of instruments that is available for Quick Response mode can be used for Rapid Response mode.

Proposals for Rapid Response mode should be submitted through the standard proposal process and need to include a justification for the special response, as well as an explicit description of the trigger event. For approved programs, the PI will create template observation plans within the standard Gemini Phase II process. When an event occurs, there will not be a lot of time to generate observing plans, so templates for all possible contingencies should be developed.

Programs can include scheduled follow-up observations after the initial Rapid Response activation. Since these observations are not known in advance, some basic calibrations may need to be included in the template. After these templates have been reviewed by NGSC and Gemini staff, they are set to On-Hold status.

Once an event occurs, such as a gamma-ray burst detection with Swift, the PI can select from among these On-Hold templates for the one that best matches the science goals

and the instrumentation available on the telescope (links describing which instruments are available, along with the current GMOS configuration, can be found at www.gemini.edu/sciops/schedules/schedIndex.html).

The PI will then enter the coordinates of the target, choose a guide star, and set the observation for activation after checking to make sure the object is, in fact, currently observable from the chosen telescope. This action will alert the observer at the appropriate Gemini telescope to interrupt the current program and slew immediately to the new target. The programs affected will be redone at a later date. This ability to interrupt other programs requires that the Rapid Response program achieve Band 1 in the Gemini queue.

Within the observation program, the PI should also include any relevant information for the observer, such as details for the precise timing of the start of the observation or a phone number where the PI can be reached. One of the critical items to include is the location of a finding chart, just to make sure you don't get the world's best spectrum of the star near your gamma-ray burst.

There have been many exciting developments in gamma-ray burst science in the past few years. With Swift actively detecting and localizing bursts, the Gemini Rapid Response mode is ready to provide the next breakthrough in gamma-ray burst science. We encourage all interested astronomers to consider this new method of observation.



NIRI and Altair: Report from a Successful Observing Run

Bob Blum

It was once again my pleasure to visit Gemini North to support a NIRI-Altair queue run. NIRI is the Gemini North facility near-infrared imager and Altair is the facility adaptive optics (AO) module. All National Gemini Office (NGO) staff are encouraged to visit Gemini, not only to become more familiar with the instruments they help support for their communities, but also to help with the heavy observing load at the telescope, which is now nearly completely queue scheduled.

Staff at the US national office, the NOAO Gemini Science Center (NGSC), take this responsibility seriously; our goal is to visit often enough to become efficient Gemini observers. My recent run was in the middle of March, and though the weather was difficult and we had some instrument problems, we eventually made some first-rate observations, and I was able to get an insider's view of some exciting developments at Gemini.

Before reporting some of these developments, let me remind you of some basics. Altair is a 177-actuator, Shack-Hartman wavefront sensing system that receives the 8-meter telescope $f/16$ beam and delivers the same back through the instrument support structure (the big box that holds Gemini's multiply mounted instruments at the Cassegrain focus). This capability allows Altair to feed more than one instrument with an adaptively corrected beam. NIRI imaging in the J, H, and K bands gets the largest share of Altair work, but the Gemini Multi-Object Spectrograph (GMOS) will use Altair in conjunction with its integral field unit (IFU). With NIRI's $f/32$ camera, Altair can deliver near-diffraction-limited performance with a bright natural guide star on-axis. The performance degrades fairly quickly off-axis for typical atmospheric seeing, so there is a premium on bright guide stars at or near the science target position (R-band brighter than 12 for an AO star and within about 7 arcsec are good rules of thumb).

Less than optimal performance off axis is the result of an optical design choice based on atmospheric turbulence profiles that have not panned out. It is my understanding that there is a relatively straightforward fix in the works. In the meantime, problems with finding bright on-axis guide stars should soon be a thing of the past.

While waiting for high winds and thick clouds to recede over the first few nights of the run, I got a chance to talk to my Chilean neighbor, Maxime Boccas, as he was busily preparing the new laser launch telescope (LLT) for Altair/Gemini North. Max and Dan O'Connor (along with a host of other Gemini technicians and engineers from two hemispheres) were nearly ready to install the 35-centimeter telescope behind the Gemini secondary. The LLT fires a laser beam at the wavelength of the well known Sodium (Na) transitions near 5890 angstroms in the visible portion of the spectrum in order to excite the Na atoms in a naturally occurring layer some 90 kilometers above the surface of Earth. The beam itself is produced by a solid-state laser mounted at the Nasmyth level of the telescope. The beam is transferred to the M2 position of the LLT with a completely self-enclosed and reflective set of optics.

By the time the weather cleared, the Gemini team had the LLT mounted behind M2, and owing to the importance of the task, they were given several hours on the sky to begin aligning the LLT optical axis with that of the telescope. Everything looks well placed to see first "laser" light later in

semester 2005A. This truly exciting development will greatly enhance Altair's performance and will be critical to the planned science goals of the Near Infrared Integral Field Spectrometer (NIFS) to be delivered later this year.

Clear weather meant we could finally observe as well. While we did experience some difficulties with Altair that have since been fixed, the system worked very well for much of the night, and we were able to observe for a number of Band 1 programs aimed at finding planets or other faint companions around the nearest stars. After the wait for good weather, we were rewarded with seeing so good that we were able to observe in NIRI $f/6$ mode (i.e., without AO) allowing us to search for some of the most distant objects in very deep J-band exposures.

I would like to thank the Gemini North staff for inviting me to observe with them, and for their kind hospitality in Hilo and on the summit. Particularly helpful were Tracy Beck, who observed with me and provided Q training on the summit, and Andrew Stephens, NIRI scientist and Q manager during my stay. Chad Trujillo and François Rigaut were invaluable for their expert help with Altair.

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Phoenix in Classical Mode

Verne Smith & Ken Hinkle

Since the start of the 2005A semester, Phoenix, a high-resolution (R=50,000) spectrograph for the 1- to 5-micron infrared, has been scheduled at Gemini South in classical mode. Phoenix was built by NOAO and has been on long-term loan to Gemini since late 2001. Previous use of Phoenix on Gemini has been in queue mode, with both a Gemini staff astronomer and an NOAO astronomer present at the telescope. In classical mode, the principal investigator (PI) is now present at the telescope, with an NOAO astronomer to provide the initial instrument setup, checkout, and general assistance to the PI as needed. Classical observing runs are fairly uncommon at Gemini South and we report here on our first experiences.

The first classically scheduled block of Phoenix time occurred from 24 February to 3 March 2005, with four separate classical programs supported. Both telescope and instrument performed well and data were obtained on all four programs. Another novelty was that two programs shared time over two nights, with one using the first half and the other the second half. Hand-off of the telescope/instrument occurred midway between evening and morning

twilight, with no significant loss of time. Such scheduling allows more flexibility to proposers, as classical proposals must be for whole nights. Such time-sharing, however, must be coordinated via the NOAO Gemini Science Center (NGSC), with Verne Smith (vsmith@noao.edu) as point of contact. There is, of course, no guarantee that a suitable match will be found. Any desire to find a matching program with which to share nights should be communicated to NGSC before your proposal submission.

There are advantages to classical observing as opposed to queue. Visiting a large, advanced telescope is a useful experience. You will be able to adjust your program based on the data you see arriving at the telescope. Classical proposals are not grouped by rank into Bands 1 through 3; all Phoenix proposals granted time will now have equal access to the telescope. And of course, you can carry your data away following your run. Gemini will continue to archive Phoenix data, and a copy of your data will be sent to you following your run.

For 2005, Gemini observers are housed in the Cerro Tololo dorm as if they were CTIO observers. Every evening before sunset, the observers ride with the Gemini

Systems Support Associate (SSA) to Cerro Pachón. The drive over a winding dirt road takes about 30 minutes. There are spectacular views of Cerros Tololo and Pachón along the way and frequent sightings of Chilean wildlife, including a puma on one recent occasion. The evening ride is typically much more enjoyable than the return 30-minute drive at sunrise! There is a small dining room at Cerro Pachón, but do not expect other astronomers at dinner. Until SOAR becomes operational, the Gemini crew is the only scientific team working at Cerro Pachón. The four Phoenix observing teams so far were impressed with the telescope, the Gemini staff, and the high-quality data that were obtained under the superb delivered image quality that characterizes Gemini.

Future availability of Phoenix on Gemini South could well depend on user demand and paper production. If you have potential scientific projects for Phoenix on Gemini, we encourage you to apply. For all users of Gemini, including users of Phoenix, we strongly encourage rapid publication of scientific results in refereed journals.

Following the Aspen Process: Presentations and Reviews

Taft Armandroff & Ken Hinkle

An outcome of the June 2003 Gemini Aspen Instrumentation Workshop was a list of possible new instruments for the Gemini telescopes that would enable frontier science. Following review and prioritization by the Gemini Science Committee and the Gemini Board of Directors, a call for design study and feasibility study proposals was made

in December 2003. This call listed two instruments for competitive conceptual design studies and another two for noncompetitive feasibility studies. The instruments for the conceptual design studies were discussed in the September 2004 and December 2004 issues of the *NOAO-NSO Newsletter*: HRNIRS, a high-resolution, multi-object near-infrared spectrograph, and Extreme

AO Coronagraph (ExAOC), a high-contrast adaptive optics system and coronagraphic instrument designed to detect planets. Feasibility studies were undertaken on WFMOS, a wide-field multi-object optical spectrograph discussed in the March 2005 *NOAO-NSO Newsletter*, and GLAO, a ground-layer adaptive optics system.

continued



Following the Aspen Process continued

These conceptual design and feasibility studies have now been completed. HRNIRS studies were carried out by an NOAO/University of Florida team and a United Kingdom Astronomy Technology Centre/University of Hawaii team. Two teams, one led by the University of Arizona (including NOAO, the University of Hawaii, and Oxford University), and one led by the Lawrence Livermore National Laboratory, undertook ExAOC studies.

The WFMOS feasibility study was headed by the Anglo-Australian Observatory and included Johns Hopkins University, NOAO, several United Kingdom institutions, and the Canadian Astronomy Data Centre. The University of Arizona, University of Durham, and the Herzberg Institute of Astrophysics collaborated on the GLAO feasibility study. The deadlines for the design/feasibility reports were in February, with the reviews taking place in March. Each group submitted reports of multiple hundreds of pages. The reports included detailed science cases, flow-down from science to instrument requirements, systems engineering, optical design, mechanical design, electronics design, software design, management plan, schedule, and cost.

Gemini, under Associate Director for Instrumentation Doug Simons, formed committees to review the proposals. The review committees have now filed reports, and the instrument teams have responded to these. Gemini Observatory, its Board of Directors, and its other advisory committees will now take the results of these studies and the funding available to create an instrument plan that is responsive to the very exciting scientific opportunities.



The NOAO/University of Florida HRNIRS team outside the Gemini Headquarters building in Hilo, following the review of their conceptual design study.



The WFMOS team after their presentation to Gemini.



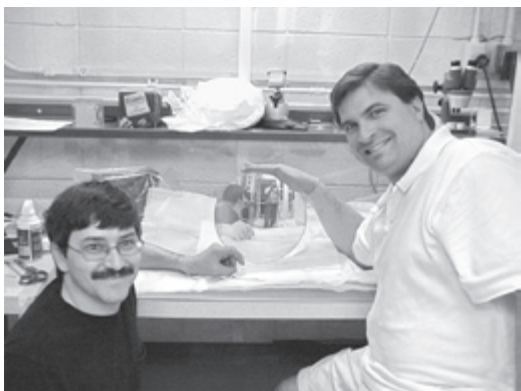
NGSC Instrumentation Program Update

Taft Armandroff & Mark Trueblood

The NGSC Instrumentation Program continues its mission to provide innovative and capable instrumentation for the Gemini telescopes in support of frontline science programs. This article gives a status update on Gemini instrumentation being developed in the United States, with progress since the March 2005 *NOAO-NSO Newsletter*.

FLAMINGOS-2

FLAMINGOS-2 is a near-infrared multi-object spectrograph and imager for the Gemini telescopes; it will be commissioned at Gemini North and used there for some period before being relocated to Gemini South. It will cover a 6.1-arcmin-diameter field at the standard Gemini $f/16$ focus in imaging mode, and will provide multi-object spectra over a 6.1×2 -arcmin field. It will also provide a multi-object spectroscopic capability for Gemini South's multiconjugate adaptive optics system. The University of Florida is building FLAMINGOS-2, under the leadership of Principal Investigator Steve Eikenberry.



The FLAMINGOS-2 calcium fluoride field lens is shown with Principal Investigator Steve Eikenberry and Instrument Scientist Nick Raines.

The FLAMINGOS-2 team is proceeding with the integration phase of the project. Additional FLAMINGOS-2 optics were received and tested. Notably, the large calcium fluoride element that serves as the FLAMINGOS-2 field lens was received and met all of its specifications. With that element, all optics for the imaging mode of FLAMINGOS-2 are in hand and meet or exceed specifications. Calculations based on the as-delivered performance of the optics indicate that the FLAMINGOS-2 throughput in imaging mode will significantly exceed the throughput that was originally predicted and adopted as a requirement. In addition, the University of Florida carried out the first cold and vacuum testing of the FLAMINGOS-2 main cryostat. During this testing, measurements of the temperature and temperature gradient were better than the instrument requirements.

As of mid-March, the University of Florida reports that 70 percent of the work to FLAMINGOS-2 final acceptance by Gemini has been completed.

NICI

The Near Infrared Coronagraphic Imager (NICI) will provide a 1- to 5-micron dual-beam coronagraphic imaging capability on the Gemini South telescope. Mauna Kea Infrared (MKIR) in Hilo is building NICI, under the leadership of Doug Toomey.

NICI is in the final assembly and testing phase of the project. Several modest changes were made to the NICI cryostat based on the results of earlier cold testing. The NICI optics were then installed in the NICI cryostat. Included in this installation were a beam splitter, a dichroic, the subset of NICI filters that are copies of those in the Near-Infrared Imager (NIRI), the pupil mask, and the spider mask. A detailed cold test of the integrated NICI system is planned for mid-May. Efforts continue to obtain a deformable mirror for NICI that meets the demanding specifications derived from the science requirements.

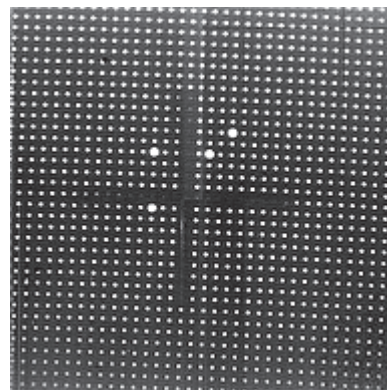


Image of a grid projected in the focal plane of one channel of NICI, with a MUX performing the imaging.

At the end of February, MKIR reported that 96 percent of the work to NICI final acceptance by Gemini had been completed. NICI is expected to be deployed on Gemini South in 2005B.