

NOAOGEMINI SCIENCE CENTER

TUCSON, ARIZONA • LASERENA, CHILE

Gemini Update

Taft Armandroff

For the Gemini partnership, 2003 continues to be exciting and productive. Several new instruments are being successfully commissioned at Gemini. These new instrument capabilities are providing frontier scientific opportunities for astronomers in the Gemini partner communities.

At Gemini South, the T-ReCS mid-infrared imager and spectrometer represents one of the new opportunities. As of late October, the T-ReCS system verification observations have been obtained. This paves the way for TAC-approved science observing to begin. T-ReCS has performed very well, and the T-ReCS diffraction-limited images are spectacular (see www.us-gemini.noao.edu/sciops/instruments/miri/T-ReCS-news-2003sep16.html). In addition, the Gemini South telescope is exhibiting very low emissivity, which enables excellent mid-infrared performance.

Also at Gemini South, GMOS-South is seeing much use in its multi-object spectroscopy,

long-slit spectroscopy, and imaging modes. The delivery of GMOS-South's integral field unit (IFU), a copy of that on GMOS-North), is expected before the end of 2003. Once installed, Gemini users will have whole-sky access for optical IFU spectroscopy. The GMOS-South IFU is being implemented in such a way as to permit GMOS's popular nod-and-shuffle mode to be used with it.

On Gemini North, commissioning of the Altair adaptive optics system, in its natural guide star mode, with the Near-Infrared Imager (NIRI) has gone very well. System verification observations with the Altair and NIRI combination are expected to begin soon. In semester 2004A, Altair plus NIRI will be used for TAC-approved scientific programs. Also at Gemini North, system verification of the Michelle mid-infrared instrument's imaging mode is expected to begin shortly.

The NOAO Gemini Science Center (NGSC) saw a strong response from the US community to the Gemini Call for Proposals

for semester 2004A. On Gemini North for 2004A, 77 proposals were received: 50 for GMOS-North and 29 for NIRI; 10 of the NIRI proposals requested its use with the Altair adaptive optics system. Fifty-nine US proposals requested Gemini South: 25 for T-ReCS, 23 for Phoenix, and 12 for GMOS-South. In total, 133 US Gemini proposals sought 301 nights on the two Gemini telescopes.

As the new instruments come on line, and as additional US community members gain experience with Gemini data, we expect the uses of various capabilities by our community to evolve. We enthusiastically encourage US astronomers to explore the relevance of the new instruments on Gemini to their scientific interests. Available resources include the Gemini and NGSC Web pages (www.us-gemini.noao.edu), questions via the Gemini HelpDesk (www.us-gemini.noao.edu/sciops/helpdesk/helpdeskIndex.html), and the NGSC contact scientist for each Gemini capability (www.noao.edu/usgp/noaosupport.html).

GNIRS Coming Soon

Jay Elias, Dick Joyce & Ken Hinkle

As discussed below in the article on the NGSC instrumentation program, the Gemini Near-Infrared Spectrograph (GNIRS) passed pre-ship acceptance tests in Tucson and arrived in Chile on October 27. GNIRS is scheduled to be installed on the Gemini South telescope in December, with first light expected in January 2004. Commissioning of its major observing modes is expected to commence in January.

GNIRS is a complex instrument with four cameras, cross-dispersed or long-slit options, three gratings, and a spectropolarimetry mode, so extensive commissioning is envisaged. An infrared (IR) on-instrument wavefront sensor is included in GNIRS. The only feature of GNIRS that is not yet functional is the integral field unit, which

is being constructed by the University of Durham and has not yet been delivered. The spectropolarimetry option requires the Gemini Polarimeter (GPOL-S), which has yet to be commissioned, so this mode will also be delayed.

GNIRS will offer resolutions of ~1700, 5500, and 18000. A principal goal of GNIRS is sensitive point source spectroscopy, and for point sources, cross-dispersion is possible. When cross-dispersed at $R = 1700$, the entire spectrum from 0.9 to 2.4 microns can be observed. At higher resolution, cross-dispersion can also be used, but coverage is limited by the 1024-pixel size of the detector to segments of the spectrum. The highest resolution mode, $R = 18000$, comes with the caveat that a very narrow (0.1 arcsec) slit is required, which is not

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GNIRS Coming Soon continued

well matched to the typical delivered image quality (DIQ). At $R = 1700$, a 5-sigma detection should be possible in one hour at $J = 21$ and $K = 19$. GNIRS does work into the thermal IR as far as 5.1 microns. Thermal IR performance is, of course, limited by thermal background, and limiting magnitudes of about $L = 14$ and $M = 11$ are expected.

The large cross-dispersed wavelength coverage of GNIRS at $R = 1700$ and the faint magnitude limits, especially when combined with the excellent DIQ of Gemini South,

suggest a number of scientific applications, including spectral classification of sub-stellar objects, spectroscopy of the most highly embedded stars, determinations of initial mass functions for very young clusters, abundance determinations for extragalactic stars, and spectroscopy of galactic nuclei. NGSC expects that there will be opportunities for GNIRS system verification projects in the next six months. Prospective users wishing to submit proposals to the Time Allocation Committee (TAC) should watch for announcements of GNIRS availability in future calls for proposals.

Michelle Update

Ken Hinkle

Michelle, a mid-infrared imager and spectrograph, is anticipated to make a significant contribution to NASA's Space Infrared Telescope Facility (SIRTF) follow-up science. Efforts to deploy Michelle as a facility instrument at Gemini North are continuing. Readers may be familiar with Michelle as a United Kingdom Infra-Red Telescope (UKIRT) facility instrument. With the move to Gemini, both the very low emissivity and 8-meter aperture will significantly enhance the performance of Michelle.

Conversion of Michelle for use on Gemini has proven more difficult than earlier envisaged due to both technical and scheduling hurdles. Gemini was working toward permanent deployment of Michelle at Gemini North when the UK Particle Physics and Astronomy Research Council (PPARC), the oversight organization for UKIRT, requested that Michelle be returned to UKIRT in 2004A. Sharing of Michelle between the sites is a term of the loan agreement with PPARC. At this time, NGSC believes that Michelle will only be required for a few months at UKIRT. Potential Gemini Michelle users should look for a discussion of Michelle availability in the 2004B Call for Proposals. In the current (2003B) semester, commissioning of the Michelle imaging modes has been undertaken and queue science observations have begun.

Due to the complexity of Michelle, its conversion for cutting-edge research at Gemini is challenging.

Optical work carried out thus far includes realigning the pupil and removing vignetting at the detector. A problem that has been identified but not yet addressed is detector thermal control. The detector temperature is currently too warm and the temperature stability not sufficient to minimize detector noise when Michelle is used for spectroscopic applications. Gemini has developed plans



Michelle mounted on the up-looking port of Gemini North.

to work on the thermal problems from multiple fronts. The current broadband N filter saturates in imaging mode. A new, slightly less broad N filter has been ordered. The interim N band observations employ a tandem neutral density filter. Gemini has also reviewed the efficiency of Michelle operations, and a number of software changes are planned to significantly reduce overheads.



NGSC at the January 2004 AAS Meeting

The NOAO Gemini Science Center will have a booth at the January AAS meeting in Atlanta. The NGSC presence will include information on how to propose for Gemini observing opportunities, brochures on Gemini instrument capabilities, and tutorials on the Gemini Phase II Observing Tool.

Please stop by and see us!

NGSC Instrumentation Program Update

Taft Armandroff & Mark Trueblood

The NGSC Instrumentation Program continues its efforts 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 September 2003 *NOAO/NSO Newsletter*.

GNIRS

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

GNIRS pre-shipment acceptance testing took place in August and October. A team of Gemini scientists and engineers traveled to Tucson to carry out the testing, with GNIRS operating on the NOAO Flexure Test Facility. The Gemini Team carried out a comprehensive battery of tests, including image quality, mechanical and optical stability as the instrument orientation changes, thermal stability, detector performance, space envelope compliance, and software interface compliance. On October 15, the Gemini Team determined that GNIRS had met all of the stringent pre-shipment requirements. GNIRS was then carefully disassembled and packed. On October 24, the shipment of GNIRS from Tucson to Gemini South took place. GNIRS arrived at Cerro Pachón on October 27. It next will be



GNIRS is lowered into its crate for shipment to Gemini South under the control of Ron George and the steady hand of Dick Joyce.

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NGSC Instrumentation continued

reassembled, cooled, and fully integrated with the Gemini South control systems and hardware interfaces. GNIRS will then undergo final acceptance testing, which will include on-sky observations. Several NOAO staff members will spend significant time at Gemini South assisting with GNIRS reassembly, integration, acceptance testing, and commissioning. We anticipate that GNIRS will have advanced sufficiently in its testing and commissioning activities to be included in the Gemini 2004B Call for Proposals.

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.

The NICI vacuum jacket parts have been received and assembled, and the first vacuum test is expected soon. The NICI mechanisms have also been received and assembled. MKIR received the Gemini-provided, cooled electronics cabinets and is in the process of finalizing the cable lengths. Overall, 70 percent of the work to NICI final acceptance by Gemini, which is planned for December 2004, has been completed.

FLAMINGOS-2

FLAMINGOS-2 is a near-infrared multi-object spectrograph and imager for the Gemini South telescope. 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. FLAMINGOS-2 is being built by the University of Florida under the leadership of Richard Elston (Project Scientist), Steve Eikenberry (Co-Project Scientist), and Roger Julian (Project Manager).

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Crate of GNIRS electronics cabinets being removed from the NOAO Flexure Test Facility in preparation for shipment to Gemini South.



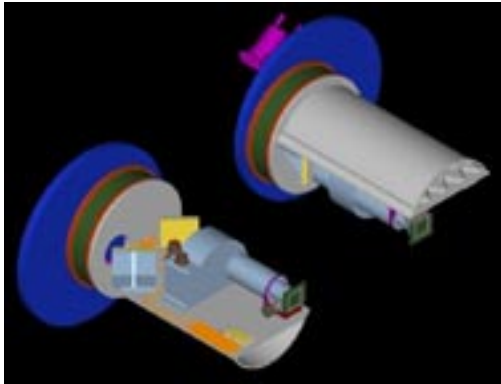
GNIRS leaving the NOAO facilities in Tucson for Chile.



GNIRS in the Gemini Cerro Pachón clean room.



NGSC Instrumentation continued



Solid modeling of the FLAMINGOS-2 camera dewar showing the optical bench, detector, and filter/grism wheel.

A Critical Design Review (CDR) for FLAMINGOS-2 took place on 20–21 August 2003 in Gainesville, FL. Participating in the review were CDR Committee members Darren DePoy (Chair, Ohio State University), Larry Ramsey (Pennsylvania State University), James Larkin (University of California at Los Angeles), Tom O'Brien (Ohio State University), Manuel Lazo (Gemini Observatory), and Kim Gillies (Gemini Observatory). FLAMINGOS-2 passed its CDR, except for software, which requires further refinement. The Florida team also finalized a contract for the FLAMINGOS-2 On-Instrument Wavefront Sensor (OIWFS). This important item will be provided by the Herzberg Institute of Astrophysics, which is basing the FLAMINGOS-2 OIWFS on the OIWFS that they developed for the two GMOS instruments.

NGSC Webcast

We are happy to report that the first NGSC Webcast for the US community was a success. The topic of the Webcast was the September 30 observing proposal deadline, in particular Gemini instrument capabilities for the 2004A semester. After the presentations, questions were entertained from the audience. The presentations are available in PDF format on the NGSC Web site at www.noao.edu/usgp/ngsc_webcast.html.

Please watch our Web site and the *NOAO/NSO Newsletter* for announcements of future Webcasts. Also, let us know (ngsc@noao.edu) if you have any suggestions or topics of interest you would like to see covered in future programs.



NGSC scientist Ken Hinkle and NGSC Director Taft Armandroff addressed the audience during the 17 September 2003 Webcast to the US community.