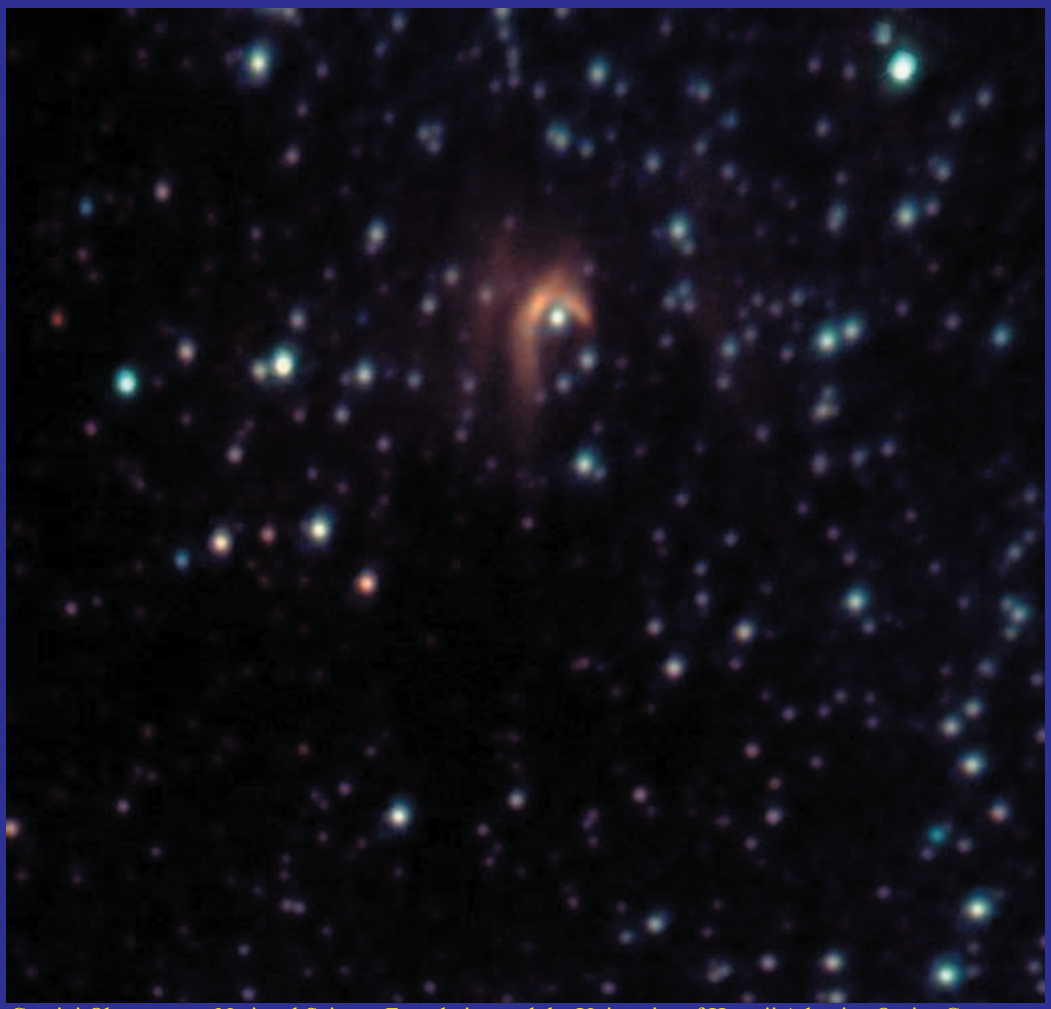
GEMINI OBSERVATORY NEWSLETTER

Issue 21 December 2000

FIRST SCIENCE
Gemini North Cuts Deep into the Galactic Center
QuickStart Science Program – July/August 2000

Gemini North Adaptive Optics Image of the Galactic Center

The first scientific observations from the Gemini North telescope provide a dramatic glimpse into the elusive core of the Milky Way, including an intriguing bow-shock from a star as it plows through a poorly understood gas cloud a mere 3 light-years from the galactic center.



Gemini Observatory, National Science Foundation and the University of Hawaii Adaptive Optics Group.

On the cover:
This image represents some of the data from the Gemini North Demonstration Science Program. The infrared images obtained are the sharpest ever taken over such a large area of the galactic center which is located about 25,000 light years away. These images were obtained using the University of Hawai`i's curvature adaptive optics system called *Hokupa`a* which removes atmospheric distortions from the starlight. The data were collected over several nights in July and August 2000 and represents the first scientific-quality data released by Gemini North.

The Gemini Observatory Newsletter

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THE HOKUPA`A/QUIRC DEMONSTRATION SCIENCE PROGRAM ON THE GALACTIC CENTER

François Rigaut and Jean-Rene Roy

At its November 1999 meeting, the Gemini Board considered the significant delays with the first facility instruments and recommended to the Director that Gemini use visitor instruments in order to produce early scientific results. After consulting with the national Gemini Project Scientists and the Gemini Science Committee, the Gemini Director started scientific observations at Mauna Kea through shared-risk observing programs using the University of Hawaii's adaptive optics system, Hokupa'a, and near-infrared camera, QUIRC, and the University of Florida's mid-infrared imager, OSCIR. First, Gemini initiated a demonstration science program to obtain key data sets with the visitor instruments, exercise an extensive subset of telescope/dome systems for engineering verification, and illustrate the scientific capabilities of Gemini. Second, Gemini started the partners' observational programs which were selected via the normal national TAC process, in queue mode through the QuickStart shared risk service observing.

The first demonstration science program was a detailed high spatial resolution near-IR imaging study of the Galactic Center using Hokupa`a/QUIRC. Hokupa`a is a 36 subapertures/actuators curvature sensing AO system developed at the University of Hawaii by Francois Roddier, Buzz Graves, and Malcolm Northcott for the CFHT and the UH 2.2 m telescope. Hokupa`a can use relatively faint guide stars, nominally down to R ~ 17. The QUIRC camera, designed and built at the University of Hawaii by Klaus Hodapp, uses a 1024 x 1024 HgCdTe Rockwell array. An international team led by François Rigaut of Gemini carried out the demonstration science program. The other members of the team included V. Alonso (U. Cordoba, Argentina), R. Blum (CTIO, USA), M. Burton (UNSW, Australia), S. Casassus (U. Chile, Chile), A. Cotera (Steward Obs, USA), T. Davidge (HIA, Canada), T. Geballe (Gemini), A. Ghez (UCLA, USA), F. Melia (Steward Obs., USA), D. Minniti (U. Catolica, Chile), M. Morris (UCLA, USA), A. Quirrenbach (UCSD, USA), and D. Simons (Gemini). They were expertly supported by W. Brandner, D. Potter, and O. Guyon of the UH Adaptive Optics Group. The reduced images obtained with Hokupa`a/QUIRC in early July and August 2000 were released to the community on October 16, 2000, barely two months after completing the observations. Since the team has been extremely busy conducting the observations and reducing the data, most of the analysis of this unique data set remains to be done. We hope that the wide distribution of the Gemini Galactic Center (GGC) AO data set will enable a comprehensive and diversified exploitation of these new images of the core of our Galaxy.

The fully reduced data set is available on CD. You can order your free CD from François Rigaut at Gemini (frigaut@gemini.edu).

The Scientific Goal of the H/Q Demonstration Science Program

The top-level scientific goal of the H/Q demonstration science program was to investigate the stellar content in the central regions of the Galaxy. Given existing efforts by other teams to explore the immediate surrounding of Sgr A*, our team developed a program that exploited the unique characteristics offered by Gemini and H/Q. For example, the 20 x 20 arcsecond field of view of the QUIRC camera is significantly larger than that of the Keck Observatory Kcam, because of its much smaller detector; thus sky coverage was a natural focus.

With the growing evidence for recent massive star formation within the central parsec and the availability of the new infrared imaging tools, interest in understanding the remarkable properties of the central stars and the surrounding medium has increased dramatically. Star formation in the deep gravitational potential well of the Milky Way nucleus seems characterized by violent events and repetitive bursts. The H/Q team planned to obtain H and K' images, with the photometric depth defined by source confusion of: (1) the bulk of the Sgr A* complex, (2) two background bulge fields, and (3) the Arches stellar cluster, which is located within a few arcminutes of the Galactic Center and has an age of a few Myr.

"...the GGC images are clearly of great scientific interest and offer a unique survey of the central regions of the Galaxy."

We expect that the GGC images will be used for a wide range of investigations. Our team defined its primary scientific objectives as follows:

- Study the star-forming history of Sgr A*, with particular emphasis on measuring the age of the most recent episode of star formation using the brightness of the main sequence turn-off.

- Obtain successive images of the field immediately surrounding Sgr A* and the Arches cluster to search for variable stars. Detecting eclipsing binaries might provide a distance estimate to the Galactic Center based on geometrical considerations.

- Search for an optical counterpart to Sgr A*, an extremely ambitious goal that would require superb imaging conditions to compete with Keck.

The Observations

Observations were conducted in early July and August 2000. Because the Galactic Center culminates at a relatively low altitude (42 degrees elevation) as seen from Mauna Kea, seeing was mediocre much of the time and the majority of fields have FWHM ~ 0.12 arcseconds, which is intermediate between the diffraction limit of an 8-m telescope and a 4-m telescope at K. Despite this limitation, the GGC images are clearly of great scientific interest and offer a unique survey of the central regions of the Galaxy.

The imaging data covers eleven 20 x 20 arcsecond fields each. One field includes the Arches cluster. H and K' images are available for all fields. CO and CO continuum images were obtained for only a few fields. Originally intending to take CO for all fields, the team ran out of time and could not complete the observations. F. Rigaut, T. Davidge, R. Blum, and A. Cotera performed the data reduction of the images, with advice from I. Jørgensen (Gemini) and J. Jensen (Gemini).

The GGC images show a strong presence of dust revealed by irregular patches blotching the field of view, indicating that differential reddening can be a significant problem in clearly separating blue and red stars. Follow-up imaging using narrow-band CO and CO continuum filters will be required to provide a spectroscopic means of identifying red and blue stars. Further details on the program, the observations, and the instruments can be found on the Gemini adaptive optics web pages, www.gemni.edu/sciops/instruments/adaptiveOptics/AOIndex.html

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Hokupa`a + QUIRC Observations of the Center of M32

T. J. Davidge

The Local Group compact elliptical galaxy M32 is an important stepping-stone for understanding the stellar contents of more distant systems. Spectroscopic observations of the central few arcseconds of the galaxy reveal features, such as strong Balmer line absorption, which suggest that a significant fraction of the galaxy formed during intermediate epochs (O'Connell 1980, Burstein et al. 1984, Rose 1985, Bica et al. 1990, Davidge 1990). However, M32 is not a simple stellar system like a star cluster, but rather contains stars spanning a range of metallicities, and this complicates the interpretation of the spectra. Moreover, the environment near the center of M32 may also affect stellar evolution in unknown ways, and produce objects such as blue stragglers with spectroscopic properties that may mimic those of intermediate-age stars.

Studies of resolved stars offer a direct means of probing the stellar content of M32. In order to fully test predictions made from spectra, it will be necessary to resolve stars over a range of wavelengths and brightnesses. While clearly ambitious, the results will give astronomers greater confidence when interpreting the spectra of more distant systems.

A basic problem is that spectroscopic data typically sample the high-density innermost regions of M32, yet individual stars are most easily resolved in the low-density outer regions (e.g., Freedman 1989, Davidge & Jones 1992, Grillmair et al. 1996). Because the stellar content of M32 may vary with distance from the center of the galaxy (Davidge 1991, Hardy et al. 1994, O'Connell et al. 1992), it is desirable to resolve stars as close as possible to the nucleus if one wishes to test directly the predictions made from integrated spectra.

The Gemini telescopes and the University of Hawai`i's custom Hokupa'a AO system offer an ideal means of resolving individual bright stars near the center of M32. H and K' images of the center of M32 were obtained during engineering time in early July 2000 as part of a program assessing the feasibility of using extended sources as reference beacons for Hokupa'a. Although the integration times were modest, 480 seconds per filter, the processed K' image shown in figure 1 indicates that the galaxy has been resolved into stars to relatively small radii.

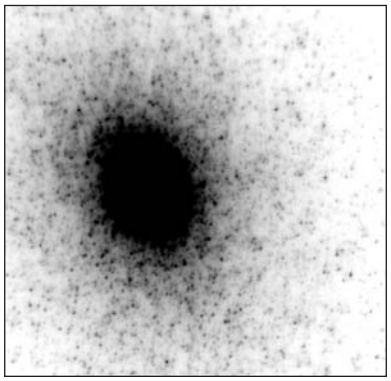

Figure 1: The 20 x 20 arsec K' image of M32 obtained with Hokupa`a + QUIRC. The total exposure time is 480 seconds. North is at top and East is to the right and the image quality is 0.12 arcsec FWHM. The bright point sources scattered throughout this image are AGB-tip stars with K = 15.5.

Figure 2 shows the (K, H-K) CMDs of stars at various distances from the nucleus. The peak stellar brightness is remarkably constant at K = 15.5 between 2 and 13 arcseconds from the nucleus. The absence of a brightening trend with decreasing radius indicates that the brightest objects, which are likely evolving near the tip of the asymptotic giant branch, are individual stars and not unresolved blends; hence, figure 2 demonstrates that individual bright stars have been resolved to within 2 arcseconds of the nucleus.

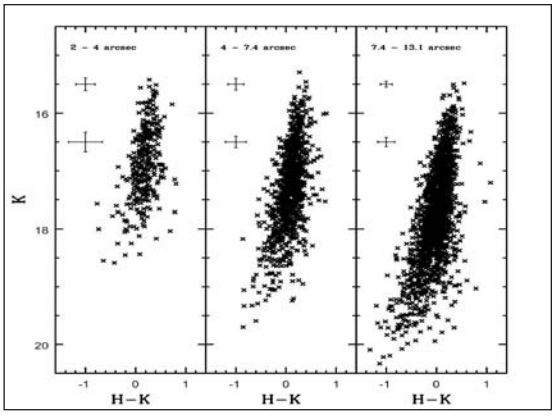

Figure 2: The (K. H-K) CMDs of stars at various distances from the center of M32. Note that the brightest stars have K = 15.5 at all distances. If the brightest stars were blends then there should be a trend of increasing brightness with smaller radii, which is not evident in these data. The error bars show the estimated scatter in the data due to photometric errors as predicted by artificial star experiments. It is evident that the scatter in the CMDs is dominated by photometric errors and is not indiicative

The properties of the brightest stars near the nucleus of M32 are remarkably similar to those of the brightest infrared stars in the outer regions of the galaxy.

First, the peak brightness of stars in the outer regions of the galaxy is also K = 15.5 (Freedman 1992, Elston & Silva 1992, Davidge 2000); thus, if the central regions of M32 contains a population that is significantly younger than in the rest of the galaxy, then it must be restricted to within 2 arcseconds of the nucleus. Second, the density of infrared bright stars also follows the surface brightness profile of the galaxy at visible wavelengths to within 2 arcseconds of the nucleus. When combined with the results from Davidge (2000), who investigated the density of bright stars between 20 arcseconds and 2 arcminutes from the nucleus, it is clear that the bright stellar component is smoothly distributed throughout the galaxy and that the luminosity-weighted mean age does not vary significantly throughout the galaxy. Consequently, the radial variations in properties such as, for example, the ultraviolet-visible colors (O'Connell et al. 1992) is probably not due to age but must involve another parameter.

"The uniform distribution of the brightest infrared stars provides tantalizing clues into the past evolution of M32."

The uniform distribution of the brightest infrared stars provides tantalizing clues into the past evolution of M32. These stars may have formed during a remarkably coherent episode of star formation. However, this process would require a high degree of tuning over spatial scales approaching a kpc. Perhaps the stellar content of M32 is coeval with an age of a few Gyr; if this is the case and if M32 is not a unique object, then we might expect to see galaxies like M32 forming at intermediate redshifts. Another possibility is that M32 might have obtained the bright stars via a merger with a lower mass system, many of which contain intermediate-age populations. If this were the case, then the infrared bright stars would be more metal-poor than the underlying body of the galaxy, whereas if the stars formed from material belonging to M32, then they would be expected to have metallicities similar to those of the most metal-rich stars, which have mean metallicities close to solar. Spectroscopic studies of individual stars in M32 are a natural application for integral field instruments such as the Gemini NIFS.

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Director's Report

Matt Mountain

The year 2000 has been a frenetic year for both the Gemini Project team and the observatory staff. Gemini North began the first community access semester through our QuickStart service program and Demonstration Science projects. Though the amount of telescope time allocated to community access was limited to 25%, this process turned into a highly effective test of our preliminary observing system. These programs exercised our web documentation, the proposal and time allocation (TAC) process, observing preparation, visitor support (much welcomed observing help from our National Project Offices!), observing execution, data reduction, data distribution, and finally the partnership's press release to the media. In the midst of this, NIRI, our first facility instrument from the University of Hawaii, arrived in Hilo. Concurrently in the south many of the complex systems that constitute a Gemini telescope were put into place. On the morning of August 29, 2000, the Gemini Observatory issued two night logs, one by Gemini North around 6:00 am, and the other, seven hours earlier by Gemini South for the very first time announcing, "*A very successful first night for Gemini South! First pointing and tracking tests were done with the alignment telescope. There are some slow drifts, but the pointing and tracking were quite good for the first time. The first photons were detected off the primary and a first look at the alignment with the cass. axis indicated that it is already very good*." For the first time the Gemini Observatory had both its telescopes collecting photons.

How well are we doing?

In the North, the accumulating statistics of QuickStart and Demonstration Science indicate 46% of the available time used usefully, with 19% lost because of weather (this is below the Mauna Kea long-term average of 27%), 15% lost due to telescope problems, and 20% lost because of Hokupa'a/QUIRC failures. Since these are small-number statistics, care should be taken when interpreting these early results. In early September we issued our first call for proposals to use 50% of the telescope time for science with NIRI, Hokupa'a, and OSCIR on Gemini North. NIRI is now back on the telescope after coming off to fix some initial flexure problems, and we will start the first NIRI commissioning run in early November 2000. By the end of 2000, we expect to fully hand over Gemini North to the operations team.

In the South, after six weeks of appalling weather and problems with the air-pressure primary mirror support system, the telescope was back on the air, literally in the case of the primary mirror, delivering one arcsecond images on its first night without active corrections. In late November 2000, we expect first light at Gemini South, with our first opportunity to test the combined performance of both the primary and secondary mirrors as part of an active telescope.

Looking towards 2001: Completing the transition to operations.

Our partner Gemini offices are already working towards the Semester 2001B Gemini North call for proposals, scheduled to be announced in March 2001. We anticipate offering both NIRI and GMOS-N, and possibly Hokupa'a and CIRPASS from the Universities of Hawaii and Cambridge respectively.

On Gemini South, we expect the construction phase to be completed perhaps as much as four months early. This completion will mark the formal end to the Gemini construction project, and will give the Gemini South science operations team the challenge of bringing their telescope to scientific readiness without any facility class instruments. Currently we are negotiating with the University of Florida to provide their multi-object infrared spectrograph, Flamingos-1, and their thermal infrared camera, OSCIR, as visitor instruments on Gemini South. We expect both facility class instruments T-ReCS and GMOS-S to arrive in Chile by the end of 2001.

In 2001 the Gemini Observatory will come of age scientifically, offering our communities science access on both telescopes for the first time. Life at the Observatory will enter a new and scientifically exhilarating phase, though I suspect it will be no less frenetic than it was in 2000!

Project Status

Jim Oschmann

We have achieved a major milestone at Gemini North with the first scientific use of the telescope. Science observations currently occupy 25% of all nights, with the remaining 75% dedicated to engineering activities such as improving reliability, increasing observing efficiency, and commissioning NIRI, our first facility instrument.

"We are reaping the benefits of lessons learned through the integration and commissioning of the northern telescope."

At Gemini South, we have been working towards first light, which we expect shortly. Our work has included prime focus alignment of the primary mirror. Though the primary is uncoated and many systems are still being completed, the quality of the telescope in terms of alignment and initial image quality looks great. We are reaping the benefits of lessons learned through the integration and commissioning of the northern telescope.

Gemini North

The primary commissioning activity in the North has been the fast tilt and chopping performance of the secondary system, a process required in order to use the University of Florida's OSCIR, one of our visitor instruments. For the last few months, we have struggled to debug the black box delivered to us along with its interface to the secondary control system. The team solved these problems several weeks ago and is currently making preparations to observe with OSCIR in November 2000. A plot of the active guiding during one half of the chop, as needed for OSCIR, is shown in figure 1 (p.9). We are tuning the guiding performance further, but the majority of the guide error signals fall within expected ranges.

Just prior to initial science observing this summer, we were able to obtain full sky pointing tests in an automatic mode with the help of Dave Terret and Pat Wallace. These pointing tests also provided a complete test of the control system sequencing functions that are required to automate and speed up many observing tasks. During these tests, the high level software of the Telescope Control Console (TCC) exercised automatic control of our Telescope Control System (TCS), Mount Control System (MCS), Cassegrain Rotator Control System (CRCS), Acquisition & Guiding System (A&G), Wavefront Sensors (WFS), and the Enclosure Control System (ECS) to acquire, guide, and transfer pointing data for more than 100 stars extracted automatically from a guide star catalogue. Figure 2 shows results from two pointing tests, resulting in a 0.7 arcseconds rms pointing. Our requirement is 3 arcseconds.

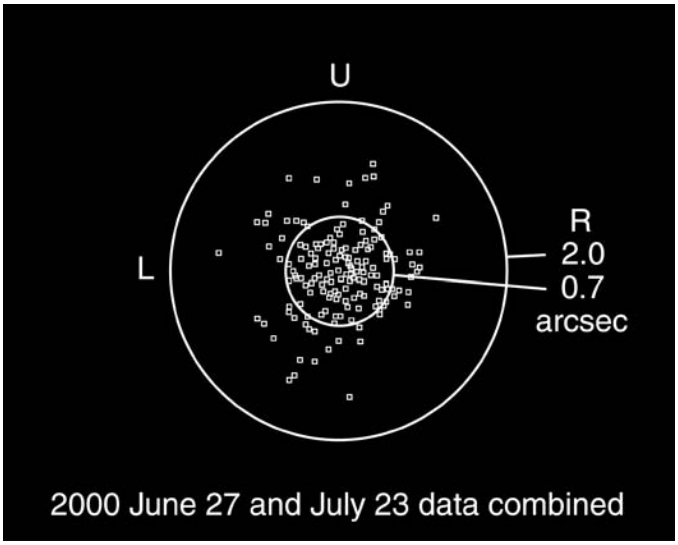


Figure 2: Pointing test results.

Our current emphasis centers around preparing for OSCIR, commissioning NIRI, QuickStart with Hokupa`a and QUIRC, improving reliability, and implementing further improvements in the high level software to improve efficiency.

Continued...

Gemini South

In the South, Eric Hansen has taken over mountain responsibilities during final integration and commissioning.

The list of recent accomplishments include:

- Wind buffeting tests completed with the dummy mirror in the telescope,
- M1 installed (uncoated),
- MCS, TCS, PCS up and working with the real mirror,
- Secondary assembly mounted, integrated,and tested with the dummy mirror on the telescope,
- Alignment tests at prime focus,
- Measurements to prepare for lateral support adjustments, and
- Preparations to coat the primary mirror in the beginning of November 2000.

The optics group, under the leadership of Larry Stepp with the help of much of the staff and David Smith of University of Massachusetts, completed the wind buffeting tests on Cerro Pachón (CP). The team fit the telescope with more than 60 accelerometers; 24 pressure sensors in an array on the dummy mirror; and 3 dimensional wind sensors outside the dome, on the telescope top end, and at several points around the primary mirror. A picture with some of the sensors on the dummy mirror is shown in figure 3.

Figure 3: Cerro Pachón telescope with dummy mirror and pressure, wind, and accelerometer sensors.

We still must analyze many data sets taken under varying wind conditions, with different telescope wind angles and with the large vent gates open to different degrees. Dr. Myun Cho of the University of Arizona analyzed the first few cases, and figure 4 (p.9) shows the wind pressure spatial variation, and the resulting deformation expected on the primary mirror. The case shown is atypical, under high wind with the gates fully open. Under more typical conditions, or even under high wind but with the gates partially closed, the mirror deformations remain well within the error budget. Figure 5 (p.9) shows the pressure variations for vents open and closed, and figure 6 (p.9) compares the effect with vents open then closed, showing the order of magnitude level of control that the enclosure allows us to have.

"Under more typical conditions, or even under high wind but with the gates partially closed, the mirror deformations remain well within the error budget."

Figure 7 shows the first prime focus image, taken for alignment. Active optics were off and the initial quality, with no adjustment, was 1-2 arcseconds.

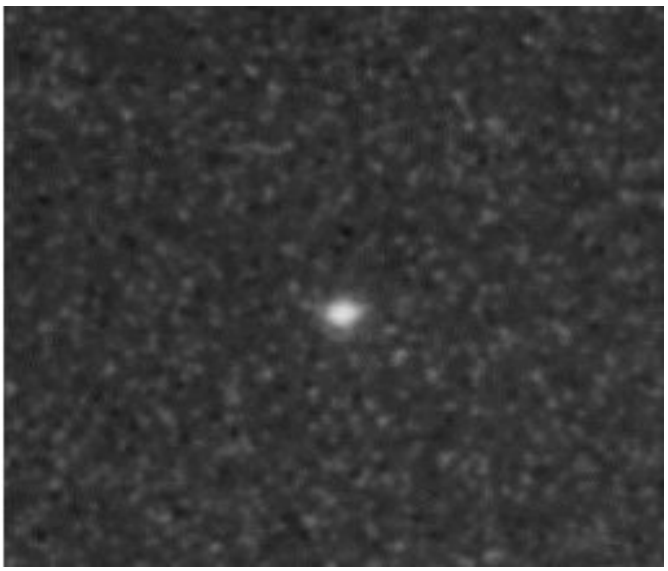


Figure 7: Image of star projected on viewing screen at Gemini South taken with the alignment telescope, a commercial camera, and the uncoated M1.

It was 20-30 arcseconds on Gemini North at the same stage.

Though some of the work is taking a little longer than we had hoped, the quality of the results are high and we are making good progress. Some of the delays have been caused by uncooperative weather conditions, as demonstrated in figure 8. Any ideas of how to control this phenomenon will be welcome!

"The next six months will be an exciting period as we dedicate 50% of nights to regular science operations at Gemini North, and achieve first light and proceed with commissioning at Gemini South."

Finally

The next six months will be an exciting period as we dedicate 50% of nights to regular science operations at Gemini North, and achieve first light and proceed with commissioning at Gemini South. We are grateful for all of our partners who have supported these efforts, directly and indirectly, as we enter into probably the most critical phase of the construction project—the final phases at both sites. Your continued help will be appreciated.

Figure 8: An all too familiar picture of the road to Cerro Pachón this winter in Chile.

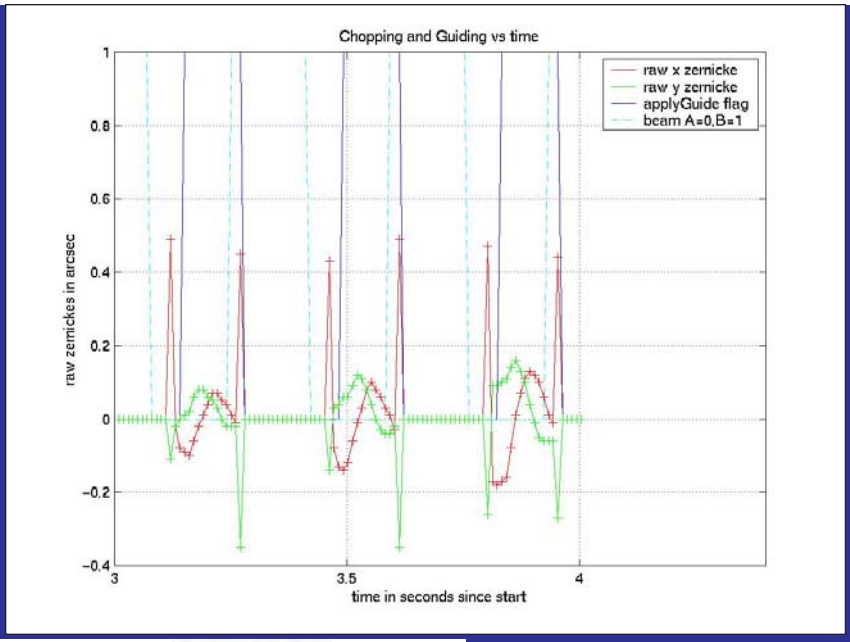


Figure 1: WFS signal showing guiding during one half of a chop cycle.

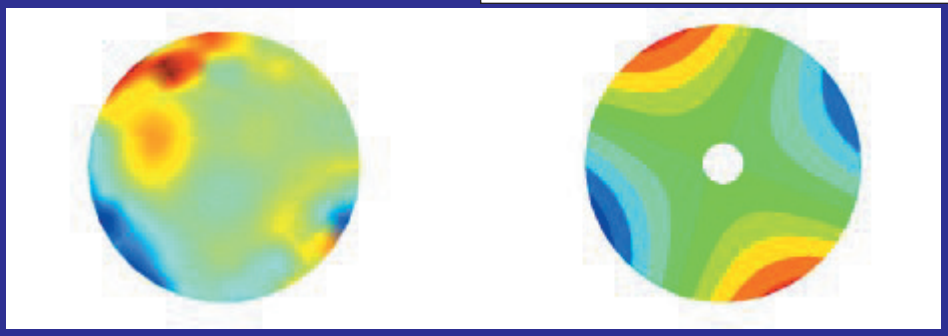


Figure 4: Pressure variation above primary with resulting deformation, based on finite element analysis.

Figure 5: Pressure variations, high wind, vents open then closed.

Figure 6: Surface deformation from wind with vents open, then closed (high wind case). Results show that the primary easily meets its wind performance requirements.

Gemini North at Sunset

Mauna Kea Ridgeline

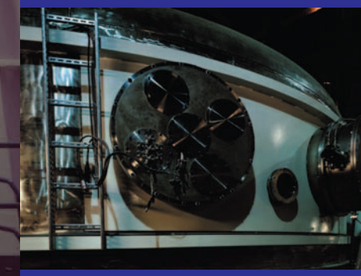
Gemini North 8 Meter Mirror

Interior of Gemini North at Sunset
From *Tools of Vision* Exhibition
Images by Neelon Crawford
National Academy of Sciences : September 26, 2000 - January 15, 2001

Funded with Support by the National Science Foundation

Gemini South at Sunrise

Gemini South Interior
At Dusk



Gemini South's Coating
Chamber

Public Information and Outreach Update

Peter Michaud

There is nothing like the buzz of activity and accomplishment to inspire and fuel even more activity and accomplishment—and the past 6 months have seen lots of both at Gemini! Gemini North is releasing world-class science, Gemini South is looking skyward, and new staff appear daily to help take our operations into high gear. I think it is safe to say that after many years of hard work, we are all starting to feel the gratification and satisfaction that comes from a difficult job well done.

PIO Assistant Janice Harvey demonstrates Active Optics with a deformable plexiglass mirror. These and other demos are used in our schools to share Gemini with students and the public.

The Public Information and Outreach (PIO) office is no exception to this excitement and in fact, it is appropriate that the mood of the organization is focused on this office since we represent the public face of Gemini.

Given the state of affairs at Gemini, the PIO office has seen its share of activity over the past six months. Many new and ongoing projects have allowed us to keep up with the rest of the project, and in many cases I think we have been able to help set the pace!

The Gemini PIO office is generating excitement and enthusiasm with local outreach. Both of the StarLab portable planetariums are up and running to rave reviews by area schools. Special thanks go to PIO Assistant Janice Harvey in Hilo and the RedLaser group in Chile for making this happen so effectively. The following letter, recently published in Hilo's local newspaper, the *Hawaii Tribune-Herald*, demonstrates that our efforts are getting noticed:

Several of Gemini images that are part of the "Tools of Vision" show currently being presented at the National Academy of Sciences.

Kamehameha School students watch in anticipation and enthusiasm as "Einstein" shows them the wonders of science.

"Gemini Observatory has a wonderful outreach program. This program has been instrumental in providing schools with exciting, interactive learning experiences that enhance learning in the classroom. One such program is the StarLab.

This is a traveling planetarium. Students enter the StarLab and are transported on a wondrous journey as astronomers. Through a series of slides and a well-moderated presentation, students travel from the summit of Mauna Kea to the galaxies beyond.

Students are treated to spectacular photos taken by the sensitive cameras used by the observatory. They are taught to recognize the constellations over Hawaii and their movement through the night skies. The folklore of Hawaii enhances the factual information given to children.

They learn of the vastness of the universe and the countless number of galaxies beyond our own. The excitement of the students as they actively participate in their learning is contagious.

It brings about so many possibilities and children are filled with questions. Having the experts to answer these questions or provide avenues to have these questions answered makes for an exciting partnership with schools.

We, Connections New Century Public Charter School, would like to thank Janice Harvey and the Gemini Observatory's Outreach Program for inviting us to participate in two excellent presentations. We are looking forward to participating in more stimulating programs as they become available through Gemini's Outreach Program."

E. Miyazono, Connections New Century Public Charter School, Mountain View [HI]

Letters like these lead me to believe that we are definitely on the right track with local outreach!

Another extremely successful program that Gemini Observatory recently brought to Hawaii was "Einstein Alive." This program is the brainchild of a remarkable speaker named Arden Berkovitz, a scientist from San Diego, who transforms himself—with a wig and a few dabs of make-up—into a striking likeness of Albert Einstein. Albert—uh, I mean Arden—gave 8 spellbinding performances in East Hawaii, as he wove stories from Einstein's life and work into inspiring presentations to over 2,500 school children, teachers, and local residents. As a testimonial to the program's success, several school groups forfeited recess to ask more questions!

Another project that could greatly benefit educational outreach throughout the partnership is a new NSF-funded exhibition of images by photographer Neelon Crawford. Called *Tools of Vision*, this exhibit shows over 40 large framed photographic prints featuring Gemini Observatory and other tools that allow scientists to explore everything from atoms to galaxies. The images are on display until January 15, 2001 at the National Academy of Sciences in Washington DC, and the collection will be available to the Gemini partnership for the next five years. A catalogue (thanks again to NSF) highlights many of the show's spectacular images, several of which have been reproduced in the color centerfold of this newsletter.

Catalogues can be requested and inquires on borrowing the show for public display can be addressed to the Gemini Observatory Public Information and Outreach Office at: pmichaud@gemini.edu.

Most recently, the Gemini PIO office generated our first press release template in support of scientific operations with the Galactic Center Demonstration Science data set release. To support this effort a significant amount of new video B-roll was created and distributed throughout the partnership, and the story was picked up by many media venues. Although the process ran relatively smoothly this time, the experience will facilitate even more effective science releases in the future.

Finally, the Gemini Public Information and Outreach Office is gearing up for a busy new year with the dedication of Gemini South in 2001, the ramp-up of scientific operations at both telescopes, and an expected increase in the number of requests for media resources and visits. Without a doubt, 2001 will be full of activity and accomplishments all around!

PIO Resources & Services

A large part of the Gemini PIO effort supports the Gemini Partnership with media resources to make media requests easier for everyone in the partnership. If you are not aware of what is already available, the list below is a sample of the available resources and some of the services we currently provide.

- Video B-Roll and extensive documentation of Gemini North and South mirror moves
- Animations (New AO animation for 2001)
- Photographs, diagrams, and CD's
- Exhibits and displays
- Presentations and demos for outreach prgramming
- Assisting media from partnership while visiting Gemini facilities
- Providing press release templates for key Gemini events and milestones

In early November Gemini was featured in both Time Magazine (Table of Contents) and Time for Kids. (Cover)

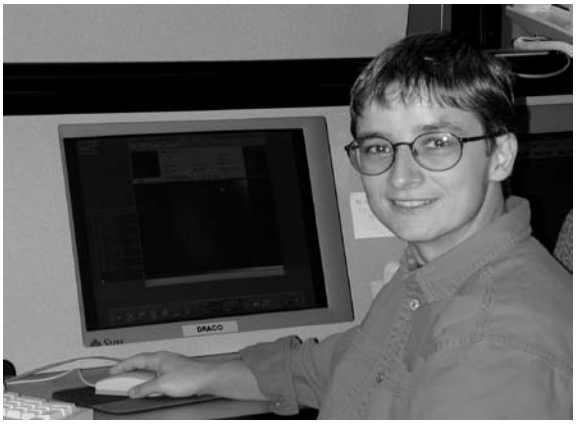
Spotlight on Staff

Melissa Welborn

Note: This interview is part of a new series of articles that will appear in this newsletter on a regular basis. We hope that the Gemini communities will get to know the staff a little better and understand why we are so proud of our excellent team.

Dr. Inger Jørgensen

Dr. Inger Jørgensen was hired September 1, 1998, in Hilo, Hawaii, as an Assistant Astronomer. Her work focuses on our understanding of the formation and evolution of galaxies. Dr. Jørgensen worked as a McDonald Fellow at the McDonald Observatory in Texas from 1993 to 1995 and then as a Hubble Fellow between 1995 and 1998. Selected as the Gemini Observatory's specialist for the Gemini Multi-Object Spectrographs (GMOS), Dr. Jørgensen also oversees the design of the software that will be used to process observations from the Gemini telescopes.



Inger Jørgensen at the controls of Gemini North

Educated at Copenhagen University, Dr. Jørgensen received her Ph.D. in Astronomy in 1993. As a citizen of Denmark, she represents the international nature of both Gemini Observatory and the worldwide profession of astronomy. The following is an interview with Dr. Jørgensen about her work at Gemini.

MW: What do you think prepared you for your position at Gemini?
IJ: I participated in the start-up phase of the Hobby-Eberly Telescope, and during that time I served on a number of committees that set guidelines for distributing telescope time. I saw first-hand how the queue process works.

I have done many observations with a lot of telescopes that had no operator or telescope assistant. Because of this, I had to solve technical problems myself. Those telescopes ranged from many ESO telescopes to Kitt Peak to McDonald Observatory. My previous experience in data processing has helped me in my responsibilities at Gemini, because I am leading the design and programming work on the data processing software at Gemini Observatory.

MW: What aspect of your job is most interesting?
IJ: There are really two aspects to my job: service and research. The part I like about the service aspect is getting really good data for some approved program. The QuickStart observations have been very exciting because we are getting really good science data. I look forward to the PIs actually publishing research based on these data.

Thirty percent of my time is spent on my own research. The most exciting part is the process of getting the observational data I have to fit together to form a bigger picture. Imagine having a jigsaw puzzle in a box with no picture, and then after a lot of work, you get the puzzle put together and see the picture.

MW: Tell me about your research.
IJ: The main topic of my research is the evolution of elliptical and lenticular galaxies. Unlike our own galaxy, the Milky Way, these types of galaxies do not have spiral arms. Elliptical galaxies appear on images as elliptical distributions of stars with nearly no dust or gas content. Lenticular galaxies appear to be similar except they also contain stars distributed in a disk. Both elliptical and lenticular galaxies are traditionally thought to contain mostly stars formed early in the history of the Universe.

I study the galaxies by using direct imaging from which the radii, the surface brightnesses and the shapes can be measured, and spectroscopy from which detailed information about the contents of iron, magnesium, and other elements can be derived.

Some of the most interesting results I have found came from my study of the Coma cluster. This cluster is the nearest very rich cluster of galaxies. I have

found that a large number of the elliptical and lenticular galaxies in this cluster contain quite young stars. The average age of the stars in some of the galaxies is only about 5 billion years. Another result from this study shows that a lot of the elliptical galaxies contain disks. Both of these results contradict the classical picture of this type of galaxies.

I am now pursuing a project to study similar galaxies at high redshifts using Gemini and GMOS. The idea is to determine the average ages and metal content of the galaxies as they looked 5-10 billion years ago and attempt to tie this to the properties of the nearby galaxies.

Human Resources Update

Melissa Welborn

Activity in the Human Resources Department has surrounded the current and projected need for employees in various positions throughout the Observatory. Gemini's growth, spurred on by the transition to Operations on the Gemini North telescope and the commissioning of the Gemini South telescope has meant continuing emphasis on recruiting.

We are pleased to announce that Dr. Jean-René Roy, formerly of Université Laval in Québec, Canada, has become the Associate Director for Gemini North. Dr. Roy is responsible for executing the scientific mission of the Gemini North Telescope and the first scientific use the Mauna Kea telescope.

Gemini welcomed the following employees to Gemini North: Matthieu Bec, Software Engineer; Eric James, Mechanical Engineer; Michael Ledlow, Gemini Fellow; Chip Michels, Electronics Technician; David Moe, Mechanical Technician; Tumua Rosen, Human Resources Assistant; Kathy Roth, Gemini Fellow; and Wendy Shook, Systems Support Associate.

We also happily welcomed the following employees to Gemini South: Jeff Cox, System Support Associate; Roberto Rojas, Software Engineer; Luis Solis, Instrumentation Technician; Gelys Trancho, System Support Associate, and Cristian Urrutia, Software Engineer.

Our thanks go to Tod Fujioka and Paloma Patterson who left Gemini Observatory for other challenges.

SPECIAL AWARDS AND RECOGNITION

- Helen Smith - received her certification as a Certified Archivist, August 2000.
- Gabriel Perez - presented the AURA 25 Year Service award, May 2000
- Jim Kennedy - appointed by UH Regents to the Mauna Kea Management Board
- Eric Hansen - AURA Service Award
- Paul Gillett - AURA Service Award

Partner Office Reports

US Gemini Partner Office

With the enthusiasm and expectation of new discoveries, the U.S. Gemini Project Office 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 and August 2000, and also participated in several QuickStart programs in August. Stefanie Wachter provided

support for the Hokupa`a/QUIRC QuickStart programs at Gemini North in October 2000. Patrice Bouchet is scheduled to support the OSCIR demonstration science program from Hilo and Mauna Kea in November 2000 and will work with IGPO for the OSCIR QuickStart programs in November and December 2000.

The U.S. Gemini Project Office received a total of 77 proposals for the 2001A semester on Gemini North. These proposals were handled through the standard NOAO proposal system. The proposal breakdown per instrument follows:

H/Q	21 proposals	33.7 nights
	1.60 nights per proposal	
NIRI14	4 Proposals	2.55 nights
	0.64 nights per proposal	
NIRI32	1 proposal	1.0 night
	1.00 night per proposal	
NIRI6	23 proposals	33.325 nights
	1.45 nights per proposal	
OSCIR	31 proposals	51.45 nights
	1.66 nights per proposal	

The U.S. Gemini Project Office is also attempting to run mini-queue proposals for Hokupa'a/QUIRC and OSCIR, to permit observing programs shorter than 0.5 nights. We received 5 mini-queue proposals each for Hokupa`a and OSCIR.

Thus, we received a total of 77 proposals requesting 122.025 nights for an average of 1.58 nights per proposal. Because 3 proposals requested 2 different instruments, the total does not add to 77. With 34 nights available for U.S. programs, the raw oversubscription is 3.58. Mike Merrill and Bob Blum (NIRI), Tod Lauer (Hokupa`a), and Patrice Bouchet (OSCIR) are reviewing the proposals for technical merit, and the NOAO TAC will evaluate the proposals in early November 2000. The U.S. deputy project scientist, Caty Pilachowski, is coordinating this effort and the proposal system support in Tucson.

The accompanying article (p.18) by Taft Armandroff details the considerable effort of the U.S. instrument program. We have also been actively involved in planning and coordinating the MCAO workshop, October 23-25, 2000 at CfAO in Santa Cruz. Steve Strom, Taft Armandroff, and Tod Lauer co-chaired two of the discussion groups and served on the scientific organizing committee. We have invited 15 prominent scientists from U.S. institutions to partake in the science conference and anticipate reporting the results of the workshop next semester.

Bob Schommer

UK Gemini Project Office

Support Activities

Since the last newsletter, U.K. National Office staff processed the applications received for Gemini North semester 2000 QuickStart observing. The U.K. Gemini Time Allocation Committee under the Chairmanship of Dr. Dave Axon, University of Hertfordshire, ranked the U.K. proposals and transmitted the top 16 proposals to Gemini who then compiled the complete partner-wide ranking list. The UK Gemini Support Group (UKGSG) website anonymously published the results of a survey of applicants for semester 2000 QuickStart observing time.

We have also been busy with the Gemini North semester 2001A proposal submission round which had a U.K. deadline of September 30, 2000. The UKGSG website server received a total of 37 proposals submitted through the Gemini Phase I submission tool, PIT. Of these proposals, 54% requested OSCIR

mid-IR imaging/spectroscopy,30% NIRI near-IR imaging/spectroscopy, and the remaining 16% Hokupa'a/QUIRC near-IR AO observations. The division between instruments was surprising but demonstrates the demand for sensitive instruments in the mid-infrared, an area in which Gemini will have particularly high sensitivity. Once the overheads are properly taken into account, it is likely that semester 2001A will be oversubscribed by about a factor of 5.

The Gemini HelpDesk received a number of inquiries from U.K. astronomers preparing observing proposals and is proving to be a useful tool for disseminating information and resolving problems.

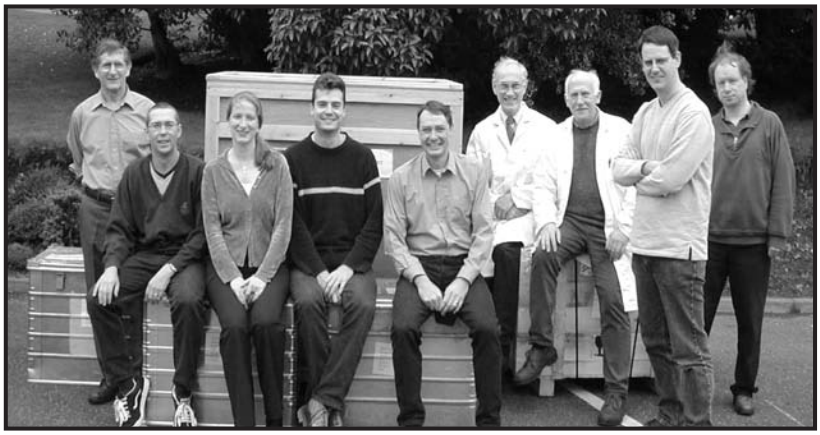
Instrument News

Several instruments destined for Gemini are undergoing important verification measurements and critical tests as preludes to their acceptance tests. We will report on those instruments in the next newsletter.

The first of the Gemini Calibration units (GCAL) has been shipped to Hawaii for installation on the telescope; the second unit will be shipped to Chile in Spring 2001. The calibration unit is a key component in ensuring that data produced by Gemini are well-corrected for instrumental effects. GCAL is mounted on one of the utility ports on the Instrument Support Structure below the primary mirror. GCAL provides a set of lamps selected remotely for spectral and flat-field calibration from the ultraviolet to the near-infrared. A novel feature of the design, the illumination system diffuses the sources to fill the 7 arcminute field required for GMOS and produces a cone of light matched to that field. This provides much higher efficiency than a traditional integrating sphere approach. The output from GCAL simulates the f/16 telescope beam and is returned to the instruments via a folding mirror in the ISS. GCAL will be fully integrated into the observatory control system so that procedures for calibrating data from optical and near-infrared instruments can be implemented automatically.

A team at the ATC in Edinburgh, led by Dr. S. Ramsay Howat and Mr. M. Strachan, designed and built GCAL. They will travel to Hawaii in November 2000 to help install and commission the first unit on Gemini North, which must be ready for NIRI system verification early in 2001.

Colin Aspin
& Pat Roche



The GCAL team saying goodbye to the first unit as it sets off for Hawai`i.

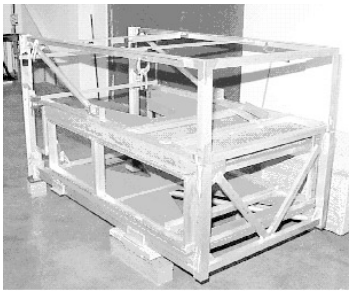
Canadian Gemini Project Office

Harvey Richer is the new Canadian Gemini Scientist replacing Jean-René Roy who is now Associate Director of Mauna Kea for the Gemini Observatory. Harvey will also represent Canada on the Gemini Science Committee (GSC) and on the Gemini Board. Harvey is based at the University of British Columbia in Vancouver.

Canada received a strong response to the second call for proposals with a total of 24 proposals received: 13 proposals were received for NIRI, 9 for OSCIR and 4 for Hokupa`a. This includes two proposals that requested two instruments. The Canadian allocation of time, 110 hours, was oversubscribed by a factor of

2.5. This factor will rise once the proposals are reviewed to ensure that overheads are properly included.

The CGO gave presentations at eight universities soon after the first call for proposals in March 2000. Because a second tour was not feasible in September, the CGO gave a Webcast to inform Canadians about Gemini's capabilities for Semester 2001A. To participate, universities needed a PC, with the latest version of NetMeeting running, connected to the Internet. The CGO then shared a PowerPoint presentation using NetMeeting. This was projected for the clients by having a video projector connected to the PC. All of the participating sites were connected by a telecon that provided good audio to everyone. We gave our presentation twice, once to two and once to four sites. This worked quite well and we received a lot of positive feedback from the participants. The smaller sites felt they benefited by hearing the questions from the larger sites. One site connected via video-conferencing and this was definitely better than having only the audio. We plan on having more Webcasts in the future to supplement visits to the universities or presentations at annual CASCA meetings.



Instrument structure of ALTAIR

Tim Davidge of the CGO participated in the Demonstration Science project with Hokupa`a. Tim was also present during some of the Hokupa`a engineering work and managed to acquire some data on M32 while testing whether Hokupa'a could guide on galactic nuclei. Read about the results of this work elsewhere in this newsletter.

Simon Morris, currently the ALTAIR Project Scientist and one of Canada's GSC members, is leaving HIA for a position at Durham (At least Simon is staying within the Gemini community!). David Schade (HIA) will be replacing Simon on the GSC. At the moment no decision has been made on a new ALTAIR Project Scientist.

ALTAIR, Altitude Conjugate Adaptive Optics for Infrared, is under construction at NRC. The photograph to the left shows the Instrument Structure or outer frame, and two of the insulation panels that surround the electronics. The optical bench will be suspended in the upper area and the electronics will reside in the lower half.

Wereceived the tip/tilt mirror in September 2000 and expect to get the deformable mirror in November 2000. While the major structural elements are being assembled and tested, a subset of the optics will be aligned on a laboratory optical bench. The plan is to connect the control system to this bench and close the servo loop for the first time in late 2000.

Dennis Crabtree

Brasilian Gemini Project Office

Dr. Thaisa Storchi Bergmann, of IF-UFRGS, has been nominated as the new Gemini Project Scientist for Brazil until the end of 2001. Dr. Augusto Damineli, of IAG-USP, will substitute for Dr. Bergmann when necessary.

Dr. Albert Bruch, of Laboratorio Nacional de Astrofisica (LNA), our National Project Office, is the new Project Manager, replacing Dr. Bergmann who was the former project manager. Dr. Bruch, who was recently hired by LNA, is taking care of most of the Gemini-related activities and is also the chair of the Time Allocation Committee in Brazil.

Thaisa Storchi Bergmann

Australian Gemini Project Office

The proposal deadline for Australian time on the Gemini-North telescope in semester 2001A has just passed. We received a total of nine proposals: five for NIRI queue-scheduled programs and two for each of the classically scheduled instruments Hokupa'a/QUIRC and OSCIR. A preliminary review of these proposals indicates an oversubscription factor of at least 2.3. The Australian Gemini Office carried out the initial technical assessments of the proposals and the Australian Time Allocation Committee will later review the proposals. Approved proposals will be forwarded to Gemini and incorporated into the final schedules with proposals from the other partners.

The Australian National University (ANU) and AURA/Gemini have agreed upon a fabrication contract for the Near-infrared Integral Field Spectrograph (NIFS), which was designed to be used with the ALTAIR Adaptive Optics system on the Gemini North telescope (see the NIFS web page at http://www.mso.anu.edu.au/nifs for details). The current schedule calls for the Critical Design Review for NIFS in February 2001 and delivery of the completed instrument to Hawaii in late 2002.

On the public outreach front, the ARC-sponsored Gemini display created for the National Science Festival has been permanently and prominently displayed in the Mount Stromlo Observatory Visitor Center. Here it will be seen by the thousands of visitors as they pass through the Center each year.

Gary DeCosta

Chilean Gemini Project Office

Jane Shuttleworth (jshuttle@conicyt.cl) joined the project at the beginning of June 2000 as an Executive Assistant.

The proposal submission process for semester 2001A was successfully completed on October 2, 2000. We received seven proposals, with three requesting observing time with NIRI, two with Hokupa'a/QUIRC, and two with OSCIR. The oversubscription factor was 1.4, slightly higher than in the previous semester. Dr. Leopoldo Infante replaced Dr. Maria Teresa Ruiz as chair of the Chilean TAC, but the composition of the TAC membership remained unchanged.

Phase I of the Gemini Science Archive project is proceeding well and should be completed by March 2001. Felipe Richardson, our computer engineer, continues to work at the Canadian Astronomy Data Center (CADC) with the Canadian team members and is developing the first prototype of the archive.

Chile sent two representatives, Douglas Geisler (Universidad de Concepcion) and Dante Minniti (P.U.C.), to the MCAO workshop in Santa Cruz.

The Chilean project office website has been completely revamped in order to provide more information in Spanish to the general public about Gemini, particularly Gemini South. When possible, all scientific information appears in both Spanish and English. The website address is http://www.conicyt.cl/gemini.

Luis Campusano
Sebastian Lopez

US Instrument Program Update

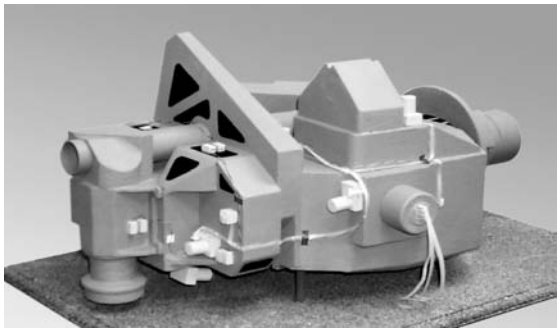
The U.S. Gemini Instrumentation Program has been very active over the past several months. Instrument design and construction are underway both in-house at NOAO and in the wider community. This article gives a status update as of mid October.

NIRI

The Near Infrared Imager (NIRI) is a 1-5 micron 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. A team from the University of Hawaii and Gemini tested NIRI in August and September and successfully produced images. NOAO plans to deliver the 1 frame per second upgrade to the NIRI controller later this fall. We are also planning on-telescope final acceptance testing of NIRI later this fall.

T-ReCS

The Thermal Region Camera and Spectrograph, T-ReCS, 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. Thus far, the team has received and inspected the majority of the T-ReCS optics, including the critical diamond-turned mirrors. They have nearly completed mechanical parts fabrication, started mechanical assembly, and proceeded with the electronics and software development.



Scale model of the GNIRS optical bench assembly with mechanisms attached. The model was made to help with cable routing and other detailed design issues.

GNIRS

The Gemini Near-Infrared Spectrograph (GNIRS) is a long-slit spectrograph for the Gemini North telescope that will operate from 1 to 5 microns and offer two plate scales and a range of dispersions. Neil Gaughan (Project Manager) and Jay Elias (Project Scientist) are leading the project at NOAO in Tucson. GNIRS underwent 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 team is now completing the detailed design while initiating fabrication for sub-assemblies with completed designs. September brought a major milestone with the initiation of fabrication of the optical benches. The project team has ordered all of the critical optics and has received and accepted a little more than one-third of them.

Phoenix

Phoenix is a high-resolution near-infrared spectrometer that has been producing science at the KPNO 4-m and 2.1-m telescopes. Phoenix yields spectra with resolution up to R=70,000 in the wavelength range 1 to 5 microns. Phoenix will be shared equally between Gemini South and CTIO/SOAR. NOAO/USGP and IGPO have signed an agreement covering the modification of Phoenix for Gemini and instrument support. Phoenix will be offered as a visitor instrument on Gemini South beginning with the first scientific use of Gemini South. An IGP-provided ALADDIN InSb array will be installed in Phoenix in order 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.

Flamingos 2

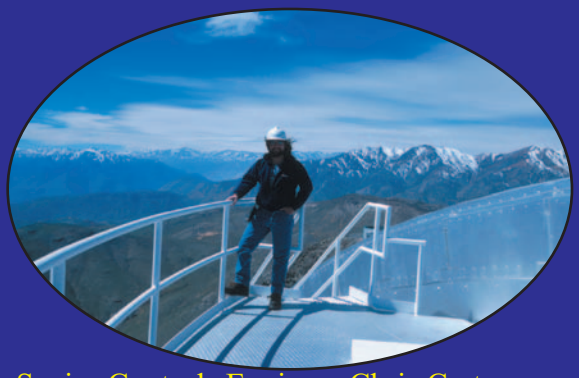
Flamingos 2 is a concept for a near-infrared multi-object imaging spectrograph for the Gemini South telescope, developed by Richard Elston and his team at the University of Florida. The Flamingos 2 concept builds on the heritage of the original Flamingos imaging spectrograph, which will be offered as a visitor instrument on Gemini. Flamingos 2 has been developed in response to the "gap filler" opportunity for Gemini South, which seeks the relatively rapid deployment of a near-infrared spectroscopy and imaging capability. A conceptual design review of Flamingos 2 was held on April 28, 2000. The Gemini review committee judged Flamingos 2 as suitable for Gemini's needs and aspirations. Currently, IGP, USGP, and the University of Florida are discussing strategies for procuring Flamingos 2.

Taft Armandroff
Mark Trueblood

Views of Gemini South

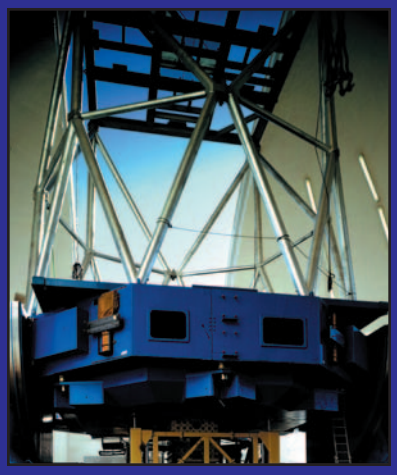
Approach to Cerro Pachón by C. Carter

Mirror Coating Chamber by N. Crawford



Senior Controls Engineer Chris Carter on the walkway of the telescope by G. Perez

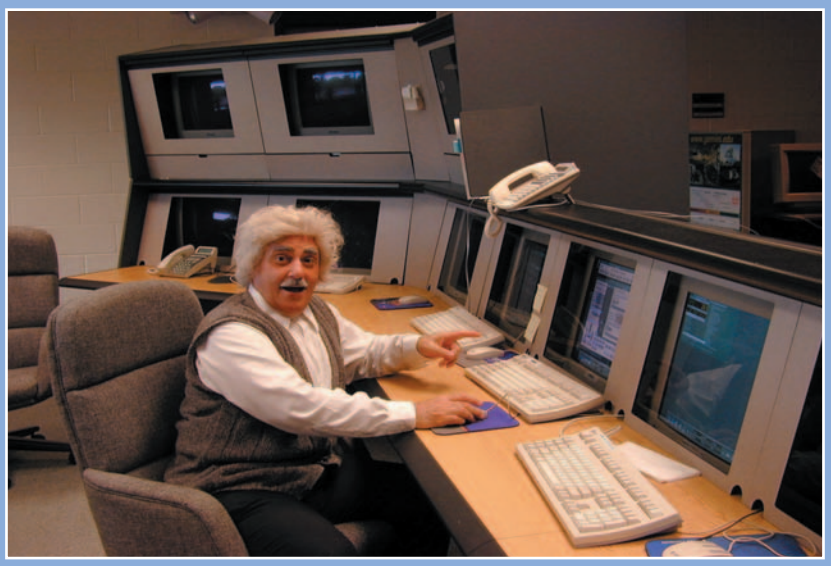
First Oil on Gemini South



Gemini South before the secondary mirror assembly was attached. Photo by N. Crawford

Gemini South on Cerro Pachón by N. Crawford

A surprise visit to the Gemini North Control Room by a well known face in science! See PIO update (p.10) for details.



In this issue:

- The Hokupa`a/QUIRC Demonstration Science Program on the Galactic Center
- Hokupa`a + QUIRC Observations of the Center of M32
- *Tools of Vision* Centerfold Images by Neelon Crawford
- New Feature – Spotlight on Staff : Dr. Inger Jørgensen

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