

USGP

U.S. GEMINI PROGRAM

Gemini Telescopes Update

Bob Schommer

The Gemini telescopes continue to progress significantly in engineering and science domains. Among the highlights are:

- The first Gemini science results, the Galactic Center Demonstration Science observations, are available on the Web at http://www.us-gemini.noao.edu/gallery/observing/release_doc/manual.html (see article on Page 3 and release details below).
- Chopping and guiding on Gemini North are now mostly fixed so that the 2000B QuickStart queue and Demonstration Science programs for OSCIR have been rescheduled for November.
- Gemini South remains ahead of schedule; first engineering light was achieved in September, and substantial progress has been made on

the Pachón coating chamber and the primary and secondary support systems. Pointing and system tests on the sky resumed in late October.

- The USGP has provided additional resources for the start of early science operations on Gemini North. Bob Blum participated in the Galactic Center Demonstration Science effort in July/August, and Patrice Bouchet is scheduled to be in Hilo and Mauna Kea for the OSCIR Demonstration Science program in November. Stefanie Wachter was at Gemini North in October to assist with the Hokupa'a/QUIRC QuickStart programs (Blum also participated in several QuickStart programs in August), and Bouchet will work with the IGO for the OSCIR QuickStart programs in November/December.

There has been considerable effort on the US instrument program, which is detailed in the accompanying article by Taft Armandroff and Mark Trueblood.

We have also been very actively involved in the planning of the MCAO workshop, which was held October 23–25 at CfAO. The Gemini MCAO system is described in the article on the next page and at the Gemini Web site (<http://www.gemini.edu/sciops/instruments/adaptiveOptics/AOIndex.html>). Steve Strom, Taft Armandroff, and Tod Lauer were members of the organizing committee and co-chairs of two of the discussion groups. We invited 15 prominent scientists from US institutions to participate in the science conference. Results of the workshop will appear in the next newsletter.

First Gemini Data Released

François Rigaut
International Gemini Observatory

The International Gemini Observatory announced the first release of Gemini Science Data from the Hokupa'a/QUIRC Demonstration Science program. In July and August 2000, 3.5 GigaBytes of data were obtained on the Galactic Center with the adaptive optics system Hokupa'a and the infrared camera QUIRC on the Gemini North Telescope. These data have been reduced and sixty images (250MB) are available on request. For information about the data set, see the Gemini Web site at http://www.us-gemini.noao.edu/gallery/observing/release_doc/manual.html. For any questions regarding the data set, or to get a copy on CD-ROM, please contact François Rigaut (frigaut@gemini.edu) at the International Gemini Observatory.



Proposed MCAO System for Gemini South

Bob Schommer

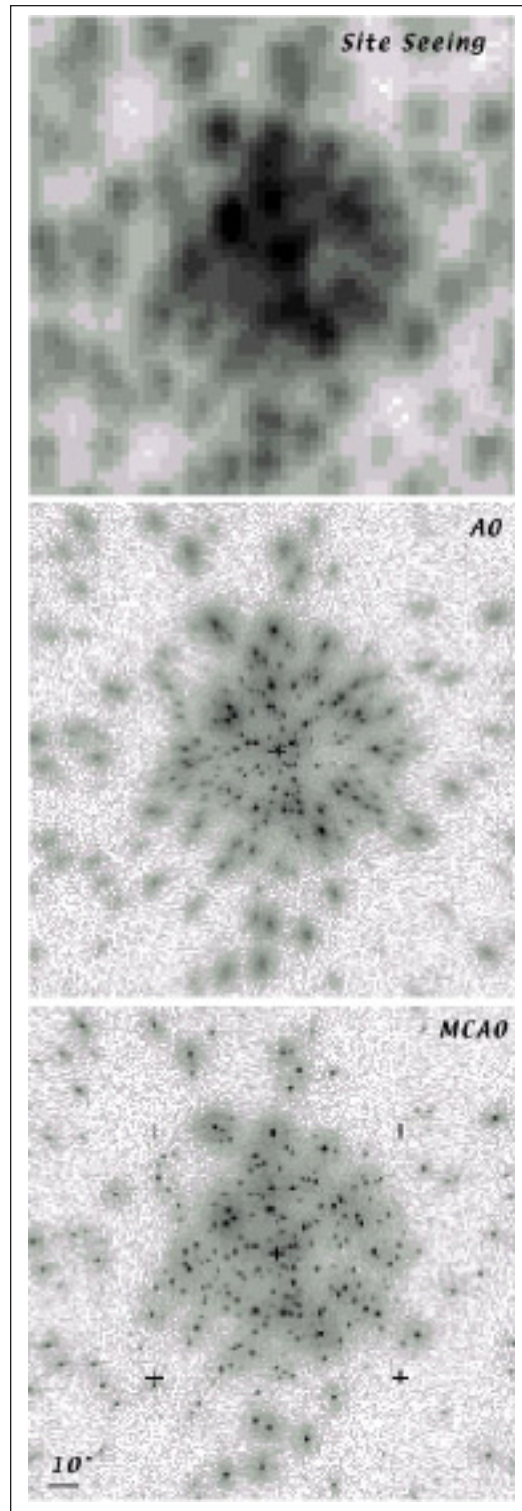
The Gemini Multi-Conjugate Adaptive Optics system (MCAO) is a facility proposed for Gemini South on Cerro Pachón. Its goal is to deliver diffraction-limited images, with a uniform image quality over a one arcminute field of view. It does so by using several deformable mirrors that are optically conjugated at different altitudes in the atmosphere and multiple wavefront sensors that use laser beacons as their guide sources. The intent is to measure and compensate for the turbulence-induced phase aberrations in three dimensions (“atmosphere tomography”).

This new technique not only increases the compensated field of view by an order of magnitude or more and provides a uniform point spread function over this field, but it also solves for the cone effect, a consequence of the use of laser guide stars. In a classical AO laser system, the cone effect reduces the performance at short wavelengths on large telescopes.

In addition to the 10-fold gain in angular resolution, MCAO potentially pushes the detection limit by 1.7 magnitudes on unresolved objects with respect to seeing-limited images. The figures to the right show the effectiveness of MCAO.

An MCAO Science Workshop was held on 23–25 October at the Center for Adaptive Optics in Santa Cruz, California. The goal of this workshop was to explore the scientific opportunities for MCAO, quantify its advantages over current and planned conventional AO systems for a comprehensive set of science cases, and derive the MCAO instrument requirements. We will report on the results of this workshop in the next newsletter.

Compared with classical adaptive optics, the Gemini Multi-Conjugate Adaptive Optics system would produce a ten-fold gain in angular resolution, with an order of magnitude wider field, and 1.7 magnitude deeper detection limit. The figure shows simulations of 320 stars in a 2.5' square field with 0.7" natural seeing (top panel), the effect of a natural guide star AO system with one deformable mirror and one wavefront sensor (middle), and the Gemini MCAO system with two deformable mirrors, five wavefront sensors, natural guide stars. Stars have been magnified for clarity. Simulation courtesy of International Gemini Observatory.





US Gemini Instrumentation Program Update

Taft Armandroff and Mark Trueblood

The US Gemini Instrumentation Program has seen much activity over the past several months. Instrument design and construction are underway both in-house at NOAO and in the wider community. This article gives a status update as of mid-October.

NIRI is a 1-5 μm imager with three pixel scales, designed and built by Klaus Hodapp and his team at the University of Hawaii. NIRI passed its Pre-Ship Acceptance Test in Honolulu in May. NIRI was then shipped to the Gemini North Base Facility in Hilo and set up in the instrument lab. A team of controller and detector experts from NOAO traveled to Hilo in June and successfully resolved problems with ringing in the NOAO-supplied NIRI array controller. NIRI was tested on Gemini North in August and September, and it imaged successfully. Delivery of the 1 frame per second upgrade to the NIRI controller by NOAO is planned for later this fall. On-telescope final acceptance testing of NIRI is also planned for later this fall.

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 majority of the T-ReCS optics have been received and inspected. The instrument's 320 \times 240 Si:As IBC array detector has also been received. Mechanical parts fabrication is nearing completion; mechanical

assembly, the electronics, and software development are well along. In particular, the dewar and the cold mechanisms are nearly complete. The mechanisms have been assembled and cold tested. The dewar has been vacuum tested and is undergoing its first cold test as of mid-October.

GNIRS, the Gemini Near-Infrared Spectrograph, is a long-slit spectrograph for the Gemini North telescope that will operate from 1 to 5 μm and will offer two plate scales and a range of dispersions. The project is being carried out at NOAO in Tucson under the leadership of Neil Gaughan (Project Manager) and Jay Elias (Project Scientist). GNIRS held a Pre-Fabrication Review on May 11 and 12. The review committee examined the GNIRS team's progress on mechanical design, mechanical analysis, thermal analysis, software design, and prototyping efforts in the areas of cold motors, mechanism drives, and lens mounts. The review committee delivered a positive report. The project is now completing the detailed design while initiating fabrication of those sub-assemblies for which design is complete. A major milestone was the initiation of fabrication of the optical benches in September. The critical optics have all been ordered, and somewhat over one-third have been delivered and accepted.

Phoenix is a high-resolution near-infrared spectrometer that has been in productive scientific use on the KPNO 4-m and 2.1-m telescopes.



The T-ReCS dewar and cryocooler during its first cold test at the Department of Astronomy, University of Florida. The T-ReCS mechanical engineer, Jeff Julian, provides a perspective of scale.

Phoenix yields spectra with resolution up to $R=70,000$ in the wavelength range 1 to 5 μm . Phoenix will be shared equally between Gemini South and CTIO/SOAR. An agreement has been signed between NOAO/USGP and IGP regarding the modification of Phoenix for Gemini and how the instrument will be supported. Phoenix will be offered as a Visitor Instrument on Gemini South, beginning with the inception of scientific use of Gemini South. An IGP-provided ALADDIN InSb array will be installed in Phoenix; the performance of this array is expected to yield a significant improvement in Phoenix's sensitivity. The mechanical design of the frame that will couple Phoenix to the Gemini Instrument Support Structure is underway.

continued



Gemini Instrumentation continued

FLAMINGOS 2 is a concept for a near-infrared multi-object imaging spectrograph for the Gemini South telescope, developed by Richard Elston and his team at the University of Florida. The FLAMINGOS 2 concept builds on the heritage of the original FLAMINGOS imaging spectrograph. (The original FLAMINGOS will be offered as a visitor instrument on Gemini.) FLAMINGOS 2 has been developed in response to the

“Gap Filler” opportunity for Gemini South, wherein the relatively rapid deployment of a near-infrared spectroscopy and imaging capability was sought. A conceptual design review of FLAMINGOS 2 was held on April 28. The Gemini review committee judged FLAMINGOS 2 to be suitable for Gemini’s needs and aspirations. IGP, USGP, and Florida have begun the process of contracting for the detailed design and fabrication of FLAMINGOS 2.

Gemini Proposals for 2001A

Caty Pilachowski

NOAO received 77 proposals for time on the Gemini North telescope for the 2001A semester. These 77 proposals requested a total of 122 nights. Since only 34 nights are expected to be available for allocation to US programs, this represents an over-subscription factor of 3.6. The shortest request is for an hour of time, while the longest requests ask for four nights. The average amount of time requested is 1.6 nights.

The proposals were well balanced among the three instruments: 21 requests for Hokupa’a, 28 requests for NIRI, and 31 requests for OSCIR. Ten investigators took advantage of the US “mini-queue” opportunity for observations with Hokupa’a and OSCIR for programs needing a half night or less. Mini-queue observations will be taken by USGP and NOAO staff.

Investigators can expect to hear from us in mid-December about the outcome of their proposals, after the International Gemini TAC meets and the telescope schedule is finalized.

GMOS Coming for 2001B

The first Gemini Multi-Object Spectrograph (GMOS) should be available for proposals for the 2001B semester. Delivery is expected in a few months. GMOS provides optical spectroscopy and imaging over a 5.5 arcmin field of view. The GMOS will also be equipped with an Integral Field Unit (IFU), making it possible to obtain spectra simultaneously of an area of about 50 square arcsec with a sampling of 0.2 arcsec. The GMOSs are under construction as a collaboration between the UK and Canada.

How to Contact the US Gemini Program

The Web	http://www.noao.edu/usgp
Questions	gemini@noao.edu
E-mail a Staff Member	first_initial+last_name@noao.edu

NOAO Workshop on Hokupa’a Image Analysis and Data Reduction

Tod R. Lauer

NOAO will be hosting a workshop on Hokupa’a image analysis and data reduction February 26–27, 2001, at NOAO–Tucson headquarters. The emphasis will be strongly oriented toward understanding what is required to produce leading-edge science returns from successful observations. Investigators with Hokupa’a data or observational experience are especially encouraged to attend. We also invite those with experience on similar instruments or who are interested in the general problems of Adaptive Optics image analysis. We do hope to keep the workshop small and informal enough, however, such that detailed discussions as well as more formal presentations can occur.

As information about the workshop becomes available, it will be posted on the Web at http://www.noao.edu/usgp/lao_workshop.html.

At this time we would enjoy hearing if you are interested in attending and if you would like to give any sort of talk or presentation at the workshop. Please contact Tod Lauer (tlauer@noao.edu).