Gemini Update and Opportunities in Semester 2003A

Taft Armandroff

The US Gemini Program (USGP) strongly encourages the US community to take advantage of Gemini observing opportunities for semester 2003A. This is accomplished by applying through the standard NOAO Time Allocation Committee (TAC) process. A number of exciting new instrumental capabilities are expected to be offered, as described below. Also, more nights are planned to be used for scientific observations than in previous semesters. The US proposal deadline for 2003A is September 30. Please watch the USGP Web page *(www.noao.edu/usgp)* for the Call for Proposals for Gemini observing to establish the actual capabilities that one can request.

Gemini North

- The NIRI infrared imager/spectrometer will be offered in 2003A. The f/6 imaging mode (over a 2-arcmin field) and f/6 grism spectroscopy mode are expected to be the most popular configurations in 2003A (and until Altair is commissioned). NIRI underwent a major refurbishment to make the instrument more robust operationally that removed it from the telescope for most of July and August (see the following article by R. Blum).

- The GMOS optical spectrograph/imager will be offered in 2003A. Imaging, long-slit spectroscopy, multi-object spectroscopy, and integral-field unit (IFU) modes will all be available. Excellent progress has been made on commissioning the "nod-and-shuffle" mode, which greatly enhances sky subtraction, particularly at the red end of the spectrum. Consequently, it is anticipated that GMOS nod-and-shuffle mode will be offered in 2003A. It is also expected that a GMOS spectroscopy mode with the slit position angle set to the average parallactic angle for the exposure will be available in 2003A (see the following article by T. Lauer).

- Michelle is a mid-infrared (8–25 micron) imager and spectrograph for shared use between Gemini and UKIRT. Observing modes include direct imaging and long-slit spectroscopy with spectral resolutions of approximately 200, 1000, and 30,000. Michelle is in use at UKIRT and is expected to be delivered to Gemini Observatory in late 2002. After delivery, there will be a period of characterization and commissioning before Michelle will be available for scientific use. Michelle may be included in the 2003A Gemini Call for Proposals, with science availability anticipated toward the end of the semester.

- Based on Gemini Board action, the science fraction for Gemini North is expected to be between 50% and 55% in 2003A. Some of the activities for which nonscience time will be used include performing system verification for NIRI polarimetry, commissioning Michelle, commissioning and performing system verification on the Altair adaptive optics system, and commissioning new gratings and narrowband filters for GMOS.

Gemini South

- The Phoenix infrared high-resolution spectrograph will be offered in semester 2003A (see article below by K. Hinkle).

- The Acquisition Camera will be available for Quick Response in 2003A.

- It is expected that the T-ReCS mid-infrared instrument will be offered in 2003A. Although T-ReCS has both imaging and spectroscopic modes, only the imaging mode is expected to be fully commissioned and verified for this semester.

- The GMOS South optical spectrograph/imager may be offered at the end of semester 2003A. With GMOS South's arrival, optical spectroscopy with identical instrumentation will be available in both hemispheres. It is particularly important to check the Call for Proposals for up-to-date expectations of GMOS South's potential availability.

- Based on Gemini Board action, the science fraction for Gemini South is expected to be between 40% and 45% in 2003A. Some of the activities for which the nonscience time will be used include commissioning and performing system verification for GMOS South, recoating the primary mirror (M1), commissioning the T-ReCS spectroscopic mode, and commissioning the high-resolution optical spectrograph bHROS.

Further information on all of the above instrumental capabilities is available at *www.us-gemini.noao.edu/sciops/instruments/instrumentIndex.html*.

USGP was very pleased to see a strong community response to the Gemini Call for Proposals for semester 2002B. In total, 103 US proposals sought 181 nights on the two Gemini telescopes. The results of consideration of these proposals by the NOAO TACs and then the Gemini International TAC (ITAC) were announced in mid-June, with a total of 48 US programs being approved for the Gemini Queue in 2002B. A list of these programs and their PIs is available at *www.us-gemini.noao.edu/sciops/schedules/schedQueue2002B.html*.

continued

Gemini Update continued

The selected 2002B observers will define their observational programs in detail via the Gemini Phase II process. USGP staff will provide technical support to US PIs as they construct their Phase II programs. The Phase II process for semester 2002B is described at *www.us-gemini.noao.edu/sciops/OThelp/otSpecialInstructions2002B.html*.

Scientific papers based on Gemini observations continue to appear; a list of papers is available at *www.us-gemini.noao.edu/science/publications/users.html*. These papers demonstrate how others have exploited the capabilities of the Gemini telescopes and instruments, and are likely to be of use to potential proposers.

Changes in Gemini Partner Share

Wayne Van Citters (National Science Foundation) & Taft Armandroff (USGP)

Chile is a partner in the Gemini Observatory and has had control of 4.76% of the observing time, in addition to the time that it receives as host country for Gemini South. Chile is undergoing a change in status as a Gemini partner. In order to better fund astronomy data analysis, interpretation, and related research within the Chilean astronomical community, as well as to establish a fund to invest in the development of astronomy within the country, Chile wishes to retain only its share of Gemini telescope time that it receives as host. Chile will remain a Gemini partner.

The Gemini Board has settled on the shares of the Chilean subscription of Gemini time. The Chilean fraction will be divided as follows: US 47%, Australia 33%, Canada 15%, and Brazil/Argentina 5%. We believe that this represents an excellent outcome, firmly establishing US and Australian interest, getting Canada back to their fraction before Australia joined Gemini, and solidifying the South American position. The National Science Foundation will fund this expansion in US Gemini share from 47.62% to 49.86%. The AURA Observatory Council and the US Gemini Science Advisory Committee discussed and endorsed this increase in US Gemini share. Given the high oversubscription currently seen for the US Gemini time, these additional nights will allow additional high-priority science projects to be carried out by the US astronomical community.

GMOS Science Operations

Tod Lauer

The Gemini Multiple Object Spectrograph (GMOS) has just completed its first full semester of science operations. While poor weather and other demands on the Gemini North telescope reduced the number of programs that could be completed, enough data have been obtained to give a good look at the instrument's performance. Overall, the instrument performance is well modeled by the GMOS exposure time calculator (see *www.us-gemini.noao.edu/sciops/instruments/gmos/gmosIndex.html* for complete information on GMOS), and the IRAF GMOS package works successfully to produce calibrated one-dimensional spectra from the spectroscopic multi-slit images.

Figure 1 shows an example of a GMOS multi-slit image. This image and figures 2–4 show spectra of galaxies in the rich cluster A851 (z = 0.407) obtained by Inger Jorgensen (Gemini Observatory) as part of her program to investigate galaxy evolution out to half the age of the Universe. The image shown represents 2.5 hours of integration time; the spectra cover roughly 3000 Å, with roughly 0.46 Å/pixel. Note that the spectra extend across the three 4608 × 2048 GMOS CCDs. Final reduced spectra of four representative galaxies, with 5.5 to 11.5 hours of total exposure, are shown in figure 2. To give some feeling for the quality of sky subtraction, figure 3 shows the Hβ + OIII region of A851-2365 before and after sky subtraction, and figure 4 shows the Ca II H+K lines region

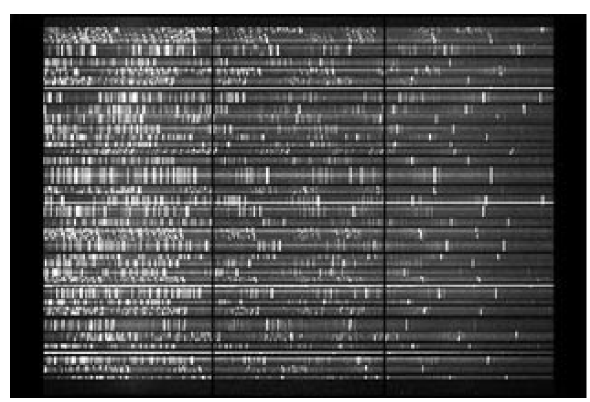

Figure 1. Sample GMOS multi-slit image of galaxies in rich cluster A851 (z = 0.407).

continued

GMOS Science continued

of A851-2559. Although the doublet in the latter galaxy is bisected by the strong 5577 Å [O I] night sky line, the H+K lines themselves are well observed in the reduced spectrum. For observers interested in getting a feel for GMOS observations in advance of obtaining their own data, the Gemini Observatory offers some publically available examples of GMOS data sets at *www.gemini.edu/sciops/data/dataSVGMOS.html*.

Figures 5a, 5b, and 6 show how well GMOS performs on cosmologically distant and faint objects. Figure 5a shows an R-band image from the NOAO Deep Wide-Field Survey, while figure 5b shows the same field observed in a narrow band filter with the KPNO 4-meter telescope as part of the Large-Area Lyman-Alpha survey (PIs James E. Rhoads and Sangeeta Malhotra, STScI). The central object in figure 5b is a candidate Ly-α emitting object at roughly z = 4.5; its R magnitude is 26.2. Figure 6 shows a preliminary reduction of the flux-calibrated spectrum.

The Gemini Observatory is presently investigating the "nod-and-shuffle" mode of observing, to improve both the quality of the sky subtractions and the density of multi-slits. An initial attempt to use the nod-and-shuffle mode was conducted in July. Despite poor weather conditions, good progress was made. Both the instrument and the telescope are capable of performing the functions needed for this mode. Sky-subtraction uncertainties of 0.1% in the wavelength region 6000-9500 Å were obtained, even on the cloudy sky. The overheads from the telescope nodding are currently large and work is underway to improve this situation. The plan is to offer GMOS North in nod-and-shuffle mode to the community in semester 2003A, though the user should check the final Call for Proposals before planning to use this mode.

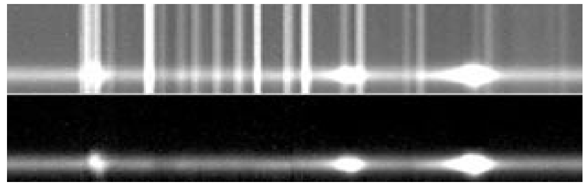

Figure 3. Hβ+OIII region of A851-2365 before and after sky subtraction.

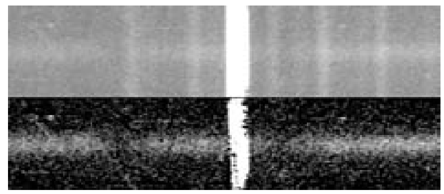

Figure 4. Ca II H+K lines region of A851-2559.

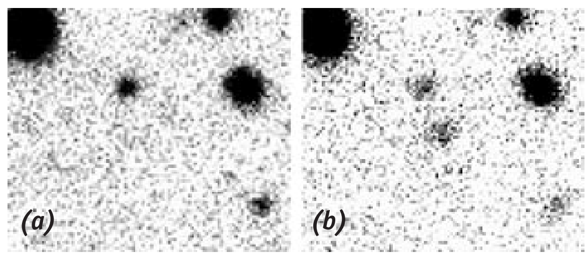

Figure 5. R-band image from NOAO Deep Wide-Field Survey (a) and same field from Large-Area Lyman-Alpha Survey (b).

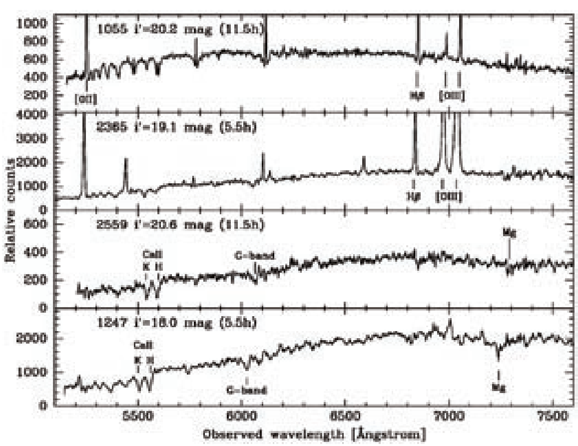

Figure 2. Final reduced spectra of four representative galaxies.

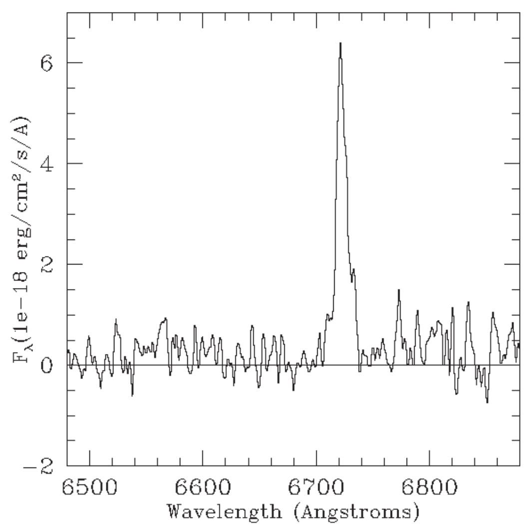

Figure 6. Preliminary reduction of flux-calibrated spectrum.

Credits: Data in Figures 1–4, courtesy of Inger Jorgensen (Gemini Observatory); Figure 5a, courtesy of the NOAO Deep Wide-Field Survey; and Figure 5b and 6, courtesy of Rhoads and Malhotra(STScI).

NIRI, a Visitor's Perspective, 2002A

Robert Blum

I had the good fortune to travel to Mauna Kea in April to see and work firsthand with the Gemini North Near-InfraRed Imager (NIRI). A facility-class instrument built by the University of Hawaii, NIRI also has spectroscopic capability through the use of grisms.

The bottom line is that NIRI is now working well and should soon become very productive. Parts of all Band 1 programs were executed in 2002A, and the data for each are currently in quality assessment. More than one half of the Band 2 proposals had some data taken, and several Band 3 proposals were also observed. Currently, NIRI is off the telescope and in the lab for maintenance and for installation of a Shack-Hartmann prism in the onboard wavefront sensor (to provide focus capability).

I arrived in Hawaii on April 25 and went to the summit the next day with Tom Geballe, one of the senior astronomers at Gemini Observatory. Tom gave me the quick rundown on NIRI operations and, together with staff at the Hilo base facility, we outlined the night's queue (Q) observing plan. In practice, the bulk of the Q planning is done in advance by Gemini staff (in this case Joe Jensen) by producing a matrix of possible observations set by scientific priorities and possible observing conditions. As the next two nights unfolded, I learned more about the Q, its pitfalls, and its promise.

Designed to maximize scientific return, the Q is based on the idea that a range of programs are executed depending on the current observing conditions. This requires that the telescope and staff be able to change observing modes quickly. For Gemini and NIRI, this is no problem. The instrument can be reconfigured in a matter of minutes and the experienced staff can adapt just as fast. The real challenge is assessing the current conditions, predicting how long they will last (or when they will improve or deteriorate), and choosing the right observing program.

Let's face it, anyone can write a proposal asking for the best observing conditions Mauna Kea has to offer. For modest amounts of time, the chances of eventually getting the perfect conditions during the semester when your object is up are good. But the more time you need, the more likely it is that part of your program won't get observed if it requires the best conditions. The sage observer, then, should always be looking for ways to accomplish her/his science with the WORST-possible "acceptable" conditions. Do you really need photometric weather for your JHK spectra? Could you live with worse seeing and a few less targets? Of course, if you absolutely require photometric weather and 0.3-arcsec seeing for a challenging bit of science, ask for it! The whole point of the Q is giving the very best conditions to the few programs that truly need it.

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A related point is that the proposer should not assume the Gemini staff will "modify" a program on the fly, even if it makes sense based on the staff's understanding of the scientific requirements. The staff make every effort to review programs before they reach the Q, but the ultimate responsibility lies with the proposer. In the end, the observing staff is charged with giving proposers from each partner country what they request. Do not ask for better conditions than your proposal requires, or it may be indefinitely postponed due to prevailing observing conditions.

As our Q run unfolded, the weather deteriorated to the point of a spring snowstorm, but not before we had one marginal weather night and one really good one. The latter was said to be the best NIRI science night up until that time. We observed all night without a hitch in f/6 imaging and grism spectroscopy mode. Until Altair arrives, these will be the dominant modes on NIRI. The spectroscopic mode proved to be quite routine, even accounting for the extra overheads of centering objects precisely on the 0.23-arcsec slit.

Recent improvements in the Gemini observing tool (OT) interface to the instrument/TCS helped to provide rapid acquisition of K = 13 magnitude targets in crowded fields. The user interface is now quite manageable, to the point where most experienced infrared observers would have little difficulty using it with some initial guidance from the Gemini staff. This type of increased efficiency should eventually lead to lowering of the nominal observing overheads (at least for standard observations) charged during the proposal process. In the meantime, don't forget to add the overheads to your observation planning!

The Gemini OT is now capable of completely configuring NIRI, including different array readout modes and blocking filters for grism mode. Proposers should make sure to properly set these parameters for their

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NIRI continued

Phase II proposals. Remember that the OT is a powerful tool for planning all aspects of your observations. If you have questions about how to use the Phase II OT, don't hesitate to contact the USGP staff through the HelpDesk for assistance in getting the most from your planned observations.

Will Q observing come to dominate the ground-based astronomy scene? I think the jury is still out on just how much a strong Q program can improve the total scientific throughput of an observatory. However, I do know that if the Q is going to succeed, it will need a strong interaction between the observing community and the observatory staffs that are serving them. Be careful with what you ask for, you may get it. Or, more to the point, you may NOT get it.

All the latest NIRI news can be found on the Gemini Web pages at *www.us-gemini.noao.edu/sciops/instruments/niri/NIRIIndex.html*. Thanks to Joe Jensen of Gemini Observatory for providing me with current NIRI status reports prior to posting them on the Web. Thanks also to Michael Merrill of NOAO for contributing to this article.

NIRI BASICS

Detector: 1024 × 1024 Aladdin array (InSb) 1–5 micron sensitivity

Cameras (3):
- f/6 0.117 arcsec/pixel, 120 × 120 arcsec FOV
- f/14 0.050 arcsec/pixel, 51 × 51 arcsec FOV
- f/32 for use with Altair

Filters: standard near-IR broadband and 13+ narrowband

Grism Spectroscopy Mode: f/6 camera, 50 arcsec slit, resolution 500 to 1700

Polarimetry: check for availability

Imaging S/N: ~5 in 1 hour at K = 22.3, H = 22.7, J = 23.6

For further details and the latest news and system availability see *www.us-gemini.noao.edu/sciops/instruments/niri/NIRIIndex.html*.

Phoenix Queue Update

Ken Hinkle

Phoenix had two scheduled runs in 2002A. The first, 15 nights starting in early February, was largely devoted to the DemoScience* project, although some queue observations were executed each night. The second run was 10 nights of queue in early May. An additional run of 7 nights was added in June, which is well into the winter season in Chile. This Phoenix run coincided with a major winter storm that required the evacuation of both Cerro Tololo and Cerro Pachón. Thus, few data were collected.

A summary of the 2002A semester results for Phoenix may prove insightful in what data yield to expect from your 2003A proposal. All four of the Band 1 Phoenix proposals received some data. One Band 1 proposal was completed. In Band 2, three out of four received some data. The one Band 3 proposal received no data. For Band 4, two of the six proposals received some data. Unfinished proposals are NOT extended into the next semester.

For semester 2002B, 21 Phoenix proposals were submitted by the US community. After evaluation and merging with the proposals of other partner countries, the Time Allocation Committee (TAC) assigned two Phoenix proposals to Band 1, two to Band 2, two to Band 3, and eight to Band 4. The assigned Phoenix run dates are as follows: 5 nights in September, 15 nights in late November through early December, and 10 nights in mid-January. There are some operational differences from the 2002A semester. In particular, PIs must now undertake the Phase II planning themselves, with assistance from USGP

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Phoenix Queue Update continued

instrument scientists via the HelpDesk. Phase II planning was previously done by the Gemini South scientific staff.

As of this writing, the formal Call for Proposals has not been released for 2003A. However, it seems likely that Phoenix will be offered the entire 2003A semester. Long-term plans call for Phoenix to be shared 50/50 with SOAR, but the earliest this will start is 2003B. In preparing a Phoenix proposal, consult the Gemini Web pages for the overhead associated with changing objects and wavelengths. The RA limits given in these Web pages will be strictly enforced. Also, please state clearly the basis of signal-to-noise (S/N) estimates (e.g., "S/N was calculated from the exposure time calculator assuming K =12 , 0.5-arcsec seeing, and averaging over the 4-pixel-wide slit").

*The DemoScience data from "Determining the O/Fe ratio in the Large Magellanic Cloud" are now available at *www.gemini.edu/sciops/data/dataSVPhoenix.html* (links to Science Data and Calibration Data appear in yellow bar in middle of table).

US Gemini Instrumentation Program Update

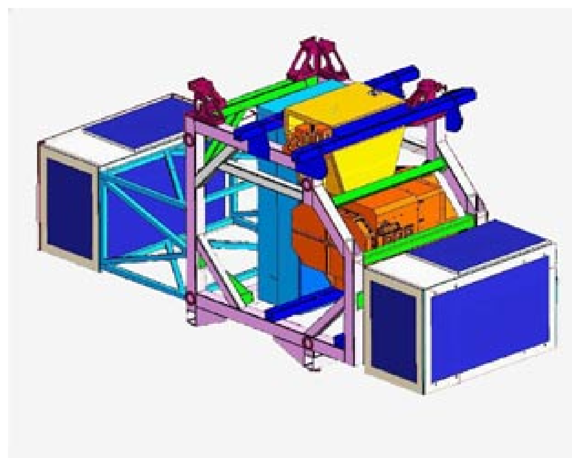
Taft Armandroff & Mark Trueblood

The US Gemini Instrumentation Program's mission is to provide highly capable instrumentation for the Gemini telescopes in support of frontline science. This article gives an update on Gemini instrumentation being developed in the US, with status as of mid-July.

NICI

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

The NICI Critical Design Review (CDR) took place in Hilo on 24–25 June 2002. Participating in the review were CDR Committee members Chick Woodward (Chair, University of Minnesota), Ben Oppenheimer (American Museum of Natural History), Don Hicks (former CEO of Ball Aerospace), Derrick Salmon (Canada France Hawaii Telescope), Bret Goodrich (NSO), Ed Hileman (NOAO GNIRS), and Manuel Lazo (Gemini South). NICI passed its CDR; and USGP, Gemini, and MKIR received valuable guidance from the CDR Committee Report. MKIR has been authorized to proceed with the fabrication, testing, and delivery of the instrument. NICI delivery to Gemini South is planned for December 2004.



Rendering of the complete NICI instrument, as it will be mounted on Gemini South. The boxes at either end of the assembly are the cooled electronics cabinets. The squat box in the center is the NICI dewar, and the tall rectilinear shape to the left represents the warm adaptive optics system.

GSAOI

The Gemini South Adaptive Optics Imager (GSAOI) will be used with the multi-conjugate adaptive optics (MCAO) system being built for the Gemini South telescope. The imager will cover wavelengths between 1 and 2.5 microns, and will be based on a 4K × 4K HgCdTe detector mosaic. GSAOI's imaging area will cover the well-corrected field of view of the MCAO system (about 80 × 80 arcsec) with a pixel scale matched to diffraction-limited images. NOAO was selected as one of two teams to develop a conceptual design for GSAOI. Jay Elias and Bob Blum lead the NOAO GSAOI Team scientifically; Neil Gaughan serves as Project Manager. Technical personnel from Tucson and La Serena are participating in the GSAOI effort. The NOAO GSAOI Team has developed a robust design for GSAOI, and a management plan and cost estimate are nearing completion. The study results are being documented as a report for Gemini. The NOAO Team was scheduled to present their GSAOI results to the Gemini Source Selection Board on August 21 in Hilo.

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Gemini Instrumentation continued

GNIRS

The Gemini Near-InfraRed Spectrograph (GNIRS) is a long-slit spectrograph for the Gemini South telescope that will operate from 1 to 5 microns and will offer two plate scales, a range of dispersions, and an integral-field unit (IFU). The project is being carried out at NOAO Tucson under the leadership of Jay Elias (Project Scientist) and Neil Gaughan (Project Manager).

Cold mechanism testing continues. Previous testing of the most demanding mechanism (the slit/IFU slide) revealed a need for enhanced bearing performance. Consequently, a program of testing new bearings was initiated; molybdenum disulfide-coated bearings were found to meet the demanding requirements; these improved bearings are being installed in the GNIRS mechanisms. An important fit check of the GNIRS optical benches into the dewar, with the radiation shields in place, was performed (see figure 1). Also, the dewar vacuum checks were successfully completed. The first cooldown of the assembled instrument was expected to take place in August. After that, two-axis flexure tests will be performed on GNIRS using the NOAO Flexure Test Facility (see figure 2). Overall, 92% of the work to GNIRS delivery has been completed. Finally, the GNIRS Team won the Grand Prize for Modeling in the 2002 SolidWorks SolidGallery Design Contest (see *www.solidworks.com/swdocs/gallery/contest2002/winners.cfm*).

Figure 1. The GNIRS optical bench is lowered into the dewar shell as a fit check, with guidance from GNIRS Project Support Scientist Dick Joyce.

Figure 2. The newly installed NOAO Flexure Test Facility will be used to test GNIRS for flexure. GNIRS mechanical engineers Ed Hileman (left) and Gary Muller are shown fit testing the GNIRS ISS interface assembly.

T-ReCS

T-ReCS, the Thermal Region Camera and Spectrograph, is a mid-infrared imager and spectrograph for the Gemini South telescope, under construction at the University of Florida by Charlie Telesco and his team.

The team continues tests and resulting adjustments of the assembled and functional instrument. Particular attention is being paid to background flux measurements (to rule out light leaks), detector noise, and other detector performance tests and enhancements to insure that T-ReCS meets its performance specifications. This will allow USGP, Gemini, and Florida to carry out the Pre-Ship Acceptance Test of T-ReCS.

See ***www.noao.edu/usgp*** for constantly updated information about the US Gemini Program.