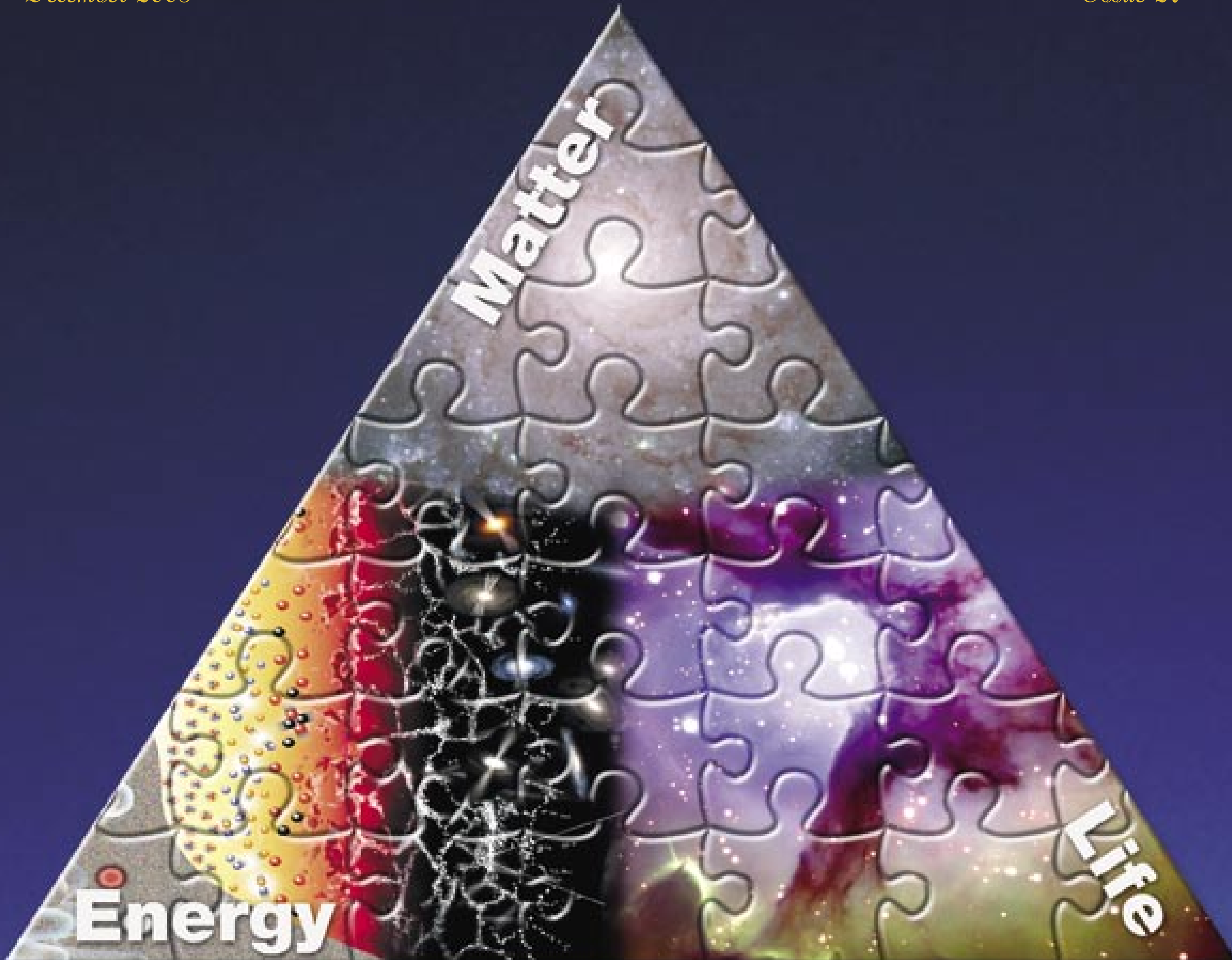
GEMINI OBSERVATORY NEWSLETTER

December 2003 Issue 27



Energy, Life and Matter: The three major themes of Gemini's future Science & Instrumentation Programs

Inside This Issue

IMAGE FROM GMOS-SOUTH RIVALS VIEW FROM SPACE

HCG 87 – Gemini GMOS-S

The individual images captured by GMOS-South in g', r' and I' were obtained in seeing conditions better than 0.4 arcseconds.

HCG 87 – HST/WFPC2

Semester 2003A at Gemini South was highlighted by the swift and successful commissioning of GMOS-South. Supported by the expertise of the UK and GMOS-North commissioning teams, the GMOS-South team fully commissioned the instrument—including imaging, long slit, multi-object slitlets and Nod and Shuffle capabilities—within a few months. Data taken by GMOS-South of the Hickson Compact Group 87 illustrate the point that, under excellent sky conditions, Gemini's image quality rivals space facilities. Gemini's image was released in mid-summer alongside an image of the same field obtained with Hubble Space Telescope's WFPC2 that is also shown here.

GEMINI OBSERVATORY NEWSLETTER

Published twice annually in June and December.
Distributed to staff, users, organizations and others involved in the Gemini Observatory.

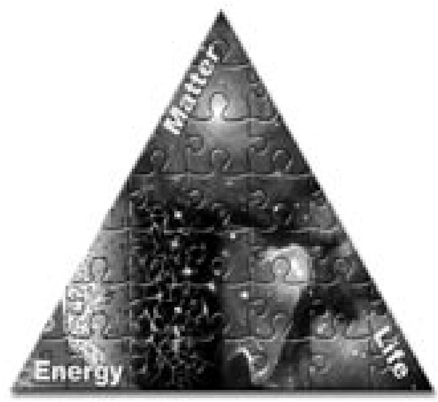
FUTURE SCIENCE AT GEMINI

New Horizons, New Science, New Tools

Astronomers are some of the most fortunate scientists in the world. After all, we work in a field that has captured humanity's attention and imagination for millennia. Through our marvelous observatories perched high atop mountains, we detect radiation in a myriad of forms, measure its properties, compare it to experiments run on the Earth, and deduce awe inspiring conclusions about the Universe and our place in it.

Gemini, as a forefront astronomical observatory, plays a critical role in the ongoing process to understand our Universe and reveal its nature for everyone to understand. Gemini's current generation of instrumentation has already begun to unravel many mysteries. These include a wide range of studies, from surprising new details on galactic evolution in the early Universe to direct infrared images revealing the telltale impact of a planetary system in a stellar debris disk.

Based on this foundation, the future of Gemini's instrumentation and the exciting science that it enables, is now being defined. It began with the mandate by the Gemini Board in 2001 to initiate a process that would define Gemini's science and instrumentation plan for the next decade. The process culminated in the small resort town of Aspen, Colorado, in June of 2003, when almost 100 scientists and Gemini users came together to discuss future goals. The Aspen conference resulted in the development of the formal science case and a detailed plan for future instrumentation. At its November 2003 meeting, the Gemini Board approved the recommendations of the Aspen conference and now the real work begins.



Key Questions Posed at the Aspen Conference:

- ***How do galaxies form?***
- ***What is the nature of dark matter on galactic scales?***
- ***What is the relationship between super-massive black holes and galaxies?***
- ***What is dark energy?***
- ***How did the cosmic "dark age" end?***
- ***How common are extra-solar planets, including Earth-like planets?***
- ***How do star and planetary systems form?***
- ***How do stars process elements into the chemical building blocks of life?***

The results of the so-called "Aspen Process" can be distilled into a few basic questions (listed at left) that Gemini intends to answer starting in the middle of this decade. These questions can be conceptually grouped into three "Universes": Energy, Matter and Life.

The boundaries and interfaces between these topics are perhaps best understood in a piecemeal fashion, similar to the early steps in solving a jigsaw puzzle (at left and on cover). Only through detailed future observations will we collect enough pieces to understand the most important links, bridges and gaps in the puzzle, and ultimately complete the picture that represents the Universe that we live within.

In this newsletter, the Gemini Observatory is pleased to announce that we are poised to launch a next-generation instrumentation program yielding tools that are more advanced, sensitive, and dramatically more scientifically enabling than anything built to date. This is all driven by the bold expectations of our astronomical community that, in the tradition of science, we can answer still deeper questions about our Universe.

BOARD APPROVES LONG-RANGE INSTRUMENT PLAN

Doug Simons

During November 2003, the Gemini Board decided to proceed with key elements from the recommendations generated at the Gemini Aspen Instrumentation Workshop. What follows is a status report of the existing instrumentation program, a look into the longer-term future of Gemini's instrumentation and a glimpse at the science that it will enable.

Current Status of the Instrument Program

Since the last newsletter report on Gemini's instrument program, enormous progress has been made in developing new capabilities for the Gemini community. The "wave" of instrumentation mentioned in the previous newsletter has arrived, with new instruments being delivered at the staggering average rate of one every two months during the past year. This work includes acceptance testing, integration, commissioning, and releasing new instruments on a mode-by-mode basis—all while maintaining on-going telescope activities and an aggressive science operations plan. Keeping up with this pace of activity is a testament to the fortitude and diligence of Gemini's entire staff.

Only a few years ago, the optical ports on the telescopes' instrument support structures were occupied by ballast weights. By the beginning of 2004, they will be completely occupied with new instruments and support facilities (***Figure 1***). Commissioning all modes of the instruments delivered to date will certainly extend through 2004. Given the high demand for science time on both telescopes, this will preclude commissioning all modes of every instrument as fast as might otherwise be possible. Nonetheless, we are now equipped with instrumentation to exploit the unique observing platforms that the Gemini telescopes provide. The thrust of this update, given the Gemini instrument program's current state, is to examine the question of where we go from here.

Some might argue that the Observatory should focus exclusively on supporting research now that we are equipped with a broad range of instruments and have more coming over the next couple of years. This is tantamount to hanging "No Vacancy" signs on the backs of the telescopes and foregoing development of new instruments, at least for the near future. An enormous investment in the Observatory has been made to date, and pausing to take advantage of that investment to reap the scientific rewards that await our community is a strategy that has some merit.

The problem with this approach is that astronomy is fundamentally a technology-driven enterprise. The optical systems, electronics, detectors, and software that comprise modern astronomical instrumentation enable and limit our capacity for discovery in a universe that remains substantially unknown to us. Combined with the time needed to develop new instrumentation (in many cases the better part of a decade), it becomes clear that the vitality of an observatory like Gemini depends fundamentally on an ongoing instrument development program. Scaling back in our instrument development program now would leave us with an instrument set that is obsolete and incapable of performing at the level of advanced research our community demands and rightfully deserves.

With this in mind, the Gemini Observatory, its National Partner Offices and hundreds of astronomers within the Gemini Partnership, collectively set-out to chart Gemini's scientific course and define the new instrumentation required to keep Gemini at the forefront of

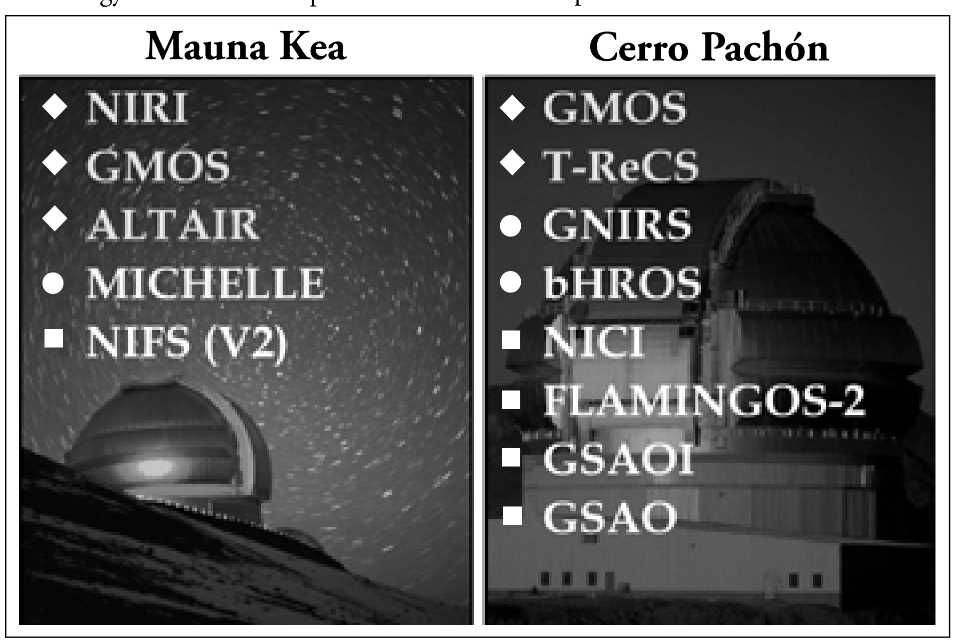


Figure 1: *A summary of the facility instrument status at Gemini North and Gemini South ◆ indicates instruments that have been commissioned and are being used regularly, ● indicates instruments that are being commissioned at the time of this report, and ■ indicates instruments that are still under development.*

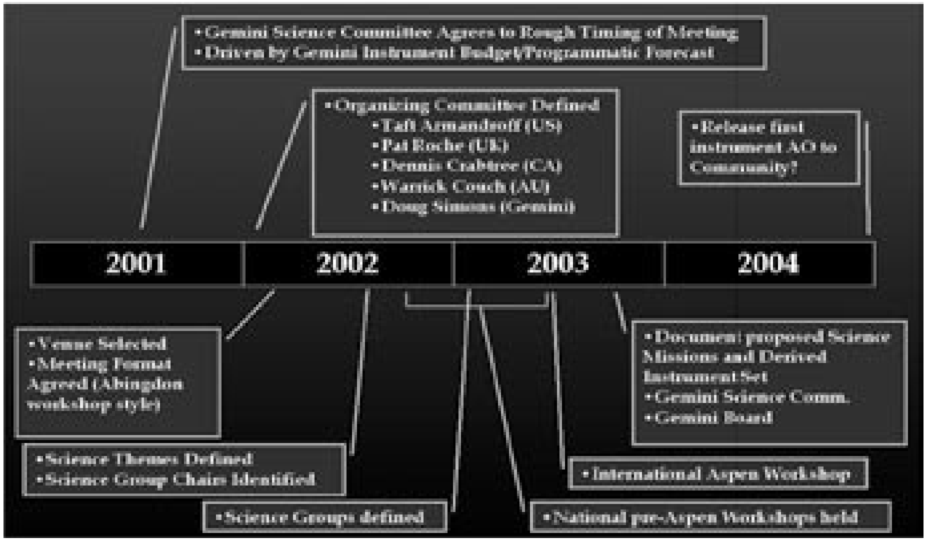


Figure 2: *A timeline depicting Aspen Process milestones over the last two years.*

astronomical research.

What Lies Ahead in the Instrument Program: "The Aspen Process"

The path to Gemini's next generation of instruments led through the small town of Aspen, Colorado, in June 2003. Over 90 members of the Gemini astronomical community attended the Aspen Instrumentation Workshop. Community involvement is a basic and essential element of the strategic planning process within Gemini's instrument program, and this workshop was the culmination of the community's involvement in defining future research directions at Gemini. The Observatory serves as a conduit for instrument teams within the Partnership, who provide capabilities that enable science for its worldwide constituency of astronomers. Therefore, it is crucial that the definition of future instrumentation stems from Gemini's users and their vision of future astronomical research. This periodic external scientific infusion into Gemini's development program is the heart of what has come to be known as the "Aspen Process."

The Aspen Process began in July 2001 with a Gemini Science Committee (GSC) recommendation to launch the next round of instruments through a science conference in 2003. ***Figure 2*** illustrates the various steps taken between that GSC meeting in July 2001 and the Aspen meeting in June 2003. The Observatory was asked to organize this science conference, and in turn, recruited lead scientists within several partner countries to act as the organizing committee. After selecting a venue for the meeting, four science themes were defined, which together broadly defined a comprehensive set of astronomical research topics. The intent of defining these themes was to structure the workshop and its participants into four groups that could each focus on a set of research topics, ranging from planetary science to high-z cosmology. The science themes and corresponding group chairs participating in the Aspen Workshop included:

- Stars, the Solar System and Extrasolar Planets (Chris Tinney);
- Star Formation Processes and the Interstellar Medium (Michael Meyer and Bob Blum);
- Structure and Evolution of the Milky Way and Nearby Galaxies (Rosie Wyse);
- Formation and Evolution of Distant Galaxies and the High Redshift Universe (Bob Abraham).

In parallel with this activity, the organizing committee also held pre-Aspen meetings within each partner country in order to develop coherent science perspectives leading into the international workshop. These pre-Aspen workshops were generally structured along the same science themes as the Aspen meeting, and acted as a channel for many astronomers to inject their perspectives regarding Gemini's scientific future. The Aspen attendees participated in these preliminary national workshops, thereby providing continuity between all of the various science meetings. The makeup of each science group was proportioned along partner shares in the Gemini Observatory, which ensured that each group had broad international representation and received input from each of the pre-Aspen national workshops. In addition, Gemini science staff members were present in each of the Aspen science groups.

The Aspen Process has two phases: (1) developing the science case; and (2) defining new instrument requirements (***Figure 3,*** next page). The science definition phase of the Aspen Process recently ended with a recommendation from the GSC to the Gemini Board about which new capabilities should be developed. A second parallel track of activity, the instrument definition phase, began soon after the Aspen Workshop. This track focuses on the generation of cost estimates for the potential new instruments and the facilities required to support the science mission identified at Aspen.

Future Science with the Gemini Observatory: The Aspen Science Report

The principal product from the Aspen Workshop is a science report articulating key questions in astronomy that can be addressed through new instrumentation at Gemini in the next 5-10 years (see center panel on page 1). In the Aspen Workshop report *Scientific Horizons at the Gemini Observatory: Exploring A Universe of Matter, Energy, and Life*, three different "Universes" are discussed as a means of naturally partitioning these key science questions.

First, the report discusses the "Universe of Matter." Far more than just an ensemble of hydrogen, helium, and trace elements on the Periodic Table scattered through space, the nature of matter begs a deeper

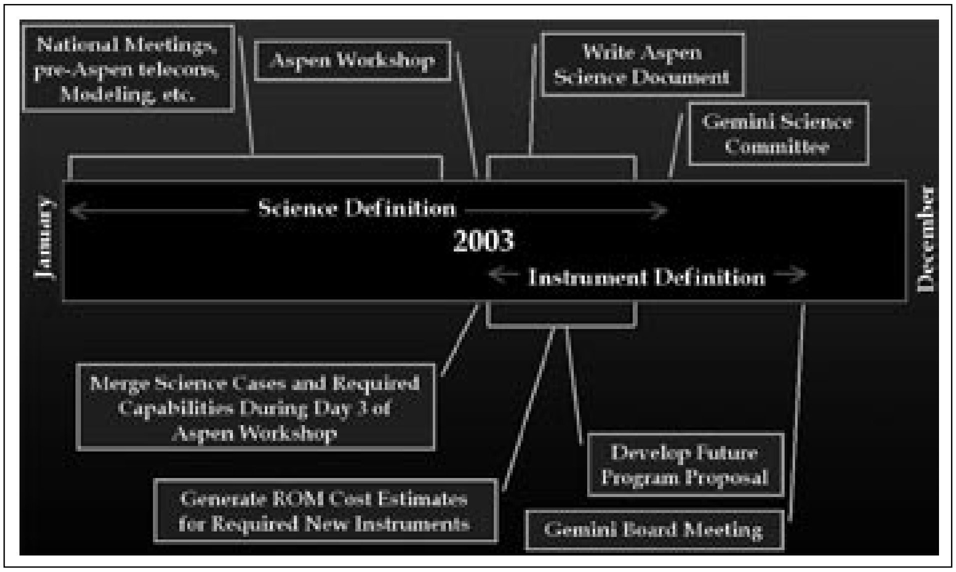


Figure 3: *A more detailed timeline of 2003 milestones in the Aspen Process.*

explanation. For instance, what led to the formation and evolution of galaxies, which are among the largest material structures in the Universe? We know that galaxies are surrounded by an unseen component, often referred to as "dark matter," which dominates their dynamics and evolution, but what is the nature of dark matter? Through observations of the motions of stars within galaxies, we expect to gain a much better understanding of the interaction between matter and dark matter. Furthermore, some of the most bizarre objects known—black holes—are understood to have an important role in the evolution of galaxies, and perhaps even in their formation. Nonetheless, we lack a detailed understanding of how this interaction between massive black holes and galaxies works; how it relates to star formation processes, regeneration and enrichment of the elements; and ultimately, how all of this leads to planet formation and the seeds of life. Past observations have left us with a myriad of possible physical connections and correlations between these processes. What we lack is clear understanding of feedback mechanisms, and how the "snapshots" that we have of distinct objects actually interact and evolve over time.

The next topic in the Aspen science report is the "Universe of Energy." Like matter, the bulk of the energy in the Universe exists in an unknown form. Recent observations have demonstrated that the Universe is expanding through an unknown force called "dark energy," which counteracts the mutual gravitational attraction of the Universe's constituent galaxies. What is the nature of dark energy, does it change with time, and what is its role in the formation and evolution of galaxies? Given that this energy is only manifest across cosmological distances, astronomers will undoubtedly make progress in this key area, though links to high-energy physics abound. What were the conditions in the early Universe around the so-called period of "first light," when the first self-luminous structures erupted into existence and filled the early Universe with radiation? Also, what role did this first-light process have in triggering the eventual collapse of structures, including the galaxies that surround us now?

Finally, the report reviews avenues for research on the "Universe of Life." In this area, the proposed research focuses on various formation processes; the symbiotic relationship of stars, gas and dust in the Galaxy; and planets and debris disks surrounding young stars. Understanding supernovae mechanisms generates a better understanding of "standard candles" upon which discoveries, such as dark energy, rely heavily. Furthermore, supernovae are the mechanisms by which enriched material is spread throughout space, only to collapse in time into more stars, disks, and planets. This life cycle of material processing, is traceable back to the first stars in the early Universe. This is an extraordinarily important research field because it represents the primary mechanism through which normal matter evolves. Part of deriving a deeper understanding of this cycle includes understanding the planetary systems surrounding our own Sun. We stand to capitalize on the growing census of planets in our solar neighborhood. Through advanced, future observations using Gemini as a platform, it should be possible to directly image and begin to characterize extra-solar planets, instead of just detecting them through indirect means.

Recommendations for New Instrumentation

The GSC was asked during its October 2003 meeting to recommend to the Gemini Board which of the instruments identified during the Aspen Process should be pursued. In order to accomplish this, ten organizations participated in generating cost estimates on the level of a rough order of magnitude for potential new instruments. This effort combined with the workshop science report links the science ambitions of the Gemini community to a set of potential future instruments. Armed with the cost estimates and top-level design requirements, the GSC's recommendations were considered by the Board during its November 2003 meeting. The Board endorsed taking the first steps to develop the new instrumentation identified through the Aspen Process. These steps include:

- Starting design studies for two new instruments, including a high performance extreme adaptive optics coronagraph and high-resolution near-infrared spectrometer;
- Initiating a feasibility study for a wide-field, fiber-fed optical multi-object spectrometer;
- Initiating a feasibility study for a Ground Layer Adaptive Optics (GLAO) system;
- Identifying innovative ways to support

key science goals developed during the Aspen Process by either modifying Gemini instruments already under development or by using unique visitor instruments.

One of the instruments our community has expressed an overwhelming demand for is an extreme adaptive optics coronagraph capable of directly imaging extra-solar planets. The past decade has been ripe with discoveries of planets beyond those in our own Solar System through spectroscopic techniques. The time has come to take this research to the next level, and Gemini is positioning itself, by the end of the decade, to both image and spectroscopically characterize gas-giant planets orbiting nearby stars.

Observing extra-solar planets will be akin to what Galileo did hundreds of years ago, but on a vastly larger scale. The technical advancements needed to realize this capability are staggering, because it requires contrast ratios that are much higher than anything achieved by existing coronagraphs. Our community, nonetheless, accepts this challenge because it recognizes the strength of Gemini's worldwide ensemble of instrumentation teams, who are uniquely poised to push adaptive optics technology and advanced coronagraphic masking techniques to new limits.

Along the same vein, our community has expressed a strong desire for an advanced high-resolution infrared spectrograph. With a maximum spectral resolution of R~70,000 and using a built-in wavelength fiducial, this instrument will be able to detect planets approaching a few earth-masses when orbiting low-mass brown dwarfs, which of course have been discovered in great numbers in recent years. When operated in an R~30,000 MOS mode, this same instrument will be able to sample large numbers of young stars in compact stellar nurseries and will provide the capability to efficiently map their multiplicity fraction, group dynamics, and the orbiting debris disks where new planetary systems are forming.

These magnificent new instruments are part of a continuum of capabilities that the Observatory is systematically developing over a 10-15 year period to drive detections of extra-solar planets to ever lower mass regimes. Such legacy-class science will surely impact astronomy for decades to come. Even though the generation of astronomers using these new instruments may not live to see the day that we launch our first interstellar probes, the extra-solar planets they observe may become some of the first targets that such deep space probes are programmed to encounter.

In addition to beginning design studies for a new coronagraph and high-resolution infrared spectrometer, the Observatory will be funding feasibility studies of still more technically challenging yet scientifically rewarding instrumentation. One of these includes a new wide-field multi-object optical spectrograph, offering a multiplex gain of nearly an order of magnitude greater than any spectrometer built to date. The many potential science missions for this incredible machine include characterizing the time evolution of dark energy, studying the detailed distribution of dark matter around galaxies, and tracing the "genealogy" of the Milky Way by distinguishing the various stellar constituents that long ago merged to form what we now recognize as our galaxy.

Gemini will also fund a feasibility study in Ground Layer Adaptive Optics (GLAO), an emerging technology that will potentially yield adaptive optics-corrected images across much larger fields than the adaptive optics and multi-conjugate adaptive optics systems currently in use and under development (albeit with lower resolution). This capability can be used to support wide-field, high-resolution near-infrared imaging and spectroscopy, with scientific applications that include the detection and characterization of "first light" objects, which are the first luminous objects to populate the Universe not long after the Big Bang.

Gemini is committed to spending nearly US$2,500,000 over the next two years to support both concept-level design studies and basic feasibility studies for next-generation instruments. This is intended to yield more accurate cost estimates and performance predictions before final commitments are made to complete new instruments. Full funding for the next-generation instruments has not yet been secured and will be taken under consideration as part of the next five-year (2006-2010) Gemini budget cycle. The Observatory is working closely with its funding agencies to acquire the resources needed to make these instruments, and their scientific potentials, a reality for our community. Additional details about these proposed new instruments, the community-based process used to identify them, the various science missions planned for them, and the bidding process can be found on Gemini's web page located at: http://www.gemini.edu.

It is important to recognize a key difference between the 1997 Abingdon Instrumentation Workshop and what occurred in Aspen in 2003. In the former, funding already existed to build the next-generation instruments for Gemini; hence, the Abingdon Workshop included a blend of technical and science discussions. With funding for new instrumentation already defined, the core question at Abingdon was how to spend it wisely. In contrast, at the time of the Aspen Workshop no funds existed to build these new instruments for Gemini, as the current five-year fiscal cycle ends in 2005. As a result, the Aspen Workshop focused on "big science questions" in astronomy that can be addressed through new capabilities. The product from the Aspen Workshop is a comprehensive and compelling science case, which the Gemini funding agencies can in turn use to support future fund-raising activities.

Continuing in the Tradition of Science

In contemplating these new horizons, and the instruments that will lead Gemini into the future, it is appropriate to put our efforts into an historical perspective.

Because the energies, time-spans, and masses of phenomena in the Universe are simply too large to contain or reproduce in the confines of laboratory experiments on the Earth, astronomers provide the "big picture" context to our understanding of our physical environment. There are countless examples of this process in astronomy. Galileo transformed our perception of the solar system as he documented the Jovian moons circling Jupiter with rhythmic precision. Observations of a solar eclipse, the better part of a century ago, demonstrated the mind-boggling concept that space is perceptibly warped in the vicinity of a massive object (like the Sun). This bending of space is one of the basic facets of Einstein's General Theory of Relativity that still acts as the "gold standard" by which other physical theories of the Universe are judged. Hubble used the largest telescope of his time to demonstrate that our Universe is not stagnant, but is in fact expanding, implying that at one instant billions of years ago, all matter and all energy shared a single infinitesimally small co-existence. In all of these cases, and many more, astronomers used the research "machines" of their times to fundamentally change our understanding of the Universe.

The bold and innovative instrument concepts developed through the Aspen Process will keep Gemini at the forefront of research well into the next decade. If we can use these new capabilities to answer but one of the questions identified in the Aspen Workshop, we will make a profound contribution to humanity's conception of a Universe that is filled with matter, energy, and possibly life beyond Earth.

ASTRONOMICAL POLARIMETRY: CURRENT STATUS AND FUTURE DIRECTIONS

March 15-19, 2004
Waikoloa Beach Marriott, Waikoloa, Hawai'i

We are pleased to announce a conference on Optical-Infrared-Millimeter-Submillimeter (OIM) Astronomical Polarimetry co-sponsored by the Gemini Observatory. The discussion topics include the most recent results in this exciting field, the potential for polarimetry in the era of 8- and 10-meter optical-infrared telescopes and millimeter-submillimeter facilities, ground-based polarization mesaurements, and new instrumentation and techniques.

The conference web site, including conference registration forms, is open at: http://www.jach.hawaii.edu/JACpublic/JAC/pol2004

SCIENCE AREAS

Sessions will be divided with approximately 80% of the time guaranteed for current results and 20% for presentations on future directions and facilities. Proceedings, including posters, will be published. The web site provides additional session details.

The following science areas will be covered: (1) Techniques, Instrumentation and Data Analysis; (2) Theory and Modelling; (3) Star Formation; (4) Extrasolar Circumstellar Matter; (5) Ejecta; (6) Interstellar Dust and Gas; (7) Stars, CVs and Magnetic Stars; (8) Galaxies, Radio Galaxies and AGN; (9) High-redshift and Cosmological Polarimetry.

DATES AND DEADLINES

End of Early Registration: 1-Dec-2003 • Abstract Deadline: 1-Jan-2004 • Late Registration Deadline: 1-Feb-2004

Contact email address: pol2004@jach.hawaii.edu

RECENT SCIENTIFIC HIGHLIGHTS

Jean-René Roy & Phil Puxley

The last six months have produced a rich variety of science results from both Gemini telescopes. The yield has been particularly spectacular at Gemini South with pioneering PHOENIX results coming out for publication.

The first papers from the GMOS-North *Gemini Deep Deep Survey* (GDDS) have been submitted and will soon be published. This work is remarkable on several fronts. It corresponds to about 100 hours of telescope time on Gemini North that led to huge amounts of deep spectroscopic data in an unexplored redshift window corresponding to a time when the Universe was between approximately 20-40% of its present age. Because only very few galaxies have been observed in this window of time, it is the called the "redshift desert." The strong background in the red optical window is responsible for part of the difficulty of observing galaxy populations at these redshifts. The Nod and Shuffle (N&S) technique described in the previous issue of the Gemini Newsletter circumvents this problem in large part. Nonetheless, spectra obtained by the GDDS team are particularly challenging to handle since the objects are only a fraction of the background sky brightness.

The team led by Bob Abraham (University of Toronto), Karl Glazebrook (Johns Hopkins University), and Patrick McCarthy (Carnegie Observatories) managed to reduce all the GDDS data, to complete the analysis and to submit the first papers in less than a year after obtaining the data on Gemini North. This work represents one of the largest GMOS datasets obtained so far. It is also among the very first GMOS papers out, a vibrant testimony to the well-organized effort of the GDDS team. GDDS data are public and can be downloaded from the GDDS homepage http://www.ociw.edu/lcirs/gdds.html

We also started two large GMOS programs on Gemini South in 2003B designed to explore the nature of distant galaxies and to probe galaxies in their very first evolutionary phases. The first program led by Jim Dunlop (80 hours) is aimed at studying the nature of extremely red objects (ERO) in the Great Observatories Origins Deep Survey (GOODS) and

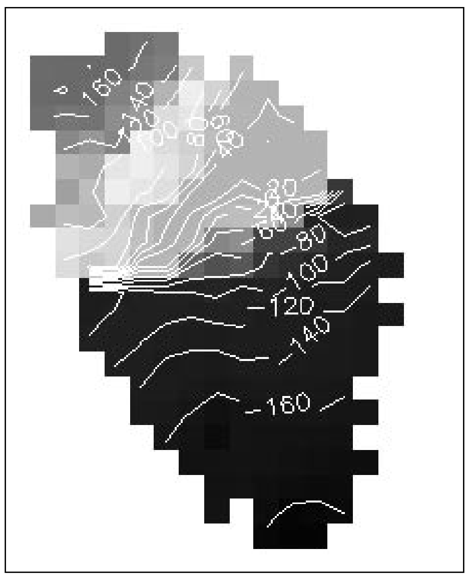


Figure 1: *The velocity field of arc #289 in Abell 2218. We see this z = 1 galaxy with as much detail as if it were at z = 0.1 (Swinbank et al., 2003).*

Chandra South Fields. The second program led by Karl Glazebrook (125 hours) is to obtain the deepest spectra ever recorded of the highest redshift objects in the Hubble Ultra-Deep Field.

The GMOS-IFU work of Swinbank et al., 2003, on the velocity field of the z = 1 lensed galaxy #289 in the galaxy cluster Abell 2218 has recently appeared in The Astrophysical Journal (November 20, 2003). This pioneering work using integral field spectroscopy is a wonderful illustration of Gemini's science capabilities (***Figure 1***). Few very large telescopes possess such a tool at the moment, and we have a unique competitive edge.

The first paper from the visiting instrument FLAMINGOS has been published this fall in The Astrophysical Journal Letters. Meanwhile, the average flow of papers from GMOS-North and NIRI programs is still slow after more than two years on the telescope. There is a massive amount of GMOS data in the hands of our communities, and frequent contacts with PIs indicate that there is no particular problem. On the contrary, the quality of the data they have is outstanding as was expressed by several Gemini PIs at the Aspen Workshop on future Gemini instrumentation. The reduction tools are working (most often the Gemini packages are used), but the analysis and interpretation is just taking some time. What we are seeing is the normal lapse of 2 to 2.5 years needed to get the papers out. The GDDS team clearly stands out. To facilitate the data reduction process, we are actively working to have automatic processing of images and spectra produced by most Gemini instruments through the On-Line Data Processing (OLDP) system. For additional details, refer to the articles in this newsletter about the Gemini Science Archive and Gemini IRAF development team report.

Gemini South With FLAMINGOS Finds Distant Quasar SDSS J0836+0054 To Be Surprisingly Red and Dusty

Daniel Stern of the Jet Propulsion Laboratory and his USA-UK-Chile team of astronomers (including Gemini South astronomer Michael Ledlow) used the visitor instrument FLAMINGOS, a multi-object near-infrared spectrograph at

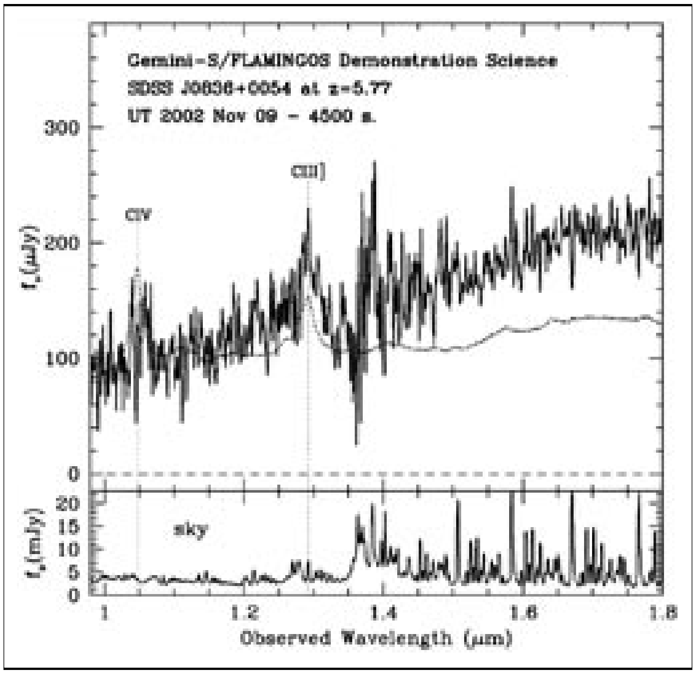


Figure 2: *Near infrared spectrum of the z = 5.77 quasar SDSS J0836+0054. The particular red slope of the spectrum is illustrated by the comparison with a composite quasar spectrum (dotted line). The quasar has a J magnitude of 17.89 +/- 0.05.*

Gemini South, to study the high-redshift quasar SDSS J083643.85+005453.3 (name shortened to SDSS J0836+0054). SDSS refers to the Sloan Digital Sky Survey where the quasar was first discovered. The object is among the most distant X-ray sources currently known, and is also the most distant known radio source.

Using the line of CIII] at 1909 Angstroms, the team was able to derive a more accurate redshift of z = 5.774 +/- 0.003 for this distant quasar. Because of its high redshift and the effect of foreground hydrogen absorption, the quasar is invisible at optical wavelengths. In addition to the spectral lines of carbon, lines of other heavy ions such as nitrogen, oxygen and silicon are also present in the spectrum of the quasar. This is remarkable because the emission-line gas associated with this quasar, seen when the Universe was less than a billion years old, has heavy element content similar to that of low-redshift quasars.

The most striking aspect of SDSS J0836+0054 is its red color (***Figure 2***). The spectrum has a spectral slope much redder than most of the 4576 quasars compiled from the SDSS. Reddening by dust in the environment of the quasar is the obvious explanation, implying substantial dust production at an early cosmic epoch. The authors of this Gemini study remark that SDSS J0836+0054 requires substantial enrichment in heavy elements of the quasar environment, even at times less than a billion years after the Big Bang.

A Census In The High Redshift Universe: Metal Abundances In The "Redshift Desert" Galaxies

Sandra Savaglio, Postdoctoral Research Fellow at Johns Hopkins University, and a group of collaborators from the U.S., U.K., Canada and Gemini (Kathy Roth and Inger Jørgensen) have published the first paper on the properties of galaxies in the "redshift desert" as part of the GDDS program on Gemini North (GDDS is described above and in the previous issue of this Newsletter). Briefly, the goal of the GDDS is to study an unbiased sample of K < 20.8 galaxies in the redshift range between 1 < z < 2. This work used the N&S technique to allow extremely deep spectroscopy in the far-red region of the optical spectrum, which is strongly affected by telluric sky emission. The GDDS is the most sensitive survey to date that focuses on the redshift desert. The ~30 hour exposures allowed the investigators to reach very faint limiting magnitudes (I_{AB} = 24.8). The 1 < z < 2 redshift range is a particularly intriguing period in the history of the Universe since it is expected to span a major—as yet unstudied—epoch of galaxy building.

Savaglio and her co-investigators have determined the heavy element abundances of the interstellar medium for a sub-sample of 13 galaxies in the redshift desert using ultraviolet absorption lines of the neutral Interstellar Medium (ISM). The galaxies chosen are the brightest in the ultraviolet, and are the most massive as well ($M > 10^{10} M_{sun}$). They have colors typical of irregular and late spiral galaxies of Sbc type. Strong [OII]3727 nebular emission indicates star formation rate (in the HII regions) at the levels of SFR ~ 12 - 95 M_{sun} /year. In the cold ISM, heavy elements can most easily be investigated through the curve-of-growth analysis of ultraviolet absorption lines. A composite spectrum of the 13 galaxies (mean redshift of 1.6) was produced and it shows strong Mg II and Fe II ISM absorption, with

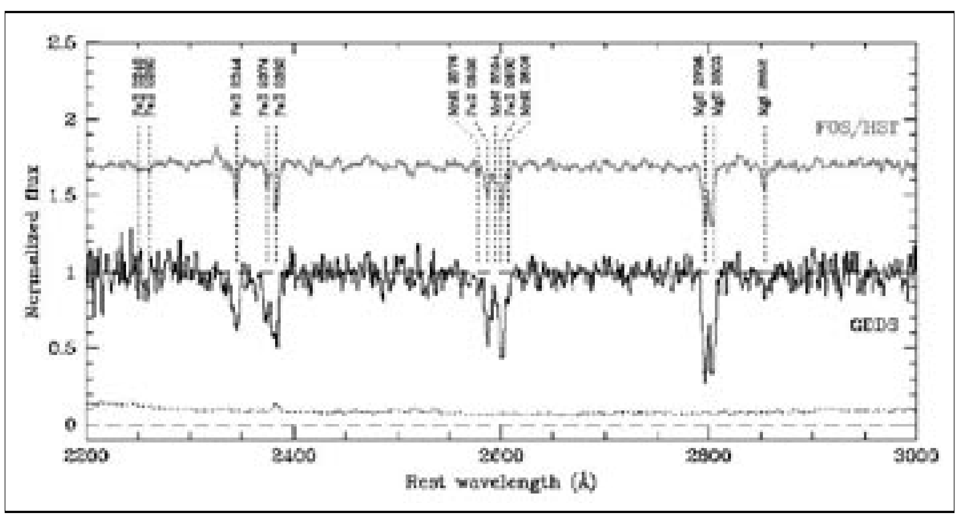


Figure 3: *Combined spectrum of 13 GDDS galaxies with ISM absorption lines (lower spectrum). Absorption features are marked with dotted lines. As a reference, a composite spectrum of 14 local starburst dwarf galaxies observed with HST-FOS is shown (top spectrum).*

weak Mn II and Mg lines (***Figure 3***). Column densities of ions are considerably larger than typical values found in damped Lyman-alpha (DLA) absorbers along Quasi-stellar Objects (QSO) lines of sight. Assuming values of neutral hydrogen column densities similar to other star forming galaxies, and a moderate Fe dust depletion, the derived metallicities of Z ~ (0.2 - 1) Z_{sun} are typical of redshift desert galaxies. This abundance range corresponds to levels seen across the most luminous part of the disk of our Galaxy.

These measurements indicate that the metal enrichment of the GDDS galaxies is high in comparison with QSO-DLAs of the same redshift range. However, elevated metallicity is not surprising in the light of the high formation rate of massive stars.

PHOENIX On Gemini South Reveals Clues About The Origin Of Fluorine

Despite our awareness of fluorine's unique properties, its astrophysical origins are not well understood. Like most heavy elements, fluorine is a product of nuclear reactions in the hot cores of stars during various phases of their evolution. Furthermore, fluorine is not easy to observe in the Universe, and very few spectroscopic measurements of fluorine in stars exist. Until this recent Gemini work, only a meager set of data for a few stars in our own Milky Way was available.

A spectroscopic program conducted with PHOENIX at Gemini South has changed this picture. Katia Cunha (Observatório Nacional, Brazil) led a team of researchers to measure the abundance of fluorine in our own satellite galaxy, the Large Magellanic Cloud (LMC), and in the massive galactic globular cluster ω–Centauri. The team studied fluorine under its most accessible form, hydrofluoric acid (HF), which is detectable through vibration-rotation transitions falling in the near infrared close to the wavelength of 2.3 microns (***Figure 4***). These Gemini observations provide unique insights on how fluorine behaves as a function of the abundance of the other elements, specifically metals, and help to identify how fluorine is made.

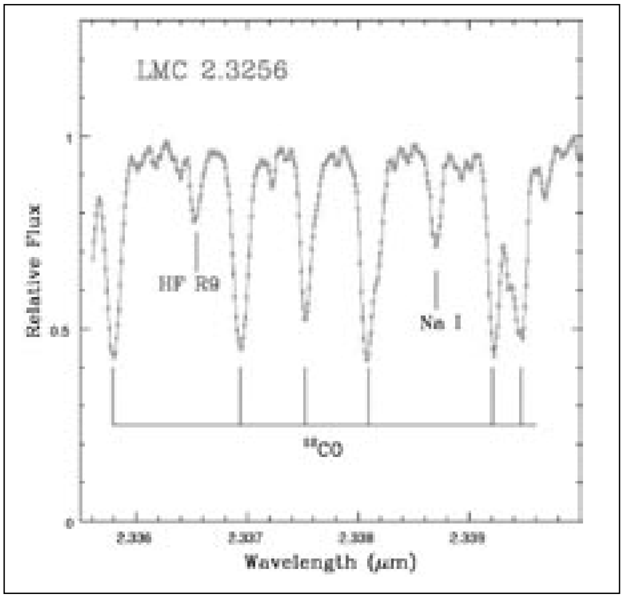


Figure 4: *Near-infrared high-resolution PHOENIX spectrum of a red giant star showing a spectral absorption line of the HF molecule used to derive the abundance of fluorine. Absorption lines of Na I and CO are also visible.*

To better understand the trend of fluorine as a function of metallicity and stellar populations, Cunha and her collaborators compared their Gemini measurements with known K and M type stars in our own Milky Way. The total Gemini sample of stars with fluorine abundance determinations reveals 23 red giant stars across three stellar populations including the solar neighborhood, the massive globular cluster ω-Centauri and the LMC.

The behavior of fluorine abundance as a function of oxygen and iron show definite trends. Oxygen is produced in the supernova explosions of stars with a mass greater than 7-10 M_{sun} (SNII), and iron is derived mostly from lower mass star supernovae (SNI). The ratio of fluorine to oxygen [F/O]—as referenced to this same ratio in the Sun—decreases when going from the near-solar metallicity galactic stars, to the lower metallicity LMC giants and Arcturus (α-Bootis).

The main mechanisms for producing fluorine in stars are known to be: (1) neutrino-induced spallation of a proton from Neon-20, referred to as the neutrino process; (2) synthesis from helium capture by Nitrogen-14 during the so-called asymptotic giant branch (AGB) thermal pulses; (3) production of Fluorine-19 in the cores of massive Wolf-Rayet (W-R) stars. Because the ω-Centauri stars show depletion of fluorine instead of enrichment, the authors were able to easily discard the AGB as an important source of fluorine. For W-R stars to be major providers of fluorine, they probably need to undergo a more substantial mass loss than is currently accepted.

Although a W-R source cannot be excluded at this stage, the best bet for the source of fluorine production is the neutrino process of spallation in supernovae from massive stars (SN type II). Models of neutrino nucleosynthesis also predict that the [F/O] ratio declines steadily as oxygen declines as can be clearly seen in ***Figure 5***.

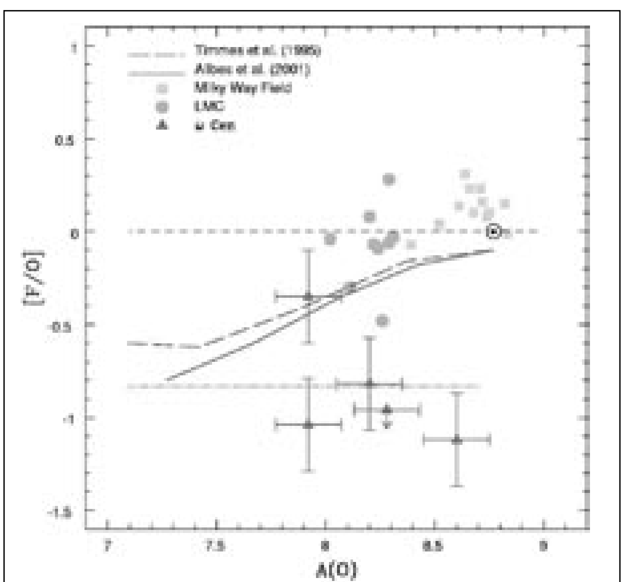


Figure 5: *The ratio of fluorine to oxygen abundance versus oxygen in red giant stars located in the Milky Way, the LMC and the rich globular cluster ω-Centauri.*

(continued next page)

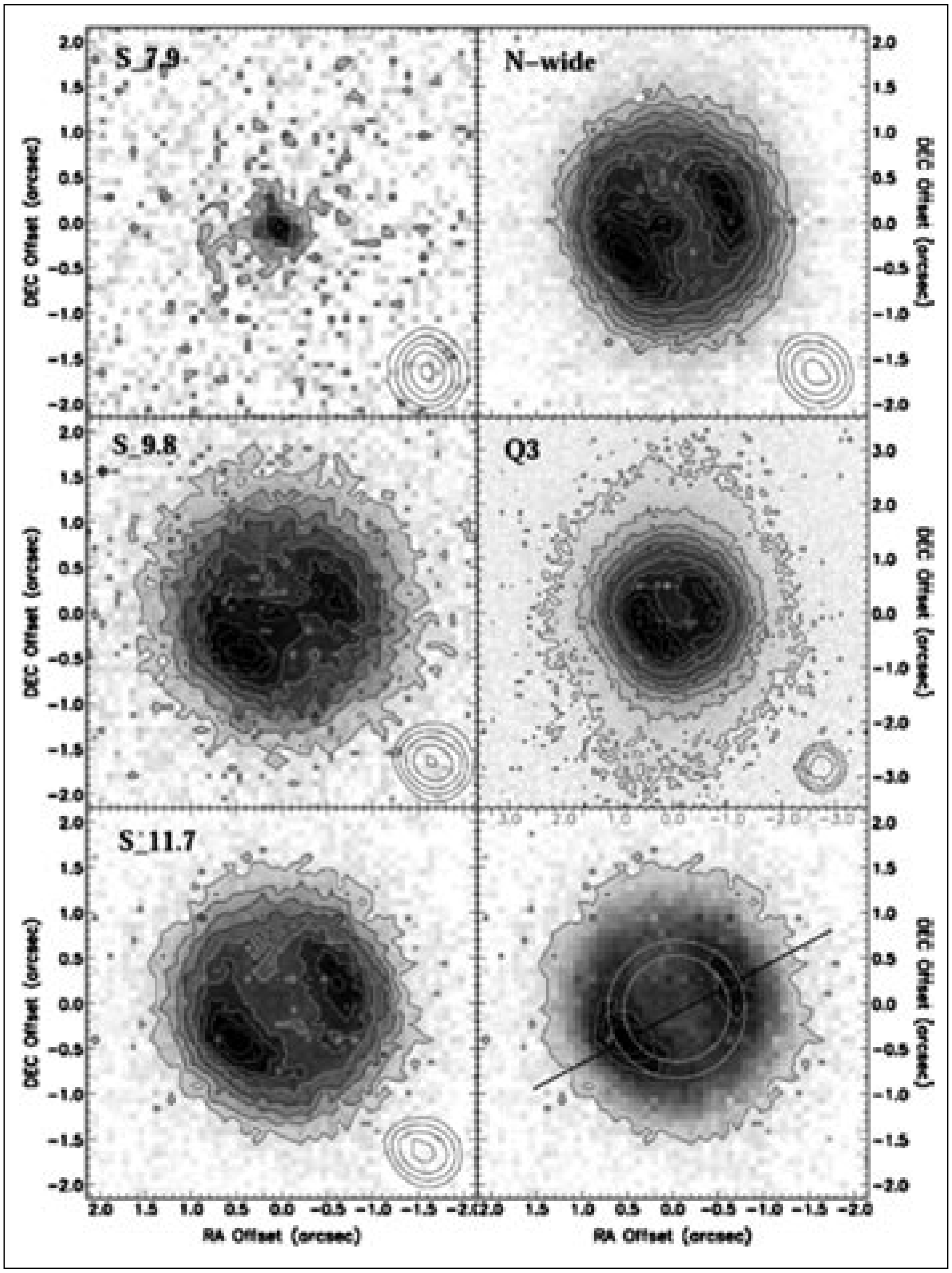


Figure 6: *Images of HD 161796 and its dust shell through five mid-infrared filters. The OSCIR images clearly show the inner boundary of a detached circumstellar envelope (radius 0.6 arcsecond).*

First Resolved Images Of Dust Shell Around Post-Asymptotic Red Giant Star Reveals Key Transition Toward Planetary Nebula Phase

From the end of the asymptotic giant branch (AGB) phase to the post-AGB phase, stars of mass between 1-8 M_{sun} undergo a sharp decrease in the rate of mass loss. This leads to a semi-detached circumstellar envelope of gas and dust that slowly expands from the star. In this immediate post-AGB phase, the star has yet to develop a fast wind or become hot enough to photoionize the gas. The shell is relatively undisturbed and is still a good record of the history of the mass loss events that created it. Gledhill (University of Hertfordshire) and Yates (University College London) used OSCIR on Gemini North to resolve for the first time the dust shell around the post AGB star HD 161796 located at 1.2 kiloparsecs from the Sun (***Figure 6***).

The authors have modeled their mid-infrared observations of HD 161796 using data at other wavelengths, from ultraviolet to submillimeter. The dust shell of HD 161796 is best reproduced by a model with an equator-to-pole density contrast of 6:1 and an inclination of ten degrees with respect to the plane of the sky.

An inner shell radius of 900 AU (with R_{outer}/R_{inner} ~ 12) is derived. The derived star parameters are: $R_{star} = 2.42 \times 10^{12}$ cm (35 R_{sun}), T_{eff} = 7500 K and L = 3.44 x 10^3 L_{sun}. This indicates a current stellar mass of 0.56 M_{sun}. The dust mass in the shell is about 2.96 x 10^{-3} M_{sun}. Assuming a gas-to-dust mass ratio of 240:1, the total envelope mass is 0.71 M_{sun}. Taking V_{exp} = 15 km/s, the mass loss episode responsible for the shell lasted approximately 3200 years, which corresponds to an average mass-loss rate of 2.2 x 10^{-4} M_{sun} /year.

The results are consistent with a model of a star of initial mass between 1 and 2 M_{sun} that lost ~0.7 M_{sun} at the end of the AGB phase and is now a few hundred years into its post-AGB evolution. Given the low core mass, it is likely that HD 161796 will take about another 5000 years to evolve to a temperature of ~30,000 K, by which time it will be the hot central star of an extended (>15 arcseconds) and mildly asymmetric young planetary nebula.

NIRI Catches Mysterious Near-Infrared Emission Following A Major Outburst Of Anomalous X-Ray Pulsar

Victoria Kaspi (McGill University) and her team (including Joe Jensen of Gemini) used NIRI to obtain K-band images of pulsar IE 2259+586 three days after a major X-ray outburst. During this outburst, on June 18, 2002, 80 X-ray bursts were detected within four hours with the Rossi X-ray Timing Explorer. NIRI (using Director's discretionary time) measured an enhancement of a factor of ~3 (with respect to what the source was in 2000) in the post-burst phase (***Figure 7***, right panel). The infrared counterpart had faded by a factor of ~2 one week later.

While the X-ray and radio observations conclusively unify anomalous X-ray bursters and soft gamma ray repeaters, as predicted by the magnetar model, the near infrared enhancement in the post burst phase is puzzling. Currently,

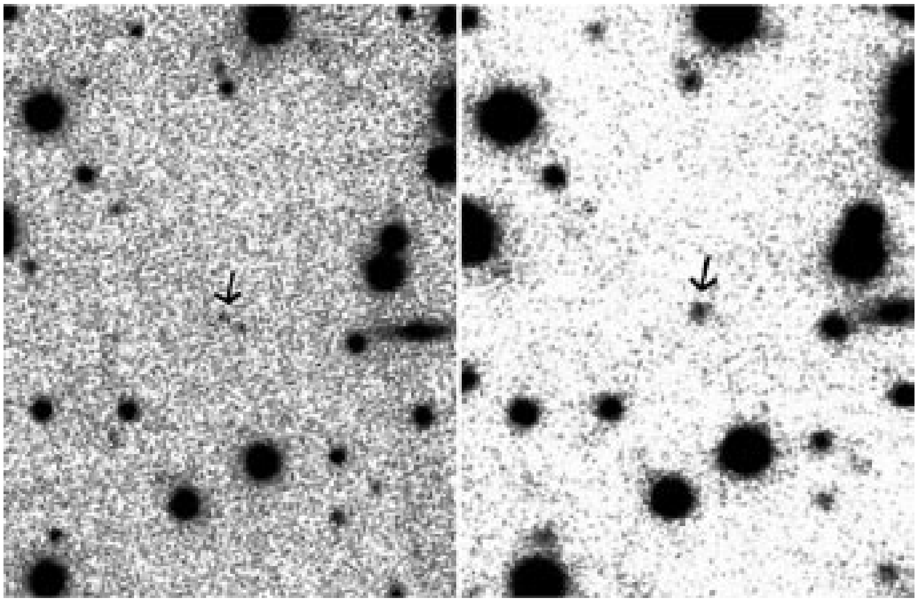


Figure 7: Infrared (2.1-micron) images of the magnetar 1E 2259+586 taken with the Keck telescope (left) in 2000 and with NIRI on the Gemini North telescope (right) just after the burst in June 2002. The magnetar (indicated by the arrow) was 3.4 times brighter in June 2002 than it was two years earlier. Keck image is courtesy of F. Hulleman and M.H. van Kerkwijk.

the magnetar model does not address the origin of such infrared emission. In conventional rotation-powered pulsars, infrared emission is thought to arise from a population of synchrotron radiation from electron-positron pairs in the outer magnetosphere. An infrared enhancement is consistent with a change in the magnetospheric field structure suggested by the torque change.

PHOENIX Discovers That The Closest Known Brown Dwarf Has A Companion

Epsilon Indi A is the fifth brightest star in the southern constellation of Indus and is located at a distance of about 11.8 light years from our Solar System. The star is similar to, but cooler than, our Sun. Widely observed by telescopes on the ground and in space, Epsilon Indi is known to host an orbiting companion, called Epsilon Indi B, which was discovered last year and became the closest known specimen of a brown dwarf to our Solar System. While searching for planet-sized bodies that might accompany Epsilon Indi, a team led by Gordon Walker (UBC), Phil Puxley and Kevin Volk (Gemini South) using PHOENIX on the Gemini South telescope in Chile, made a related but unexpected discovery. On the PHOENIX acquisition image, they found a faint companion to Epsilon Indi B (***Figure 8***), now called Epsilon Indi Bb. The new companion was suspected to be another, even cooler brown dwarf. The nature of the brown dwarf was confirmed shortly after the Gemini observation by a paper from an earlier observation by an ESO team using NAOS-CONICA.

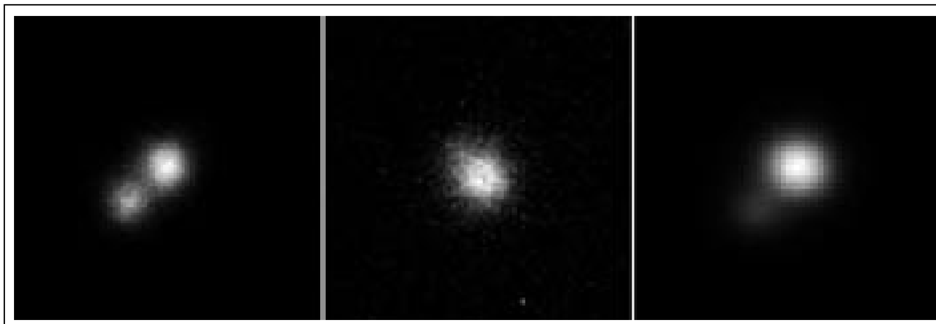


Figure 8: Left is the discovery PHOENIX image of Epsilon Indi Bb in the J-band that is shown as the fainter object at about seven o'clock. The brighter object is Epsilon Indi Ba. Both are brown dwarfs. The companion is not seen in the K image (center) because of the deep methane absorption. Right is the z image obtained with GMOS-South.

The projected separation as seen on the sky between Epsilon Indi and Indi Ba is approximately 1500 AU, and the distance between Epsilon Indi Ba and the newly discovered Epsilon Indi Bb is at least 2.2 AUs.

MICHELLE Peers At The Dust And Gas Of Planetary Nebula NGC 7027

As a part of commissioning and engineering runs at the Frederick C. Gillett Gemini North Telescope in June and July 2003, the mid-infrared imager and spectrograph MICHELLE was used to image the young planetary nebula NGC 7027 (***Figure 9***).

The planetary nebula phase of stellar evolution lasts for only a few tens of thousands of years before the gas is so distant from the star that it no longer glows. NGC 7027 is believed to be one of the youngest known planetary nebulae, having formed within the past one thousand years. Despite its young age, the nebula is approximately 14,000 AU in diameter. While optical images of planetary nebulae allow views of the hot gas that has been blown off from the outer layers of the star, these views are often partially obscured by the dust grains that can form in the cooler outer regions of the nebula. The mid-infrared MICHELLE images presented here (***Figure 9***) map where those dust grains are located within the nebula by detecting the thermal emissions from the grains as they are heated by the intense radiation given off by the central star. Since the longer wavelength infrared filters used in MICHELLE are sensitive to cold material (T ~ 300 K), the intensely hot white dwarf (T ~ 200,000 K) at the core of the nebula is not visible in these images.

On the broadest scale, these MICHELLE images are similar to previous mid-infrared observations of this source. That is, they show that the dust in NGC 7027 is distributed in a ring-like structure in the outer regions of the nebula. However, the high angular resolution imaging offered by MICHELLE and Gemini has revealed small-scale structure in the dust distribution, particularly in the 7.9-micron image (***Figure 9***). The images show that the dust ring is 'broken' in both the northwest and southeast quadrants, directly along the axis of the two outflows known to originate from the central star. In these images, we can see that the outflows are 'punching through' the dust shell and re-distributing the grains along their paths.

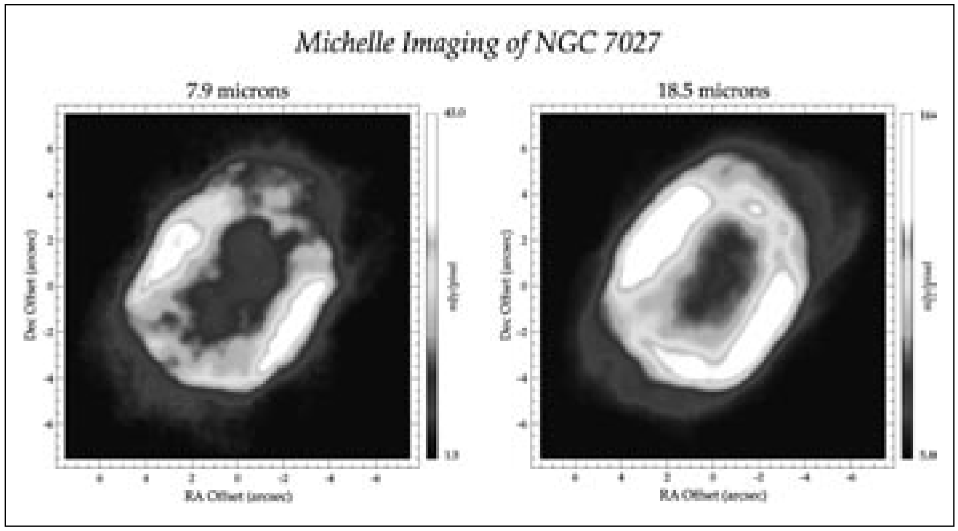


Figure 9: *NGC 7027 as seen through the 7.9- and 18.5-micron narrowband (10%) filters of MICHELLE. For each filter, the on-source exposure time was approximately 30 seconds.*

PROTECTED SILVER COATINGS AT GEMINI: A STATUS REPORT

Maxime Boccas & Thomas Hayward

The Gemini Observatory recently reached an important milestone: on October 9th, 2003, the secondary mirror at Gemini South was successfully coated with protected silver. Previously, both the primary and secondary mirrors were coated with aluminum, resulting in a total telescope emissivity of 3.8% at a wavelength of 10 microns. The success of the new protected silver coating demonstrates that the ambitious goal of 2% total telescope emissivity is attainable.

Figure 1: *The Gemini South secondary mirror passing under a magnetron, which applied the reflective silver layer in the vacuum coating chamber during the silver coating process on October 9, 2003. Gemini Observatory photo by Gustavo Arriagada*

Reflectivity and emissivity are two measures of a mirror's performance. A highly reflective mirror is desirable in any optical-infrared telescope in order to maximize the amount of light reaching the science instruments. Ideally, a coating should reflect as close to 100% of the light that strikes it as possible. However, in the thermal infrared region of the spectrum, a mirror coating also emits a great deal of radiation. The statistical "noisiness" of this emission reduces an infrared instrument's sensitivity to emission from astronomical sources. The emissivity of an optical surface, defined as the ratio between its level of emission and that of a perfect "blackbody" emitter, therefore must be as low as possible in order to maximize infrared sensitivity. Gemini's design requirement is for emissivity not to exceed 4% at 10 microns for both primary and secondary mirrors combined, with a goal of 2%.

Before the recent recoating, all of Gemini's mirrors were coated with aluminum. Aluminum is the material used by most telescopes because of its good reflectivity and high durability. From a scientific perspective, a silver coating is more desirable because fresh silver is more reflective and less emissive than aluminum across much of the optical and infrared spectrum. The drawback is that bare silver tarnishes with exposure to air, specifically to sulfur compounds, and quickly loses its advantage over aluminum. Therefore, maintaining a high-quality bare silver coating requires frequent recoating of the mirror, which is an expensive and time-consuming process. For this reason, no 4- to 10-meter class telescopes at present have silver-coated primary mirrors. Subaru is the only other large telescope with a silver coating (unprotected) on its secondary mirror.

A major goal of the Gemini Observatory since its inception has been to develop a silver coating process that maintains the high quality of fresh silver for a sufficiently long period of time so that the coating costs and the fraction of downtime for recoating are acceptable.

Traditionally, mirrors are recoated every one or two years. The science requirement for Gemini tolerates a maximum of 0.5% emissivity increase of the telescope during operations. There is no official requirement for reflectivity loss in visible light although it is also clearly an important parameter that drives the cleaning procedures and recoating schedule. Aging tests conducted at Gemini South in the dome environment show that bare silver coatings on downward-facing surfaces, which simulate the secondary mirror, tarnish about ten-times slower than silver on upward-facing surfaces like the primary mirror. This suggests that accumulated dust is the primary agent that brings the contaminants onto the film, rather than just exposure to ambient air. In addition, sulfur contamination on a bare silver film doesn't produce tarnishing unless there is diffusion with water. A secondary mirror is also more protected against moisture from condensation than the primary mirror.

The solution to the tarnish problem is to use a multi-layer coating process. A three-layer process was used for the new coating on Gemini's secondary mirror. The first layer is an adhesive mixture of nickel and chromium spread evenly over the mirror's surface with a thickness of 50 angstroms. The second layer is the reflective layer of pure silver spread about 1000-2000 angstroms thick. The third layer is an extremely thin coating of 5 angstroms (or 1-2 atoms thick in order to preserve the optical benefit of the reflective silver layer) of more nickel and chromium. The third layer, which normally acts as an intermediate adhesive in a four-layer film, was also discovered to mildly protect the silver from tarnishing when the real top protective layer is omitted. During a feasibility study conducted in 1994-1995, it was shown that this minimal design with 3 layers could be sufficient to yield the minimum durability for Gemini's secondary mirror.

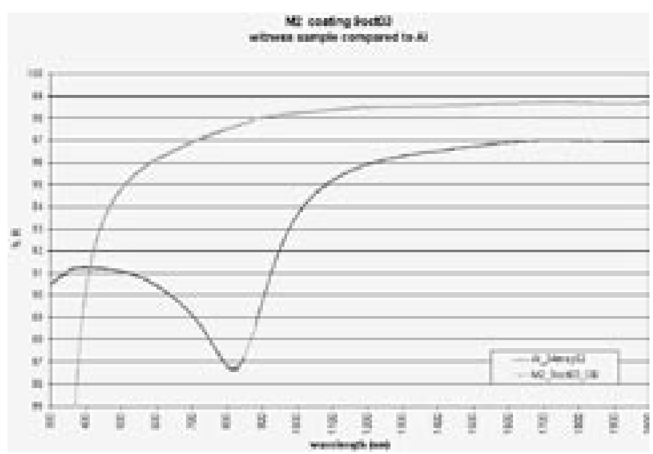


Figure 2: *Graph of reflectivity comparing the new silver coating on M2 (gray line) with an aluminum coating (black line). The vertical axis is the percentage of reflectivity, and the horizontal axis is the wavelength of light expressed in nanometers.*

Because the secondary mirror faces downward, the three-layer coating process is adequate to maintain the required reflectivity and emissivity over a one-year period. The primary mirror, however, requires more anti-tarnish protection and a four-layer process will be necessary. This will include the three layers described above plus a final layer of silicon nitride spread very thinly at 50-100 angstroms thick. This overcoat layer film is transparent and doesn't produce significant absorption across the reflectivity spectrum. Again, the expected beneficial properties of silver are maintained.

The three-layer protected silver coating applied to Gemini South's secondary mirror was a success: the mirror's emissivity was measured (using witness samples coated at the same time) in laboratory tests to be 0.9% at a wavelength of 3.8 microns and is expected to be slightly lower near 10 microns. Prior to this new coating, the Gemini facility instrument T-ReCS measured the combined emissivity of the aluminum-coated secondary and primary mirrors to be 3.8% at 9 microns. With the freshly silvered secondary mirror in place, a new measurement indicated that the total telescope emissivity had come down to 3.0%. Our first four-layer test coatings made in August 2002 have an emissivity of 1.05%. Breaking these results down, it seems likely to achieve a total telescope emissivity of 2% once the primary mirror receives the four-layer coating. Baseline silver samples were measured during the feasibility studies (with the same emissivity measurement unit) and are still being used for comparison, lending greater confidence to numbers measured now.

Aging tests on four-layer test coatings produced in August 2003 are underway, and should show by the end of the year whether there is enough confidence in the durability to apply the recipe to the primary mirror. Both the Mauna Kea and Cerro Pachón coating chambers are now being equipped with the three magnetrons needed for sputtering a four-layer coating. Accelerated aging tests—cycling through high humidity and temperatures, salt fog exposure and hydrogen sulphide exposure—are being done in parallel, and so far have demonstrated that the optimal design with four layers is durable.

Another interesting aging experiment conducted is the regular washing, roughly monthly, of a bare silver coating sample. These tests have shown that the tarnish rate decreases significantly and becomes comparable to what we measure for a downward-looking mirror. An *in situ* washing technique, which is being developed now, is clearly the ideal complement to a low emissivity coating needed to meet Gemini's durability requirements.

GEMINI SCIENCE ARCHIVE: PROTOTYPE RELEASED

Colin Aspin

The prototype of the Gemini Science Archive (GSAp) was recently released to the astronomical community and the general public. This is a significant event in Gemini's maturation since it adds an end-point to the development sequence of high-level software systems. Now Gemini users can seamlessly move from the application process via the Phase I Tool (the PIT), to observation definition using the Observing Tool (the OT), to observation execution using the Observatory Control System (the OCS), through data handling and storage (via the DHS), and finally into a permanent data archive (via the GSA).

The release of the GSAp is an auspicious event and marks the first availability of Gemini science data, not just to a project's principal investigator (PI), but to anyone who wants to make use of it. Many ground-based observatories and all space-based telescopes have previously developed data archives (for example, the HST data archive). However, few if any, ground-based archives have been designed from the beginning to be as comprehensive, far-reaching and state-of-the-art as the GSA. In order to fully appreciate the GSA, let's consider the purpose of a science archive and the limitations often imposed by the design process.

A typical ground-based astronomical science archive contains data obtained from that facility over many years of its operation. It is generally accepted that data in a science archive is not made available to the general astronomical community or to the public before the expiration of a fixed period of time, known as the "proprietary period." This allows the researcher, who requested the data, to be the first to analyze it and extract the

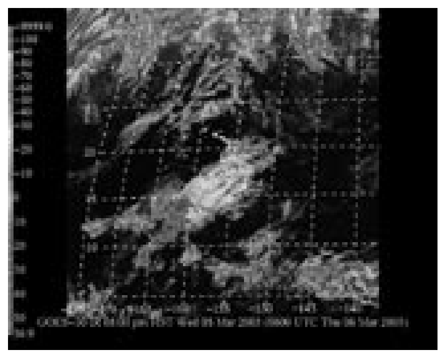


Figure 1: *The inclusion of meta-data in the GSA is important and unique because it enables researchers to more precisely assess the quality of the science dataset.*

scientifically interesting information and then publish the results. The proprietary period varies from facility to facility, and in the case of Gemini, it is 18 months from the date of data acquisition. Thus, for the length of the proprietary period, the data is accessible only to the project PI. However, it is often the case that the same dataset may be very interesting to other astronomers with slightly different research goals. Even if they cannot use it until the proprietary period is over, it is useful for them to know the data exist, which may prevent duplication of the observations elsewhere. The release of the data through a science archive enhances future access for all users.

Because scientific archives are not always complete enough to allow data from the facility to be used by other researchers, a primary aim of the GSA is to make the data from the Gemini telescopes immediately useful once the proprietary period has expired. A typical science archive developed over the last decade has generally concentrated on giving access to raw data. As is always the case with astronomical data, considerable effort has to be expended to turn raw science data, coming straight from the instrument, into something scientifically useful (or even a pretty picture). Also, this process is not always possible since only raw data is available with little association to required calibration data and other "meta-data" necessary for data reduction. While not scientifically useful by itself, meta-data is important to science archives because it enables researchers to more precisely assess the quality of the science dataset. Examples of meta-data include the weather maps and conditions during the acquisition period of the observations, the observing sequences executed to acquire the data, and instrument setup during the acquisition. ***Figure 1*** illustrates a typical weather map stored in the meta-data database.

One key reason that Gemini has been able to implement these advanced features into the GSAp is because development plans for the GSA were initiated in the late 1990s during the design period of the Gemini telescopes themselves. The Canadian Astronomical Data Center (CADC) in Victoria, BC, was selected to host the GSA and to develop the software required for its operation. Since then, Gemini staff members have worked closely with CADC staff to produce a design that makes this a world-class archive. The release of the GSAp marks both the start of the operational phase of the GSA at CADC and the incremental release of the GSA with it's many advanced features to the community.

Even at this early stage, the GSAp is a considerable improvement over many existing science archives. The prototype will lead within the next year to the "basic archive," which will be fully functional for the searching and retrieval of data. It will only lack some of the more advanced features that will make future versions of the GSA an extremely powerful tool for data mining.

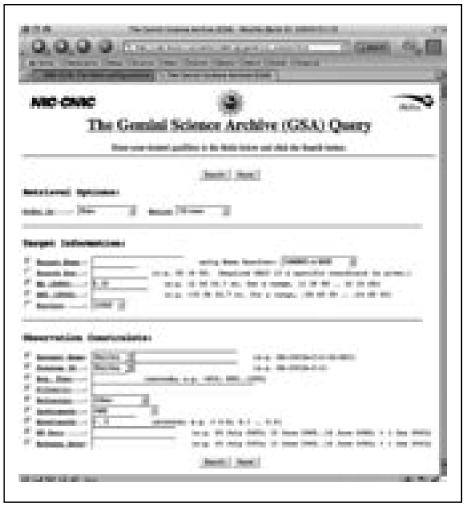


Figure 2: *An example GSA query form.*

Using the prototype requires users to have a CADC account, as is the case for all CADC-hosted archives. These are given freely to everyone upon completion of a simple registration form on the CADC homepage. The interface of the GSA prototype is web-based using a number of forms (see ***Figure 2***) to search for data based upon a variety of observation parameters.

For example, one could search for all data taken with Gemini's facility near-infrared imager (NIRI), between the wavelengths of 2 and 3 microns on sources between Right Ascension 9 and 10 hours and Declination 60 through 70 degrees. Such a search currently produces 12 observations available from Gemini whose proprietary periods have expired as of November 13th, 2003 (see ***Figure 3***). The same search can be performed for all data, even those whose proprietary period has not yet expired. This latter feature is important since it allows researchers to find all data that has been taken and determine when it will be publicly available. However, only data whose proprietary period has expired will be available for download.

Another very useful feature displayed on the results page are the hyperlinks that will either take the user to all the data acquired on the same night as a specific entry or to a view of the calibration data acquired during that night. This enables off-line processing of raw data to take place with the correct and most appropriate calibration files.

The next step in the development of the GSA will be the release of the complete basic archive, which is anticipated during the first half of 2004. The complete basic archive will contain, among other features, links to appropriate meta-data including weather information, links to the science programs under which the data was taken, augmented FITS header information, data-set catalogs of related observations and archived On-Line Data Processing (OLDP) results for instant preview.

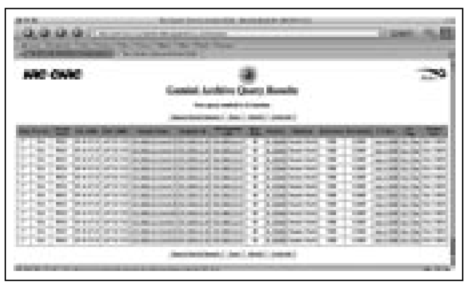


Figure 3: *The previous query example (shown in Figure 2) produces this search results page.*

We are currently working on an additional contract with CADC to implement advanced capabilities for the GSA that will allow the execution of more complex tasks and assure compatibility of the GSA with the Virtual Observatory (VO) world. Advanced capabilities include on-the-fly reprocessing of raw data to provide fully reduced datasets for download, cross-referencing archive content with other GSA contents as well as other archives, such as the HST archive, and advanced catalog creation (for example, source catalogs with fluxes cross-referenced to other similar catalogs perhaps containing fluxes at other wavelengths).

We hope you are convinced that the release of the GSA prototype is a major step in the development of the Gemini Observatory and of the usefulness of archives in general. Please try out the GSAp and make use of the growing archive of Gemini data.

Useful links to archive related sites:

http://www.gemini.edu/data/GSA.html
(The GSA information page at Gemini.)

http://cadcwww.dao.nrc.ca/gemini
(The GSA access link at CADC.)

http://cadcwww.dao.nrc.ca
(Registration page for CADC account.)

http://us-nvo.org
(U.S. National Virtual Observatory homepage.)

The Gemini Science Archive prototype is powered by software developed by CONICYT and CADC, and contains data and meta-data provided by the Gemini Observatory.

TUNNEL TO THE STARS

Peter Michaud

Ten years ago the trip up to Cerro Pachón from La Serena was very different than it is today. While the Gemini South telescope and access road have brought many changes to the mountain's landscape, the most significant changes begin much lower in the Elqui Valley, well before the ascent to the mountaintop.

The Gemini South primary mirror during its early morning passage through the Puclaro Dam Tunnel. After the even larger loads were successfully transported prior to the mirror, Gemini South's Site Manager, Diego Maltes, said the mirror's passage was a "piece of cake"!

Heading east from La Serena, the road through the scenic Elqui Valley on Route 41 once followed a rather logical path along the valley floor. Today, just west of the dirt road that leads to Gemini and the CTIO observatory complex, a significant portion of that original road and the surrounding lush valley landscape have been transformed—altered by the massive wall of the Puclaro Dam and the huge reservoir that began flooding the valley about five years ago.

For about half a century, a plan to build a dam in the Elqui Valley had often been discussed, but it was a project that never made it past the planning stage. However, a seven-year drought in Chile pushed irrigation projects to the forefront, and the Puclaro Dam moved forward with construction.

While the reservoir now provides a reliable water source for the local agricultural industry, the dam's construction and the serious logistical issues that it presented also impacted Gemini. Part of the plan involved re-routing the main highway above the soon-to-be-flooded valley. This included boring a tunnel through an intervening hillside. Government agencies involved with the dam and road relocation projects were extremely cooperative with Gemini in finding a solution, but government funds would only support the design and construction of a "standard" tunnel, which fell short of the width and height requirements needed to transport the Gemini South azimuth track, telescope mount columns, coating chamber, mirror cell and primary mirror up the mountain.

The timing of this project was most distressing considering that the dam project had floundered for almost 50 years, and suddenly it was moving forward just in time to hinder the movement of the 10-plus-meter-wide Gemini loads.

Many options were explored, including the possibility of reversing the construction schedule to finish Gemini South before Gemini North so that the loads could be moved up before the dam was built. Alternate back roads were also investigated, including one possibility that would have created a more direct route to the AURA property from a point before the dam. When all the viable options were compared, the option with the least risk and lowest cost was to make the tunnel large enough for the Gemini loads to pass.

Enrique Figueroa of AOSS worked closely with the engineering company that was designing the relocation of Route 41 around the dam. Gemini paid to create an alternate plan that would accommodate the wide loads. In an effort to reduce the costs to Gemini, several of the large mining companies further up the valley were approached to help share the costs but to no avail. It was argued that the large mining equipment could be dismantled and made to fit through the tunnel (something that we could not do with the primary mirror), so widening it was not necessary for their interests. Some have argued that financial issues, which led to the subsequent closing of the largest mine in the region, were the real reason for the lack of support. However, the bottom line was that Gemini had to foot the entire bill involved in the construction of a larger tunnel.

In the end, the tunnel gained an extra meter on each side that provides a generous sidewalk that is appreciated by precious few pedestrians. The final cost for the upgrade was about $US 500,000. While there were some anxious moments as the widest loads squeezed through the tunnel, it demonstrated how planning, foresight and vision have allowed Gemini to remain on track, even if that track needed some alterations.

While nearly everyone involved in Gemini has heard the story of the Puclaro Dam Tunnel, like any good story, most versions have a kernel of truth, surrounded by a chaff of recollection and hearsay that depends upon the teller. To help remove this chaff, special thanks go to Paul Gillett, Gemini - Tucson and Enrique Figueroa, Head of AOSS who were intimately involved in the effort and have shared their clear recollections to help document the facts of this important chapter in the history of Gemini.

THE GEMINI IRAF PROJECT

Inger Jørgensen

Gemini Observatory and NOAO have undertaken a two-year collaborative effort, the Gemini IRAF Project, to improve the reduction software available for the processing of data from Gemini facility instruments and the underlying IRAF system on which the Gemini reduction software is built.

Gemini has added two staff members to help with the effort—one software engineer and one astronomer with programming experience. In addition, the Gemini science staff continue to contribute to the reduction software. NOAO's Data Products Program (DPP) has added one staff member and additional effort for the Gemini IRAF project comes from other staff members maintaining and supporting IRAF itself. The project started in July 2003 with IRAF training of the new Gemini and NOAO staff members. In parallel, we put together the top-level plan for the project as well as the detailed plan for the first eight months of the project.

Gemini's IRAF team (from left to right): Andrew Cooke (inset, NOAO-DPP, Chile), Craig Allen (Gemini North), Kathleen LaBrie (Gemini North) and Inger Jørgensen (Gemini North).

The Gemini IRAF project aims to meet both short-term deadlines from new instruments coming on-line and to pursue a number of longer-term goals consistent with the 2-year timescale and resources provided. In addition, the project's goal is to improve IRAF through this collaboration with NOAO.

The two-year goals for the Gemini-specific software include:

• Increase ease of maintenance and support;
• Allow easy extensibility with new instruments;
• Implement improved utilities for script writing;
• Increase performance;
• Develop releases with support for new instruments;
• Decrease workload on the Gemini science staff by reducing the time spent writing reduction software;
• Advance the above goals by using compiled, generic modules for classes of data expected from Gemini instruments e.g., multi-object and longslit spectroscopy, IFU data, and near and mid-infrared data.

The two-year goals for an improved IRAF system include:

• Improving CL scripting capabilities including native error handling;
• Improving support for multi-extensions FITS files by all IRAF tasks;
• Enhancing the spectroscopy reduction software including better automatic wavelength calibration and image mask support;
• Improving the display program ximtool to support 24-bit and improved plug-in capabilities;
• Making general improvements to core IRAF software as identified.

In order to help with the planning process, we have established a Science Working Group for the Gemini IRAF Project. This group consists of both Gemini science staff members and members from the National Gemini Offices. The group's role is to review documents describing requirements and designs for the software, as well as to help with testing of the software prior to public releases.

Over the first eight months of the project, users will see three releases of the Gemini IRAF package:

1. The port of the Gemini IRAF package to IRAF 2.12.2 plus support for GMOS-South data will be released as soon as the NOAO group releases the beta version of IRAF 2.12.2. It has not been possible to port to IRAF 2.12 earlier due to software bugs identified in IRAF 2.12.1;
2. At the end of 2003, we expect to release a version that contains support for mid-infrared imaging data;
3. In late March 2004, we anticipate making the first release that will contain significant improvements in the compiled tools available in the Gemini IRAF package, as well as support for mid-infrared spectroscopic data. Support for GNIRS data will be added, as needed, by the instrument's commissioning schedule.

New releases will be announced on the Gemini home page, and users may also check for new information on the Gemini Data web page at: http://www.gemini.edu/sciobs/data/dataIndex.html

PROFILE: HARLAN UEHARA

Jennifer Anderson Akingkubedaggs

How does the Frederick C. Gillett Gemini North Telescope, a highly sophisticated machine with thousands of moving parts, stay operational? Part of the answer lies with Harlan Uehara, Mechanical Systems Supervisor, for Gemini North. Harlan and the Day Crew are responsible for onsite maintenance, scheduled repairs, upgrades, part fabrication and any other electro-mechanical jobs that the telescope, enclosure and related systems require.

Harlan is no novice when it comes to machine work. He was born and grew up in Laupahoehoe on the Big Island, located about 30 miles north of Hilo. After graduating from Laupahoehoe High School, Harlan went to machine school in Hilo at Hawai'i Community College. His first job was in the sugar industry, then the largest employer on the Big Island and the main economic engine on the island. He started as a journeyman, was promoted to administration and eventually became supervisor. He shouldered considerable responsibility for a young man. After eighteen years of service, when the machinery of the sugar industry in Hawai'i stopped turning, Harlan, with valuable mechanical and supervisory skills, moved into the construction industry. That led him up the mountain.

Harlan's first job on Mauna Kea was on the Keck 2 telescope. He then moved on to Subaru. Since 1998, he has worked at Gemini North. Harlan describes Gemini North as a place where "there is always something new, it's hi-tech and challenging."

Harlan and the Mauna Kea Day Crew's accomplishments are no small matter. For example, they recently replaced all of the roller guides that help move the 673-ton Gemini dome. Such a project would be complex and challenging anywhere, but extreme altitude and sensitive machinery complicate their work.

"Throughout my career, I have worked with many mechanical systems supervisors," says Chas Cavedoni, Senior Mechanical Engineer, "and Harlan is the easiest and most competent I have ever worked with. For instance, we recently had two proposed designs for the junction boxes in the radiation plate mirror cooling system. I ran both designs past him, and he came back with new insights and suggested an improvement that works better. Now we have a very slick solution to that problem. He just makes everything easier."

Harlan Uehara in the control room of Gemini North.

"Once, when I was working at Gemini South," explains Mike Sheehan, Mechanical Systems Manager, "Harlan and a couple of other guys from Gemini North were working on the mount base with the Chilean crew. The Chileans were trying to learn English using Harlan's examples in pidgin English. It was pretty funny. Harlan has such a great sense of humor. He developed a great rapport with the Chilean workers. His reliable leadership allows me to assign projects to him and his crew with great confidence."

Now living near Hilo with his wife, Lorelei, Harlan commutes up to the summit to work each day. His 12-hour workday starts when he leaves home around 6:30 AM and meets the other Day Crew at the Hilo Base Facility. They drive together to Hale Pohaku to make the 30-minute acclimatization stop and eat breakfast. He says that on most days he feels fine, but occasionally notices the grueling effects of working at nearly 14,000 feet—mainly fatigue, clumsiness and mental challenges. After a full day, the Day Crew heads down the mountain around 5:00 PM, and Harlan usually makes it home by 6:30 PM. He looks forward to kicking off his shoes, having a hot shower, enjoying his wife's cooking and catching up on the day's news.

When he's not working, Harlan enjoys time with his family. With a grown son and a daughter living on the Big Island, Harlan is now a grandfather. He describes his grandson as his "newest and most favorite hobby." He and his wife also have a dog, Koa, who is "pretty old already." Growing up, Harlan enjoyed fishing, hunting and sports. Basketball was his favorite sport, and he also played Little League baseball. As an only child, he spent a lot of time playing with his cousins. His parents, he assures, made sure that he wasn't spoiled.

To have some fun, Harlan and his wife like to travel off island. His favorite spot is Las Vegas. "I like to play blackjack and craps," admits Harlan, "but generally lose my gambling budget early. Then we go to the shows." They also enjoy the food, lights and often meet friends from Hawai'i, who are also vacationing there. Putting it all into perspective, Harlan says, "I just feel lucky to be able to live and work in Hawai'i, my home, and spend time with my family."

UNITED STATES

Taft Armandroff

The NOAO Gemini Science Center (NGSC) saw a strong response from the U.S. 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 with 10 of the NIRI proposals requested its use with the Altair adaptive optics system. Fifty-nine U.S. proposals requested time on Gemini South: 25 for T-ReCS, 23 for Phoenix, and 12 for GMOS-South. In total, 133 U.S. Gemini proposals sought 301 nights on the two Gemini telescopes.

T-ReCS

T-ReCS, the Thermal Region Camera and Spectrograph, is a mid-infrared imager and spectrograph for the Gemini South telescope developed at the University of Florida by Charlie Telesco and his team. T-ReCS had "first light" at Gemini South on June 2, 2003. The Florida T-ReCS Team and Gemini Staff have worked closely to commission T-ReCS. T-ReCS has performed very well, and the T-ReCS diffraction-limited images are spectacular. Several U.S. investigators are involved in T-ReCS System Verification programs.

GNIRS

The Gemini Near-Infrared Spectrograph (GNIRS) is an infrared spectrograph for the Gemini South telescope that will operate in the wavelengths ranging from 1 to 5 microns. It 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 for 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 at all instrument orientations, 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 and it was carefully disassembled and packed (***Figure 1***). Then GNIRS was shipped on October 24 from Tucson to Gemini South.
GNIRS arrived at Cerro Pachón on October 27, where it will be 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 a significant amount of time at Gemini South assisting with GNIRS reassembly, integration, acceptance testing, and finally commissioning. We anticipate that GNIRS will have advanced sufficiently in its testing and commissioning activities for it to be included in the Gemini semester-2004B Call for Proposals.

Figure 1: *The crates containing GNIRS are loaded onto a truck at NOAO in Tucson for their voyage to Gemini South.*

NICI

The Near Infrared Coronagraphic Imager (NICI) will provide a 1-5 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 mechanisms have been received and assembled, including the vacuum jacket, and the first vacuum test is expected soon. The NICI mechanisms have been received and assembled. MKIR received the Gemini-provided cooled electronics cabinets and is in the process of finalizing the cable lengths. Overall, 70% of the work on NICI to achieve 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-arcminute field at the standard Gemini f/16 focus in imaging mode, and will provide multi-object spectra over a 6.1x2-arcminute field. It will also provide multi-object spectroscopic capability for Gemini South's multi-conjugate adaptive optics system. The University of Florida under the leadership of Project Scientist Richard Elston, Co-Project Scientist Steve Eikenberry, and Project Manager Roger Julian is building FLAMINGOS-2. A Critical Design Review (CDR) for FLAMINGOS-2 took place on August 20-21, 2003 in Gainesville, Florida. 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 previously built sensors that they developed for the two GMOS instruments.

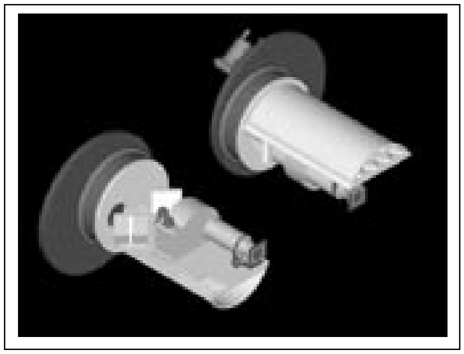


Figure 2: *Solid modeling of the FLAMINGOS-2 camera dewar showing the optical bench, detector, and filter-grism wheel.*

Next-Generation Instrumentation Planning

U.S. involvement continues in the Gemini next-generation instrumentation planning process. One aspect of this involvement is NGSC's organization of a workshop for the U.S. community "Future Instrumentation for the Gemini 8-Meter Telescopes: U.S. Perspective in 2003" that was held May 30-31 in Tempe, Arizona. Forty U.S. astronomers participated. The goals of this U.S. meeting were to:

- Explore important science questions that will be addressed via Gemini's long-range instrument plan for the period 2008-2010;
- Discuss, in general terms, the observing capabilities required to address these science questions.

The participants in the Tempe meeting conceived several high-impact scientific questions for Gemini to address in 2008-2010. These scientific investigations were justified and placed into context. The participants envisioned Gemini playing a substantial role in current and future key science questions. The report of the workshop "Future Instrumentation for the Gemini 8-Meter Telescopes: U.S. Perspective in 2003" is available at: http://www.noao.edu/usgp/Tempe_Report_7-8.pdf.

Many of the participants in the Tempe meeting served as U.S. delegates to Gemini's Aspen Workshop in July 2003 (see articles, pages 1 and 2).

The U.S. Science Advisory Committee and a subset of the U.S. Gemini Board members met at the University of North Carolina, Chapel Hill on September 25 and 26. The primary topics of the meeting were the outcomes of the "Aspen Process" for next-generation Gemini science and instrumentation, and priorities for instrument and telescope commissioning and engineering. The participants strongly endorsed the scientific and instrumental directions arising from the Aspen Process.

UNITED KINGDOM

Isobel Hook & Reba Bandyopadhyay

The UK community's response to the 2004A call for proposals followed the recent trend of gradually increasing numbers of proposals per semester. Sixty-five proposals were received, and once again, the GMOS instruments accounted for well over half of the total proposals. Nine proposals requested classical time, representing a significant increase over previous semesters. The average time request per proposal was just under 20 hours, and the UK oversubscription for 2004A is approximately 3.5 on Gemini-North and 1.1 on Gemini-South.

In September, the first meeting of a new UK Gemini Users Committee was held. This group collects feedback from the community on a wide range of issues affecting users of Gemini, including the Phase I and II proposal process, instrumentation, data reduction and other topics. As a starting point, the community was asked to send comments by e-mail (with the option of using a short questionnaire) and many useful replies were received. These were collected, discussed by the Users Committee, and a list was made of recommendations and suggestions for improvements, which has been forwarded to the Observatory. In addition, the views of UK Gemini users are fed into the international Gemini Science Committee (GSC) via the UK GSC representatives.

The UK-built instruments continue to make progress at the telescopes. The new Integral Field Unit (IFU) for GMOS-South has recently been shipped from the University of Durham to Gemini-South and is due to start commissioning later this semester. This IFU is similar to that on GMOS-North, but a novel rearrangement of the fiber blocks allows it to be used with the Nod and Shuffle observing mode, which should greatly aid sky subtraction. bHROS, the bench-mounted high-resolution optical spectrograph built at UCL, is now fully integrated with the fiber feed from GMOS, and awaits crucial on-sky throughput tests. Meanwhile on Gemini-North, commissioning of MICHELLE, the mid-infrared spectrometer built at UKATC, is continuing. Much progress has been made on the pupil alignment and detector vignetting issues. Some ongoing issues remain, including elevated detector temperature and MICHELLE's control of the Gemini secondary when chopping. MICHELLE is due to return to UKIRT for most of semester 2004A and will return to Gemini in time for final commissioning prior to semester 2004B. In the next few months, there will be some staff additions in the UK Gemini Support Group. The group is expanding to include ELT science activities, and we expect to hire a new member to work on Gemini support in early 2004. Also, in December we will be welcoming Ilona Söchting from the Isaac Newton Group (La Palma), who will be responsible for support of adaptive optics instruments.

CANADA

Dennis Crabtree

Harvey Richer (UBC) is stepping down as Canadian Gemini Scientist and Gemini Board member. Many thanks to Harvey for his dedicated effort in representing Canadian interests within the Gemini partnership. Harvey's hard work has played a major role in helping Gemini achieve its scientific promise. David Schade (HIA) is also stepping down as the second Canadian representative on the Gemini Science Committee (GSC) after several years of service. Douglas Welch (McMaster University) is replacing Harvey on the GSC and Gemini Board. Stéphanie Côté (HIA) will be Canada's second GSC representative.

Canada received a total of 37 proposals for Semester 2004A on Gemini. The distribution of the proposals is shown in the following tables. The top table shows the number of proposals, and the bottom table shows the distribution of time requested.

Telescope	Instrument Acquisition Camera	GMOS	Altair-NIRI	NIRI	Phoenix	T-ReCS	Total
GN		13	5	6			24
GS	1	5			2	5	13
Total	1	18	5	6	2	5	37

Telescope	Instrument Acquisition Camera	GMOS	Altair-NIRI	NIRI	Phoenix	T-ReCS	Total	Sub. Rate
GN		202.4	85.5	58.1			346.0	1.88
GS	12.0	86.1			17.7	55.5	171.3	1.14
Total	12.0	288.5	85.5	58.1	17.7	55.5	517.3	1.55

The number of proposals is encouraging, but with an average proposal requesting just over 14 hours, the oversubscription rate is somewhat low. As expected, the largest numbers of proposals are for GMOS.

The Altair team was in Hawai'i for the July commissioning run, and we decided to make this a "public" event in Victoria. Saturday night is public viewing night at the HIA visitor center, aptly named the Center of the Universe, and we added Gemini to the list of activities for July 14. The night started with a presentation by Jean-Pierre Véran on the wonders of Gemini and adaptive optics. Then a live video link, using our normal IP-based Polycom system, to the Gemini North control room allowed the audience to see and interact with the Altair team. Tim Davidge did an excellent job entertaining the crowd and explaining what it is like to observe with Gemini. University of Victoria students Jeff Stoez and Jacob Burgess assisted Tim. The auditorium was full for this event (about 80 people) and everyone seemed to really enjoy the program and asked many questions. As an extra bonus, Jacob was spending his co-op term in Hawai'i and his parents were able to see him as they were part of the audience in Victoria.

AUSTRALIA

Warrick Couch

The last newsletter report from Australia was dominated by the news of the bush fires that devastated the Mt. Stromlo Observatory. This produced a serious impact on the Gemini instrument construction program being conducted there by Peter McGregor and his team from the Research School of Astronomy and Astrophysics (RSAA) of the Australian National University (ANU). In compiling this report six months later, it is remarkable to reflect on how far the recovery process has progressed, particularly in getting the construction of Gemini instruments back on track.

By far the greatest loss in the fires, from Gemini's point of view, was the complete destruction of the Near Infrared Integral Field Spectrograph (NIFS), which was within six months of being completed and delivered to Gemini North. The rebuild of a new NIFS is now well underway with its fabrication being out-sourced to the Canberra-based aerospace company, Auspace Limited. Most of its mechanical components have already been manufactured ahead of schedule, many of which have arrived at Auspace. The assembly of the vacuum jacket and the cryostat will commence shortly, and they are expected to undergo the first cool-down before Christmas. Manufacturing of the optics for NIFS is also well advanced, with delivery of most of them expected before the end of the year. At this point, things are on track for having the new NIFS clone built by the end of 2004.

In addition to NIFS, the RSAA has also been contracted by Gemini to build the Gemini South Adaptive Optics Imager (GSAOI). At the time of the fires, it was in the initial design and construction phase. Through the availability of temporary office and workshop facilities on the ANU campus and at the nearby Australian Defence Force Academy, progress has continued on GSAOI essentially unimpeded. GSAOI also recently underwent its Critical Design Review. Some of the milestones reported at this review included: delivery of all the long lead-time items associated with the cryostat, redesign and fabrication of the environmental cover and the cryo-cooler mounts, replacement of all the essential equipment required to test the optics (that were destroyed in the fires), and delivery and initial testing of the San Diego State University (SDSU) controller for the detectors. Members of the review committee were also given a tour of the new temporary electronic and mechanical workshops and offices that have been erected at Mt. Stromlo.

Two other notable events for our Gemini community in the last six months have been the Aspen meeting and the IAU General Assembly, which was held in Sydney. Australia had seven representatives at the Aspen meeting, thereby allowing us to make an effective contribution through presentation of the numerous science cases that have been developed in each of the four theme areas. These were done via extensive consultation throughout the community by holding a series of nation-wide mini-workshops and meetings in the six months prior to Aspen. All of our attendees found Aspen to be a very positive experience, highlighted by the excitement and optimism that was generated in bringing the Gemini partnership together to discuss its scientific aspirations and plans for future instrumentation.

The IAU General Assembly attracted more than 2000 astronomers to Sydney, which underscores the importance that Gemini have a strong presence. Both the Australian Gemini Office (AusGO) and the Gemini Observatory had exhibit booths next to each other in a very prominent location within the exhibition area. The AusGO stand was used to showcase some of the first science results that Australian astronomers have obtained with the Gemini telescopes, and to advertise the NIFS and GSAOI projects as examples of state-of-the-art telescope instrumentation being built in Australia. The latter were also highlighted at an "Industry Day" held during the IAU to foster closer links and partnerships between our astronomy institutions and industry. Both stands attracted a constant stream of people, including astronomers and the general public throughout the IAU, with the "Virtual Tour" CD-ROM and the Gemini Newsletter being very popular "collectors' items."

CHILE

Luis Campusano & Sebastián López

The Call for Proposals for semester 2004A resulted in the submission of five research projects for Chilean Gemini-South telescope time. This is in contrast to the ten proposals received for the previous semester. Three programs asked for the use of GMOS-South and two for T-ReCS. The total number of hours requested represented a subscription factor smaller than 1.0. To understand this small subscription factor, it is important to realize that Chilean astronomers have been asking for about the same amount of Gemini time (~90 hours) every semester (the exception to this trend occurred in 2003B when GMOS was first offered). When the latter trend is taken into consideration, together with the significant increase in the fraction of Gemini-South science time, the decreasing subscription factor can be understood.

Another major effort is underway to assess the staffing and interests of the Chilean 8-meter class telescope user community. In the last issue of this newsletter, we mentioned that the process of attaining a better balance between telescope availability for Chileans and staffing in Chilean institutions was in progress. The result of this work has been that the Chilean NGO has consulted with our National TAC to study actions aimed at augmenting the community response to the superb research opportunities offered by Gemini South.

For Phase I, we have maintained the use of the PIT for proposal preparation and e-mail for submissions. The Phase II review of 2003B GMOS-South proposals (three programs) was also a smooth process. During the process, we had excellent and fruitful NGO-PI interactions during which our office made a number of suggestions to optimize the planned observations. Recall that GMOS-South is especially complex in regard to Phase II because of mask design and the many deadlines involved. Specialized queries to which we could not respond were quickly answered through the Help Desk.

The Gemini database of Phase II programs and the fetch-store tools both worked well. As of this writing, many of these observation programs have been executed and data have been obtained successfully. Overall, we feel that the office has been responding well to the new challenge of serving as the interface between the Gemini Observatory and Chilean observers.

Finally, upon availability at Gemini-South, Sebastián López will spend some time at Cerro Pachón to learn more about GMOS-South observations.

BRAZIL

Max Faúndez-Abans

We continue to successfully provide the Brazilian Gemini community with instrument support from our National Gemini Office (NGO). However, to improve our efficiency even more, the Brazilian NGO is in the process of developing a staff-training program on Gemini's Phases I and II process. Our colleague, Mariângela de Oliveira-Abans, received training at Gemini North to learn about GMOS last July, and Max Faúndez-Abans visited Gemini South to get acquainted with Phoenix and GMOS. These were beneficial experiences for both individuals and for the NGO as a whole. In addition, Alberto Ardila will be at Gemini South at the end of this year to take part in the science verification phase of GNIRS.

Mariângela also participated in the annual meeting of the Gemini Public Information and Outreach Network in Hilo, from July 29 to August 01. During that meeting, many aspects of the present and future PIO actions taken by the Observatory as a whole, as well as by each partner, were discussed. Following the Chilean initiative, the Gemini Virtual Tour will begin translation into Portuguese by the end of this semester.

The Brazilian Astronomical Community is organizing a workshop entitled "Optical and Infrared Astronomical Instrumentation for Modern Telescopes," which will take place in Angra dos Reis, Rio de Janeiro, Brazil, November 16-20, 2003. The conference website is located at: http://www.lna.br/~oiainstr/. The workshop is possible due to support from the Ministério da Ciência e Tecnologia (MCT) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) as well as from the nation-wide project named MEGALIT, organized by the Brazilian Instituto do Milênio. The workshop will focus on optical and infrared instruments for large- and medium-class telescopes, with special attention to projects aimed at the Gemini Observatory and the SOAR Telescope. Contributions about instrumentation for other telescopes are also welcome. In addition to the lectures on instrumentation, there will be talks and poster contributions about the science that will be possible with these telescopes and the next-generation instrumentation. Invited Gemini staff scientists will present some of the talks. We hope this conference will allow a close interaction between astronomers and instrumentation scientists and technicians in order to better define the path for future instrumentation development. Ultimately, this will allow us to obtain the high-quality data needed to answer the important questions in many areas of astronomy.

We have also released an announcement for the U.S. Gemini Fellowship for the period 2004-2005 with the following deadlines: November 15 for the receipt proposals and December 2 for the selected proposal to be sent to NOAO. At the time this report was written, one Brazilian candidate has expressed desire to obtain the fellowship.

As for the proposals for Semester 2004A, a total of 82.56 hours at Gemini North have been requested, representing a pressure factor of 2.66. For Gemini South, 32.23 hours have been requested, resulting in a pressure factor of 1.29. The number of proposals has diminished slightly during this semester.

ARGENTINA

Guillermo Bosch

Argentina is now overcoming the default situation that occurred in 2002, and the local community is getting ready to make use of the Gemini telescopes during 2004B. The National Gemini Committee has become aware of additional support necessary for our community's use of of the Phase II tool at Gemini South, and is in the process of selecting an individual to be trained at Gemini South early next year.

Guillermo Bosch recently spent a few days at Gemini North facilities in Hilo, thanks to an invitation from Jean-René Roy, experiencing and learning about the queue observing process from the Gemini North scientific staff.

Outreach activities are also expanding in Argentina. Gemini was present at the Buenos Aires Planetarium Science Fair, which was held during winter holidays. The La Plata Observatory is actively supporting these activities.

Within a grant scheme to assist undergraduate students, Maria Rojas Kaufman has been appointed to help with local Gemini web page updates. The staff that handles visits to the Observatory attended a mini-course focusing on the Gemini Telescopes in order to include it in La Plata's outreach activities, which receives thousands of visitors per year.

REACHING STUDENTS AND TEACHERS IN BOTH HEMISPHERES

Peter Michaud

For almost a decade now, the Gemini host communities in Chile and Hawai'i have been connecting on many levels. The association started when both host communities' mayors proclaimed the official "Sister City" relationship back in 1994. Our connection has been furthered by the ongoing exchange of Gemini staff, who share their lives by "commuting" between the two sites. Today's technology, specifically Gemini's high-speed Internet connections, allow high-quality real-time videoconferencing between the hemispheres.

The most recent connection is the Gemini StarTeachers Exchange Program. This program has allowed us to unite our teachers, students and communities in educational events that share science, culture and technology in innovative new ways.

"Special thanks...to the Gemini Observatory...for their vision, determination and financial committment, which enabled this program to be an overwhelming success...The study of astronomy in the Northern and Southern Hemispheres with Gemini's technology and experiencing learning through the integration of several content areas in Gemini's network video conferencing was very rewarding."

–The Hawai'i StarTeachers, excerpts from their Letter to the Editor published in the Hawaii Tribune-Herald Novemeber 17, 2003.

Mauna Kea Tabloid:
Another major initiative of the Gemini Public Information and Outreach Office was to coordinate the publication of a 48-page tabloid in the local Hilo newspaper, The Hawaii Tribune-Herald. Gemini's Outreach and Education Specialist Janice Harvey spearheaded this ambitious effort that resulted in what some have touted as the best publication for the public on Mauna Kea ever produced, and the only one of its kind. Copies are available upon request by contacting Janice at: jharvey@gemini.edu

Note: Plans are now underway to do a similar publication in Chile.

The StarTeachers Exchange Program has recently completed its first year as a pilot project and has done what any good experiment should—it answered some questions, inspired new questions and left everyone involved feeling like it was well worth the effort.

The format of the StarTeachers program is simple: three teachers from Chile and three teachers from Hawai'i partnered up and spent a two-week period at the other's school engaged in teaching students, parents and the community. In addition, the teachers learned about Gemini's science and technology and presented videoconference lessons to students at home while visiting their partner's community.

The opposite page shows some images that capture the spirit of the program and share some of the many activities that took occurred when the six StarTeachers visited their partners. More images can be found at: http://www.gemini.edu/media/starteachers_album.html.
The six StarTeachers who participated in the program were: Carmen Luz Briones, second grade teacher in the Colegio Isabel Riquelme de Las Compañías in La Serena; Viviana Calderón, Head of the Technical Unit at the Colegio Cardenal José María Caro in Coquimbo; Christine Copes, a math and resource teacher at Waiakea Elementary School in Hilo; Alicia Hui, a fifth grade teacher at Haili Christian School in Hilo; Kristen Luning, Chairperson of the Math Department at Kea'au High School in Kea'au; and Jenny Opazo, preschool teacher at Jardín Infantil Vista Hermosa in La Serena.

StarTeachers Image Montage Key: *a) StarTeachers and Gemini Staff en route to visit Gemini North; b) Gabriela Mistral Medal given to Matt Mountain from the Chilean Ministry of Education's representative in the region of Coquimbo in recognition of the StarTeachers program; c) Students from Kea'au High School use a digital white-board and videoconferencing to interact with students in Chile; d) The StarTeachers visiting Gemini North in October 2003; e) Haili Christian School students in Hawai'i play ukelele for students participating in a videoconference with Chilean students; f) La Serena Mayor, Adriana Peñafiel (center, with scarf) is joined by Mrs. Anamaría Maraboli-Smith (second from left) and the Chilean StarTeachers showing the La Serena flag; g) Videoconference announcing the 6 StarTeachers in January 2003; h) Gemini PIO staff Antonieta Garcia presents La Serena flag to Hawai'i County Mayor Harry Kim; i) The Kea'au High School Math and Science classes join the StarTeachers in front of the Gemini StarLab portable planetarium; j) Students from Waiakea Elementary School interact with students in Chile; k) StarTeachers and Gemini staff are welcomed by the Hawai'i Island County Council during exchange visit to Hawai'i in October 2003.*

GEMINI OBSERVATORY

StarTeachers

StarTeachers Exchange Program
Programa de Intercambio StarTeachers

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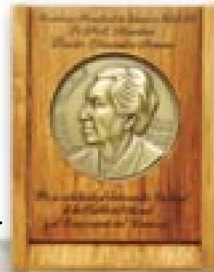

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GEMINI OBSERVATORY NEWSLETTER

THE GEMINI OBSERVATORY
is an international partnership managed by the
Association of Universities for Research in Astronomy
under a cooperative agreement with the National Science Foundation.

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Participants in the Aspen Workshop, held in June 2003, to plan Gemini's future science and instrumentation goals.