2008

ANNUAL PROGRESS REPORT AND PROGRAM PLAN OF THE GEMINI OBSERVATORY

ASSOCIATION OF UNIVERSITIES FOR RESEARCH IN ASTRONOMY, INC.

Contents

SECTION A

DIRECTOR'S SUMMARY

&

OVERVIEW

A. Director's Summary and Overview

Welcome to the 2008 Gemini Annual Report. As in past years, Gemini experienced a range of successes, challenges, and lessons learned during 2008 which are reflected in this report from all of our branches. This is the second year of our new report format, which is structured to make it possible to quickly determine what projects the observatory has undertaken and how well we have been able to complete these projects. This is also the second year in which we are making this report easily accessible to anyone with an internet connection. The feedback we received about our report's new format and accessibility has been overwhelmingly positive and we look forward to hearing further comments and suggestions for improvement from the community as they peruse this year's report.

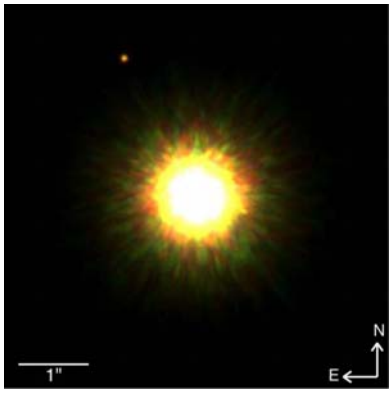
The cultural transitions we started in 2006 continue through this reporting period and are reflected in a number of ways. Prominent among these changes is a vastly improved planning system using new tools and a continued vigilance to build upon our organizational integrity by developing the discipline to *say what we will do and then do what we said*. While this may seem like a simple goal to achieve, ingraining this philosophy across a highly distributed and diverse staff that prides itself on launching ever more activity is a real challenge. Next to communications, developing solid planning skills is the most important key to developing a lasting operations model at Gemini. Toward that end, and reported in the following pages, Gemini has developed a sophisticated internal planning system that allows the staff to define, execute, and track progress on activity from literally the entire observatory. Our new planning tool features a web accessible central database that stores a wide-range of information about the projects we are pursuing, not only this year, but well into the future. In 2008 over 100 projects were loaded into this database with input from our procurement, instrumentation, science operations, engineering, information systems group, and much more. The results of all of this activity have been distilled into the tables and associated project descriptions published in this report.

Figure A.1. The Gemini North primary mirror is shown emerging from our sputtering coating chamber, freshly deposited with a 4-layer protected silver coating.

A number of accomplishments are featured in this year's annual report in the "Achievements" section. For example we continue to post a range of impressive science operations metrics with open shutter efficiencies and target acquisition times that are easily competitive with similar

Figure A.2. The new Hilo Base Facility Extension was completed in 2008. This eagerly awaited addition to the Gemini-N office accommodations essentially doubled the amount of space available for our staff and allowed us to close our Hilo satellite office, which was housing our entire Hawaii based administrative group.

facilities. Reaching these performance levels while operating the world's only multi-instrument queue based system on 8-10 meter-class telescopes has required an enormous amount of skill and dedication by our team and we take great pride in what we have achieved. Also featured in this year's report is the new protected silver coating that was applied to the Gemini North primary mirror (see Figure A.1). The previous coating lasted nearly four years and we expect the new coating to last at least as long. This three week process, conducted in August 2008, involved months of preparation and detailed planning to ensure both the safe handling of this critical optic as well as the safety of our engineering staff. In fact, a variety of new safety measures and systems were installed as part of the preparations for the mirror coating. This activity and many more projects in 2008 reflected Gemini's continued commitment to its safety program which achieved a range of accomplishments in 2008. However, we are sad to report that our safety program manager, Ron McKinnon, retired to his native South Africa this year and we are now searching for a new safety program manager. Easily the most prominent accomplishment of our administrative and facilities group in 2008 was the completion of the new Hilo Base Facility Extension (see Figure A.2). This 14,000 square-foot facility doubles the amount of office space available for the Gemini North staff, which previously was housed in a combination of the original base facility, a pair of temporary trailers configured as offices, and a satellite office we were renting across town in Hilo. For the first time since February 2006, we have enough space for the entire Gemini North 'ohana (Hawaiian for family) to work together, which has an enormous impact on the vitality of our program.



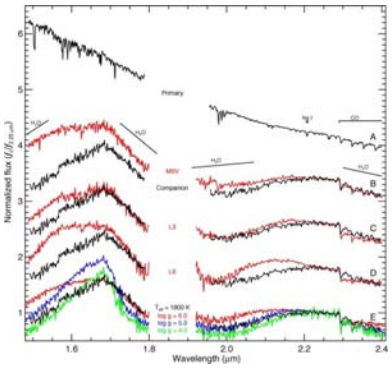


Figure A.3. Adapted from *Lafrenière et al. 2008, (ApJL, 689, L153-156*), one of the most impressive science results obtained in 2008 was the likely discovery of a planet orbiting a star similar to our own sun in mass (though much younger). This is the first time a planet has been imaged around a star like our own. Its distance from its host star is nearly ten times further than Neptune is from our sun, which challenges planet formation theories.

Our science program had a number of outstanding achievements in 2008 as well. Among the most impressive of these was the discovery of a planet likely orbiting a nearby star that is similar to our own sun in mass–albeit much younger (see Figure A.3). As shown in the accompanying image, which was recorded with NIRI being fed by the Altair adaptive optics system at Gemini North, this planet is estimated to be ~8 Jupiter masses and orbits ~300 AU from its host star, which is much further than conventional theory predicts such planets should

be found. Follow-up proper motion measurements are needed to confirm that this is, in fact, a companion to this star but, in any event, the measurements made of this object at Gemini are striking.

We also made good progress in our development program in 2008, with excellent progress made on the Gemini Planet Imager (GPI) and a pair of WFMOS studies which will be completed in early 2009. In conjunction, Gemini and Subaru observatories cosponsored a WFMOS science workshop in Waikoloa, Hawai'i in 2008 which brought together nearly a hundred scientists from the Subaru and Gemini communities to present and discuss the incredible research potential of this proposed highly multiplexed spectrometer. Next year will be a crucial year for WFMOS, as decisions will be made on several fronts that will critically impact its future.

Overall it has been another exciting year at Gemini with an abundance of activity intended to provide world-class research tools for our community. As always I encourage feedback from our community about the activity described in this report and look forward to 2009, which promises to be even more exciting as we provide new capabilities for our community.

SECTION B

SCIENCE AT GEMINI: THE YEAR 2008 IN REVIEW

B. Science at Gemini: The Year 2008 in Review

B.1 Science Highlights

The users of the Gemini telescopes have continued to explore the vast domains of the universe exploiting what our telescopes and instruments provide as unique capabilities. Our large multi-national community has a very broad-range of scientific interests and goals. A remarkable development of this past year has been the publication of several results based on the use of the Gemini North Laser Guide Star Adaptive Optics system, in conjunction with the near-infrared imager NIRI or integral field near-infrared spectrograph NIFS. The latter has been used in particularly successful ways to explore the very central part of galaxy cores where compact nuclear clusters or supermassive black holes reside – some of these exciting results are described below. The Gemini North telescope has also imaged a tantalizing eight-Jupiter mass planet around a solar-like star. This system still needs to be confirmed as a bound system, but already we have detected strong evidence that, after several years of searching, these first images of Jovian planets will become part of the normal scientific output of our telescopes in the coming months and years.

Catching the very first moments of a supernova

The most massive stars in the universe end their short lives in spectacular explosions called supernovae. These events mark the births of neutron stars and stellar black holes. They also play a central role in the process of chemical enrichment in the universe. In a rare coincidence of X-ray monitoring of the galaxy NGC 2770 with the *Swift* spacecraft, and close coordination of follow-up observations, Gemini was able to obtain an early sequence of optical spectra of supernova 2008d discovered by *Swift* on January 9th, 2008 as a bright X-ray transient. The first GMOS spectrum was obtained 1.7 days after the explosion and the brightening of the supernova as it rapidly evolved was monitored almost every night for a few weeks (Figure B.1.1). From an amorphous spectrum showing few features, the spectrum evolved rapidly by developing strong He I, Fe II and OI features that betrayed the nature of the progenitor as a massive Wolf-Rayet star. This supernova is of type Ib/c, and ejected the equivalent of 3.5 solar masses which rushed out at about 10,000 km/sec, with some very hot material at about 100,000 km/sec. The detection of this core-collapse supernova near the very instant of its explosion is unique. However, the frequency of such events in the

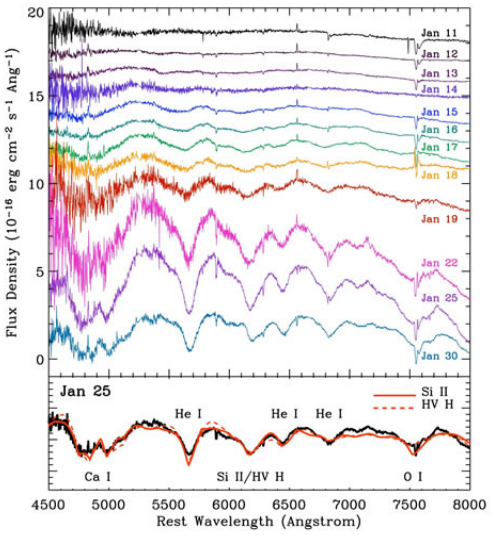


Figure B.1.1. Sequence of densely-sampled optical spectra from 1.7 to 21 days after the X-ray outburst. From the spectral evolution sequence the supernova SN 2008d is classified as a helium rich Type Ib/c supernova.

universe is probably very high, increasing the hope of detection by the few existing neutrino observatories.

First image of a possible Jovian planet around a nearby young star

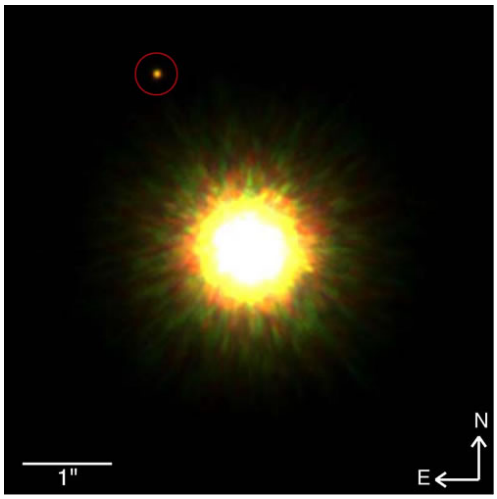


Figure B.1.2. Gemini adaptive optics image of 1RXS J160929.1-210524 and its likely ~8 Jupiter-mass companion (within red circle).

For more than ten years, astronomers have been trying to capture the first image of an exoplanet, without success. The dry spell might have finally reached an end with what may be the first-ever picture of a planet orbiting another sun-like star (Figure B.1.2). The composite near-infrared image shown here was obtained at the Gemini North telescope using the Altair adaptive optics system. We see the star, 1RXS J160929.1-210524, at the center with a candidate companion in the upper left corner. The star lies roughly 500 light years from the Earth in the Upper Scorpio association, a group of a few hundred stars formed about five million years ago. Apart from its much younger age, this star is very similar to our Sun. The near-infrared colors and spectrum of the candidate companion indicate a temperature of 1800 K. Hence, the object is still contracting under its own gravity and is very young. The mass of the candidate planet is about eight Jupiter masses. Over the next year or two, the two objects will be observed repeatedly and their relative positions measured precisely to determine their proper motions and whether or not they are indeed traveling through space together.

The smallest and coolest brown dwarfs

Objects with masses between roughly 13 and 78 times that of Jupiter are a hybrid class between stars and planets. Some burn deuterium for only a short period of time. Most will generate their luminosities by slow gravitational contraction. The properties of brown dwarf atmospheres are closer to those of giant planets. Their spectra show deep absorption molecular features like those of metal oxide, carbon monoxide, water vapor and methane. Dust clouds may even form and condense. When young (a few million years) they are relatively large and hot, but become smaller and colder with age. The objects with the lowest mass, and coldest temperatures, are particularly

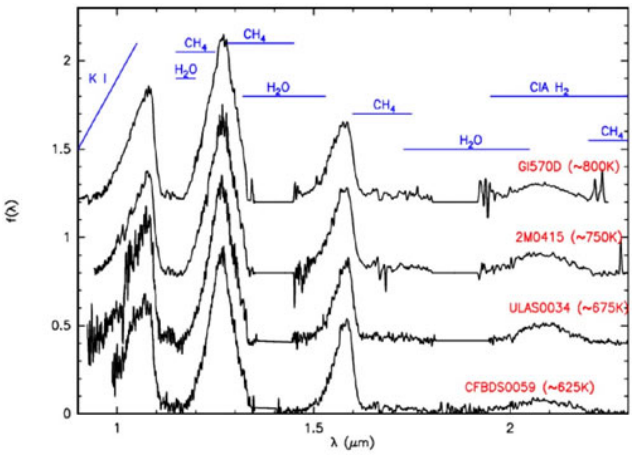


Figure B.1.3. Spectral sequence with the coolest T dwarfs and the two ammonia-bearing brown dwarfs.

intriguing because of the complex physical-chemical processes involved, they are also likely to resemble giant planets. Brown dwarfs are identified by their very red colors in large imaging surveys, particularly those from Mega-prime on the Canada-France Hawaii Telescope (CFHT) and the Wide-Field Camera (WFCAM) on the United Kingdom Infrared Telescope (UKIRT). Follow-up infrared spectroscopy with the Near-Infrared Imager (NIRI) and the Gemini Near Infrared Spectrograph (GNIRS) on the Gemini telescopes has revealed the lowest mass and coldest brown dwarfs known to date. The lowest mass brown dwarf, ULAS J0034-00, was characterized with GNIRS at Gemini South. It has a mass between 15-30 times that of Jupiter and an effective temperature of 675 K (Figure B.1.3, second spectrum from bottom). Even colder is CFBDS0059 with the temperature of a typical home barbecue at about 625 K (spectrum at bottom). These objects may belong to "Y dwarfs," a new class of brown dwarfs with features of ammonia starting to appear in their spectra. Even colder objects may exist where steam would ultimately be depleted as it condenses into water droplets to form clouds. We expect to find such objects in the near future.

Supernova impostor in Eta Carinae

Astronomers have been puzzling over the engine that powered the historical outburst of the luminous blue variable star Eta Carinae since it happened in the year 1843. Now, recent observations made using the Gemini South and the Blanco telescopes in Chile have added a startling clue. New data reveal faint but extremely fast-moving material indicative of a powerful shock wave produced by the 1843 event (Figure B.1.4). Spectra obtained with the Gemini Near Infrared Spectrograph (GNIRS) show that the famous nebulosity around Eta Carinae contains filaments moving at hypersonic speeds of 3,500 to 6,000 km/sec (a notable fraction of the speed of light). The 1843 event released more energy than previously estimated and it is surmised that a shock wave analogous to one from a supernova-type event was generated.

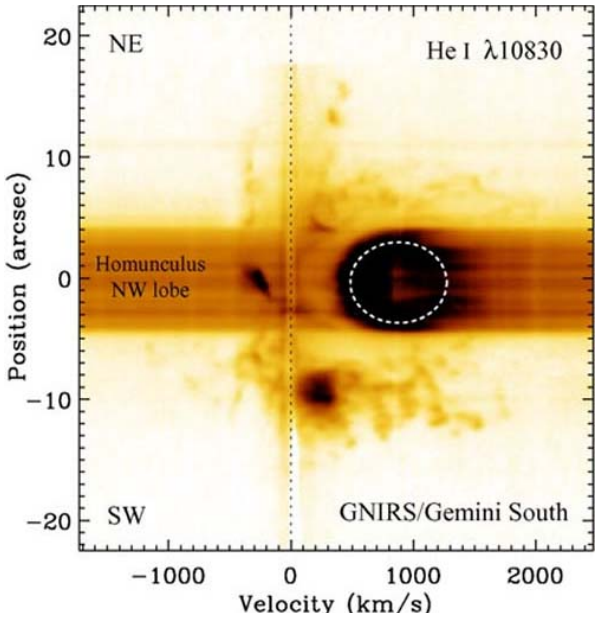


Figure B.1.4. Position-velocity plot used to determine velocities of gas in the nebula.

A black hole at the core of massive globular cluster Omega Centauri

There are two types of black holes whose existence has been established: stellar mass black holes (10 to 100 solar masses) produced from the deaths of massive stars, and supermassive ones (with 1 million to 1 billion solar masses) that reside at the centers of galaxies. There are no physical reasons that would prevent black holes from existing with mass between these two types. Gemini South observations of the velocities of star at the center of the massive globular cluster Omega Centauri and radial light from the Hubble Space Telescope have revealed the

possible existence of a 40,000 solar mass black hole as part of this well known naked-eye object. The intermediate mass black hole has betrayed itself by the rapid rise in orbital velocity of the stars between off-center and center-positions of the cluster. There are other possible interpretations, but the intermediate mass black hole is the most obvious one. If large enough numbers of these intermediate-mass black holes are found, they could be the required black hole seeds necessary to grow supermassive black holes found at the centers of galaxies.

A rotating compact nuclear stellar cluster in NGC 4244

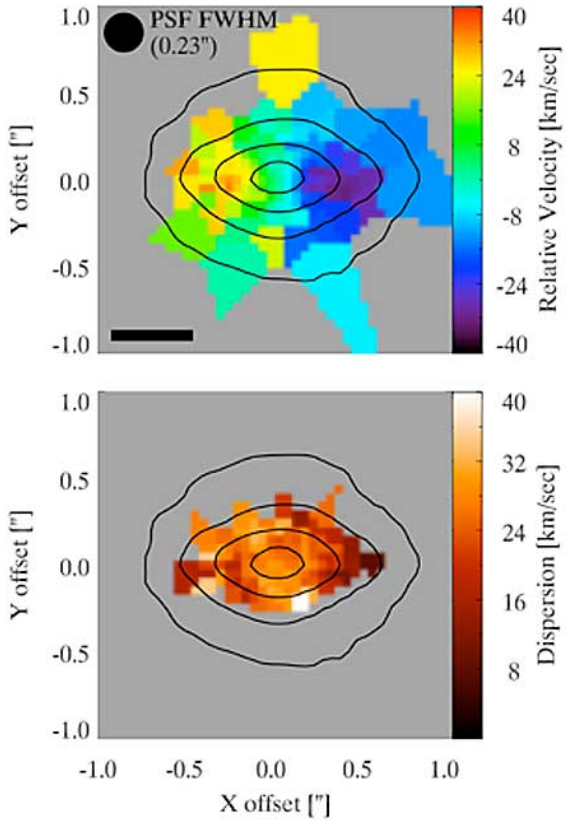


Figure B.1.5. Top: Color show the measure radial velocity observed with NIFS. Blue approaches, green/orange recedes. Rotation of ~30 km/sec is clearly visible along the major axis. Bottom: Velocity dispersion across the NSC derived from NIFS measurements. The contour shows the K-band infrared light surface brightness from NIFS. Flattening of the NSC is obvious.

Several galaxies have nuclear stellar clusters, like the one in the Milky Way's heart. They are among the densest stellar systems in the universe, and typically contain many millions of stars within the few central light-years. Such dense nuclear clusters may exist without a black hole at their core. Because they appear to hold a fixed fraction of all the stars in a galaxy, this indicates that the central volume of a galaxy is tightly linked to the formation and evolution of the entire galaxy. However, such objects are so compact that one needs the *Hubble Space Telescope* and adaptive optics on large ground-based telescopes to study them. The Gemini North adaptive optics laser guide star system and integral field unit infrared spectrograph (NIFS) were used to observe the nuclear star cluster in the nearby galaxy NGC 4244, located some 14 million light-years away. Measurement of stellar velocities reveals that the cluster is strongly rotating (± 30 km/sec), and that this rotation is in the same sense as the galaxy's disk (Figure B.1.5). The mass within the central 33 light-years corresponds to about two million solar masses. This central cluster appears to have formed by accretion of stars and/or of gas from the disk of the galaxy and not by the infall of new material from outside the galaxy.

Merging galaxies Arp299 with laser guide star adaptive optics

The Gemini North laser guide star adaptive optics system was employed to image the merging galaxy system Arp 299. The three galaxies in this system are in the final process of merging and

power a true "supernova factory" from gigantic bursts of star formation. Very deep H and K images were obtained with a spatial resolution of 0.1 arcsecond which allowed several star clusters to be detected for the first time. These infrared images were combined with *Hubble Space Telescope* V and I band images to derive detailed color properties of these galaxies and their super stellar clusters (Figure B.1.6). Color excesses reveal large extinction, as high as 15 to 20 magnitudes in the V band. Preliminary results indicate three main classes of stellar clusters, these are: 1) a very young one (about 7 million years old) that corresponds to the current interaction stage; 2) an older class (about 15 to 20 million years old); and 3) a rather old one (about 120 to 130 million years old) which may correspond to the previous interaction stage.

Figure B.1.6. Composite Altair-LGS NIRI (H and K bands) and HSTWFPC2 (V and I bands) of Arp 299. The field of view is almost 50 arcseconds across.

Weighing supermassive black holes

The close connections between quasars, the most luminous objects in the universe, and galaxies are now identified. These co-existing entities are explained by the existence of a central supermassive black hole that powers the luminous central quasar while accreting matter from its host galaxy. The most important property is the correlation between the central black hole's properties and those of the host galaxy. The tightest correlation is the relation between the mass of the central black hole and the stellar velocity dispersion of the host-galaxy spheroid. So far, mass derivation of the central supermassive black hole has been obtained by the so-called "reverberation mapping" which is an indirect way to infer the distance of the gas rotating around the black hole. The Gemini North laser guide star (LGS) adaptive optics (AO) system and integral field unit near infrared spectrograph (NIFS) were employed to measure the central velocity dispersion of the stars in the center of quasar PG426+015 (Figure B.1.7). NIFS, fed by LGS, allowed the removal of the quasar's light contribution from the spectrum and isolate the stellar light of the background host. This also allowed the derivation of the kinematics of the central stellar field by measuring lines of Mg I, CO and Si I accurately at different distances from the center. The derived mass of a few billion solar masses for the central black hole falls significantly – and uncomfortably – above the known relationship between black hole mass and central velocity dispersion. Future work using the Gemini North LGS AO system to probe other quasar host galaxies will enable us to better understand the co-evolution of black holes and their hosts.

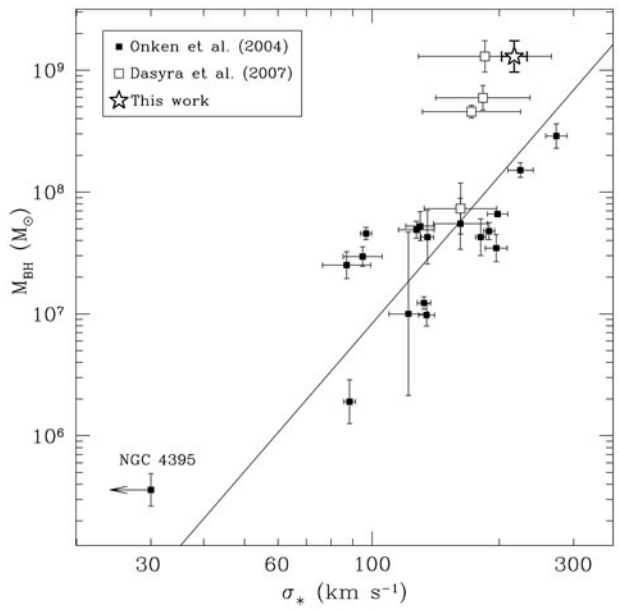


Figure B.1.7. The M_{BH} - σ* relationship for AGNs. Filled squares represent AGNs with velocity dispersion measurements based on the Ca II triplet. The open star at the top represents the Watson et al. measurement for PG 1426+015, while the open square to its immediate left is the position of PG 1426+015 in a previous study. The superior spectrum obtained using NIFS and Altair led to a more precise measurement of the velocity dispersion.

B.2 Staff and Community Publications

As of September 30th 2008, about 530 refereed papers containing Gemini data have been published or were in press in the major refereed astronomical journals. The total number of papers is expected to be about 140 for the 2008. Members of Gemini's science staff are first authors or co-authors on about 35 (about 25%) of the papers in 2008.

Figure B.2.1 (next page) shows the impact distribution of refereed papers for several large observatories through the end of 2007. This figure shows how the papers are distributed in terms of their citation rate which is normalized to the median number of citations of the same year in *Astronomical Journal* papers. On this graph, a steep function indicates a higher number of lightly cited papers compared to heavily cited ones, and a moderate slope indicates a larger fraction of highly cited papers. Papers based on Gemini data show a relatively moderate slope, which could be described as healthy. However, as warned by many bibliometric studies, one should be very careful in the interpretation of such quantitative bibliometric descriptors. The true value of the science is always best assessed by a careful reading of the original papers reporting on the research itself.

The list of Community users and Gemini staff publications based on the use of the Gemini Telescopes can be found as a PDF document at:
http://www.gemini.edu/files/governance/annual_reports/2008/AppendixII.pdf

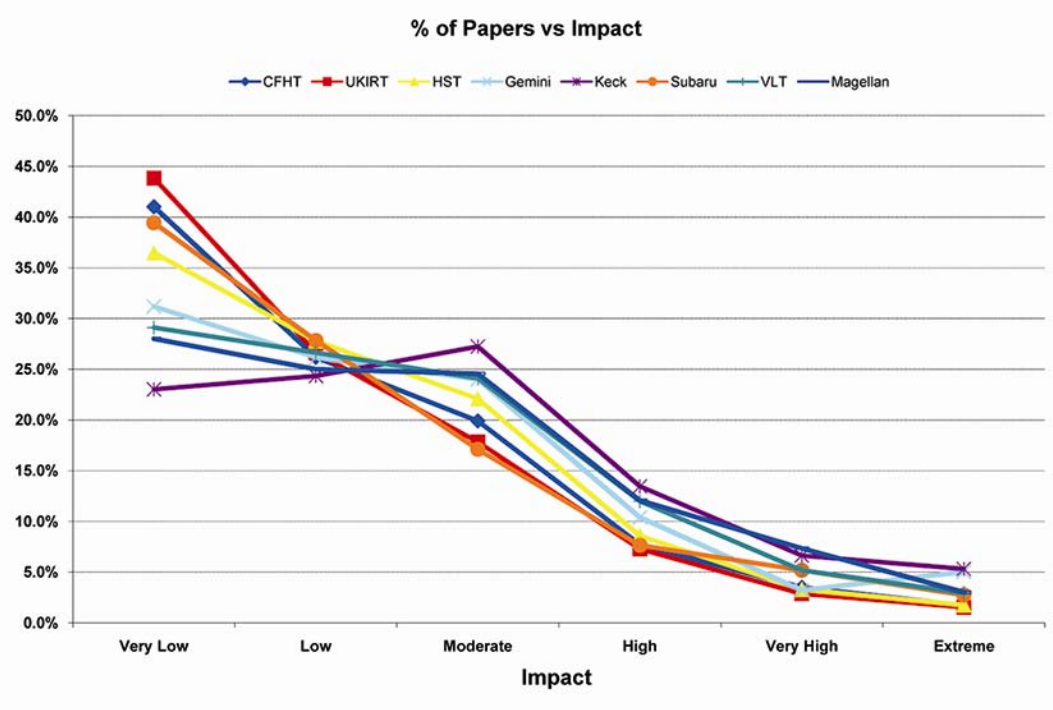


Figure B.2.1. Impact Distribution Function (IDF) for the indicated observatories. Generally an observatory with a flatter IDF is performing better.

B.3 Executed Observing Programs

B.3.1 Community Users Research Programs (Semesters 2007B and 2008A)

The Gemini North and South telescopes were operated predominantly in queue mode for Semesters 2007B and 2008A. Of the 240 programs scheduled on Gemini North during these two semesters 93.3% were queue scheduled while 95.5% of 179 Gemini South programs were queue scheduled. This includes exchange programs with Keck and Subaru which must be classically scheduled.

There were a total of eleven classical programs scheduled on Gemini North in 2007B, four of which were part of the time exchange with the W.M. Keck Observatory. The Gemini community had three programs scheduled on Keck in 2007B. There were also seven classical programs scheduled with the visitor instrument TEXES.

There were no classical programs scheduled on Gemini South during Semester 2007B. The Gemini community had six programs scheduled on Subaru, in classical mode, as part of the time exchange with Subaru. The Subaru programs on Gemini were also executed in classical mode.

In 2008A the number of classical programs on Gemini North dropped to five including two Keck exchange programs and one Subaru exchange program. The Gemini community had two programs scheduled on Keck and five programs on Subaru as part of the time exchange with

these observatories. There were seven classically scheduled programs on Gemini South in 2007A, including two Subaru exchange programs and one Keck exchange program.

As mentioned above, semester 2007B saw a second extended run of the high-resolution mid-infrared spectrograph, TEXES, a "guest" instrument on Gemini North. A total of seven programs were scheduled in classical mode during October.

Scheduled programs can be found as a PDF document at:
http://www.gemini.edu/files/governance/annual_reports/2008/AppendixI.pdf

B.3.2 Gemini Staff Research Programs in 2008

During the year covered by this report, Ph.D. astronomers at both Gemini South and North sites were active in several research programs – many done in collaboration with community members. The programs cover a wide-range of astrophysical topics from our own solar system to merging distant galaxy clusters. The list below provides a representative sample of the areas of research investigated using the suite of optical, near-infrared and mid infrared instruments on both Gemini telescopes:

- Primordial materials on the most primitive solar system objects;
- Understanding outflow launching mechanisms in young stellar objects;
- The origin and evolution of loose-pair low mass stars;
- Determining the nature of brown dwarf atmospheres;
- Searching for molecular hydrogen in planet forming disks;
- Collision of rocky planet embryos;
- Black holes and the nature of tori in active galactic nuclei;
- Star formation in merging galaxy clusters at half the age of the universe;
- Monitoring dust in the evolving supernova 1987A remnant in the Large Magellanic Cloud;
- Supergiant cannibal galaxies in cluster Abell 3827;
- Formation of organic molecules in proto-planetary disks;
- Probing exo-zodiacal materials;
- The starburst history of the galaxy M82.

SECTION C

GEMINI OBSERVATORY'S WORLD CLASS STAFF

C. Gemini Observatory's World Class Staff

C. 1 Gemini's Organizational Chart

As introduced in last year's Annual Report, Gemini's new organizational chart is borne from the idea that it is the function of Gemini's managers to ensure the success of those they lead. Accordingly, the convention of position on Gemini's org-chart is inverted compared to more traditional structures. This reinforces the support-role philosophy that Gemini's leaders have within the staff, and emphasizes the importance of those who are not in a supervisory or management position, which represents to bulk of the staff. Gemini's org-chart is somewhat analogous to a tree, with the leaves representing the upper regions of the chart and the branches and trunk providing the support and sustenance required for the entire organism (the observatory) to thrive. Ultimately this structure (chart) is grounded in the purpose for which we operate Gemini–to explore the universe and share its wonders.

Figure C.1.1 is a functional representation of Gemini's organizational structure while Figure C.1.2 (page 14) is the actual org-chart. The four primary branches of Gemini's organization include engineering, administration, instrumentation development, and science operations. Due to their strategic importance, the safety and public information and outreach programs report directly to Gemini's Director and Deputy Director respectively. Most of the staff resides in the engineering and science operations branches, as they handle myriad key functions including repair/maintenance of the telescopes and instrumentation and nightly execution of Gemini's observing queue. The instrumentation group is by far the smallest, with only three members, but together they run literally millions of dollars in development contracts which provide Gemini with a steady stream of modern instrumentation. The administrative group is traditionally thought of as providing a purely support role (handling payroll, procurement, accounting, etc.) but at Gemini the administrative group is viewed as an equal with the other branches and has consistently demonstrated outstanding leadership and innovative approaches toward running Gemini. It is also interesting to compare the degree to which branches are hierarchical or "flat" in our organizational structure. The science operations team is relatively flat with

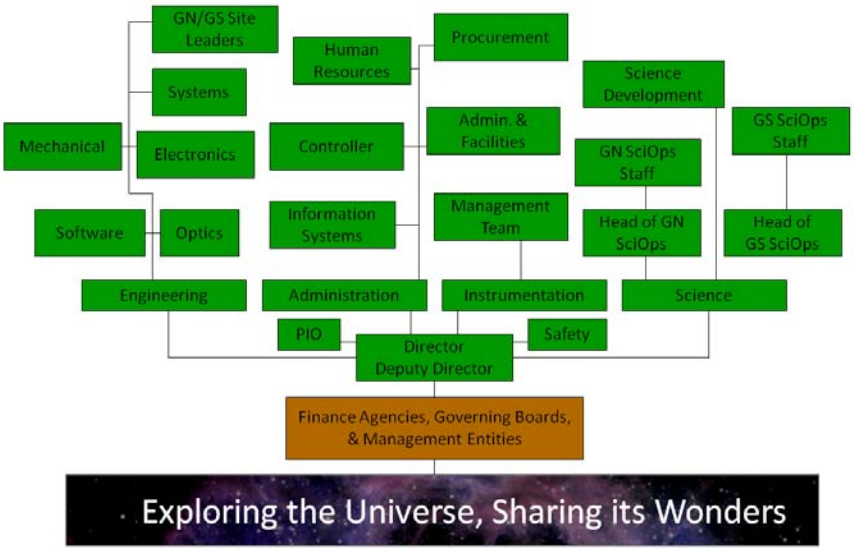


Figure C.1.1. The functional representation of Gemini's org-chart is shown. The four primary branches of Gemini's organization are shown with the entire structure grounded in Gemini's fundamental purpose and the finance agencies, governing boards, and management entities working with Gemini's Directorate to support the entire operation.

clearly defined "heads" at each site. This simplifies reporting structures and streamlines communications. In contrast engineering is partitioned among many functional groups (electronics, optics, software, etc.) and each group has its own manager. This approach makes sense in terms of organizing skills across the entire engineering team but also tends to complicate communication channels. Of particular importance though, in 2008 a new position of Deputy Chief Engineer was created. Analogous to the working relationship between the Deputy Director (in Chile) and Director (in Hawai'i), the Deputy Chief Engineer (in Hawai'i) represents the Associate Director for Engineering (in Chile), provides overall leadership for the engineering team in Hawai'i, and simplifies key communication channels which otherwise get narrowed due to the six or seven hour time zone differences between the two Gemini sites.

C. Gemini Observatory's World Class Staff

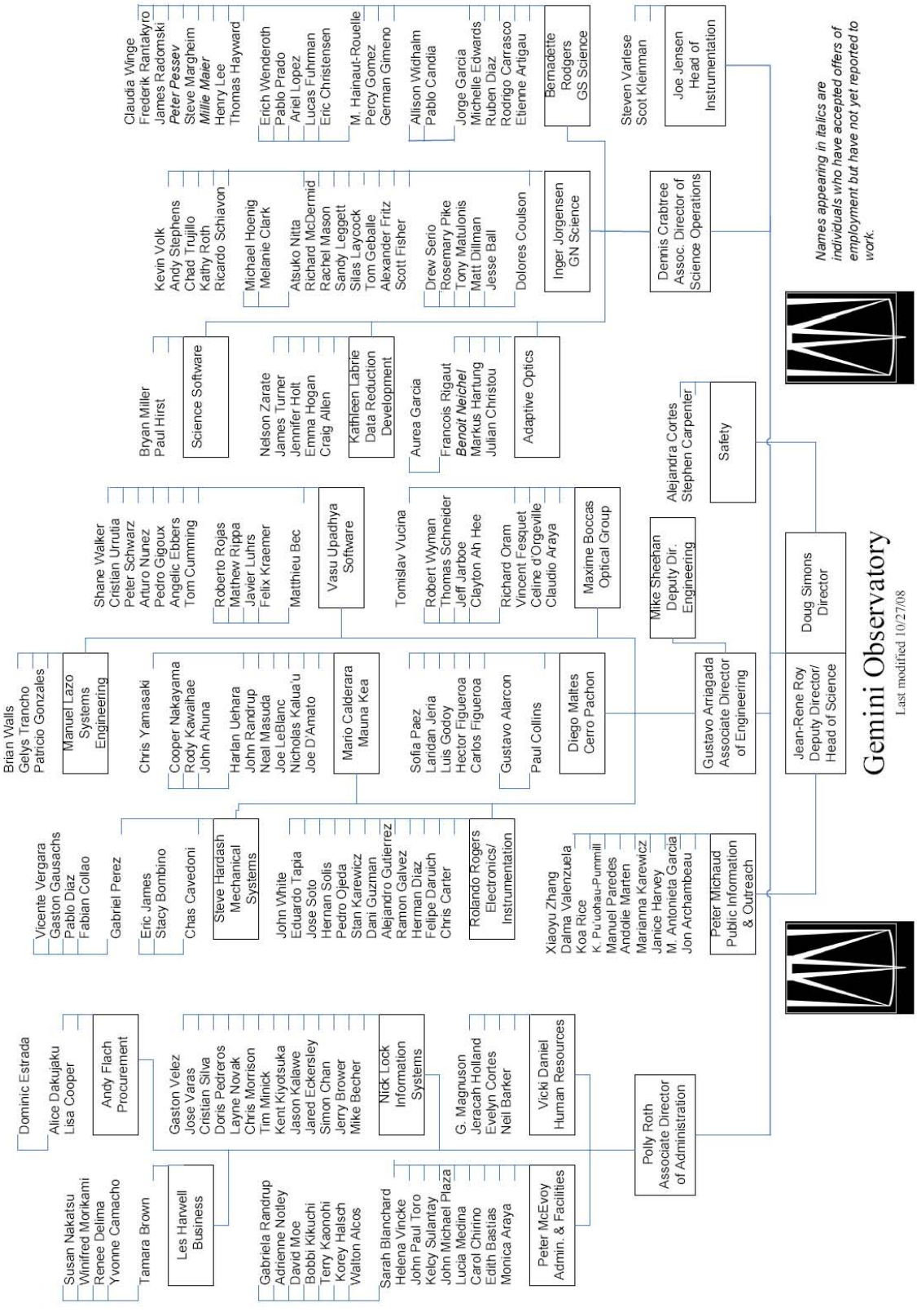


Figure C.1.2. Gemini Observatory organization chart

C.2 Fulfilling Our Mission Through Community Involvement

Educational Outreach Programs

The Gemini Observatory has, since its early days as a construction project, considered the sharing of its research, technology and resources as key element of our interaction with our various communities. While our scientific research community is at the core of our responsibilities as an observatory, it is also recognized that there are many other communities who can (and must) benefit from our exploration of the universe.

The word "community" at Gemini goes well beyond the usual defining boundaries that most organizations adopt. At Gemini it includes the public at large, students, educators, residents in our host communities (Hilo and La Serena), our staff and their families and of course our scientific user communities in the seven Gemini partner countries. Naturally, this list is incomplete, but it does provide a sense for the variety of communities ultimately served by Gemini.

Figure C.2.1. A montage highlighting many of the Gemini PIO activities described in this report.

While the Public Information and Outreach Office is not responsible for serving all of these audiences, together, the Gemini team does. For example, by making Gemini a safe working environment, the Safety Department is assuring that employees come home safe and serve our staff and their families. All of the Gemini departments serve similar functions for a wide-range

of communities and each one is critical to the ongoing operation of a complex research facility like Gemini.

In addition to being essential for an individual research organization such as Gemini, it is critical for the discipline of astronomy at-large to maintain a healthy relationship with our host communities. As has been seen over and over, a failure to see in tangible ways the work and mission of astronomical observatories can lead to more difficult acceptance (or resistance) of/to new initiatives and projects that will further our understanding of the universe. Another important aspect of local community relations is our impact and reputation on the workforce we are able to recruit and maintain. A strong educational effort has a profound impact on the quality of local hiring both in the long-term by inspiring local students to pursue an education in science and technology, and also by alerting the best and brightest in the existing workforce to career opportunities at our observatory.

For the purpose of this report we will focus on the work of the Public Information and Outreach (PIO) Office where the most visible interactions with our various general public and educational communities take place. The following samples provide highlights that illustrate the variety of programming and the world-class caliber of our programming. This programming is both contemporary (during the period of this report) and historical since many of these efforts have built on previous year's successes and lessons learned. Several of the programs implemented in prior years were extremely successful and are planned again for future. In addition, several of these programs are being modified for 2009 to better match the goals of the International Year of Astronomy (IYA) and more details on the IYA and Gemini programming can be found in Section F.6.

Gemini PIO Programmatic Highlights:

Journey through the Universe: This program, previously managed by the Challenger Center, is a program that has been leveraged by Gemini to provide educational training to teachers and classroom and community programming in astronomy and space education on Hawai'i Island. This ongoing program (currently in its 5th year) partners other Mauna Kea observatories, the Hawai'i State Department of Education and multiple community organizations and businesses.

Figure C.2.2. The Gemini StarLab portable planetarium set up for AstroDay Chile in early 2008.

AstroDay Chile: This is a local public event sponsored by Gemini with help from all local (La Serena) astronomical observatories. Held at the local shopping mall, this event attracts thousands of visitors and has become an annual event in Gemini South's host community of La Serena. The event is based on the popular AstroDay concept in

the US (and very successful in Hilo).

StarLab: Gemini is responsible for 4 StarLab portable planetaria located in both Hawai'i and Chile. Gemini now offers classroom programs and teacher training so that teachers can borrow StarLabs for integration into existing curricula. A program in Chile focuses on light pollution awareness and a program in Hawai'i focuses on Polynesian navigation and was developed in partnership with traditional Polynesian voyaging practitioners (see Figure C.2.2).

FamilyAstro: FamilyAstro is a program of the Astronomical Society of the Pacific that was originally funded by the NSF. FamilyAstro offers programs targeted at families and interactive family sessions are presented by teacher networks trained by Gemini staff. Gemini has partnered with the Hawai'i Department of Education as part of their community outreach programming for schools. FamilyAstro is particularly targeted at at-risk and underrepresented ethnic groups in Hawai'i and has recently been expanded to Chile and Argentina as well.

Outreach Partnerships: Multiple partnerships have been established to broaden our impact and leverage resources in our host communities. These include programs such as AstroDay Chile (organized by Gemini South outreach staff), the 'Imiloa Astronomy Education Center in Hawai'i and the CADIAS center in Chile, the Mauna Kea Observatories Outreach Committee (in 2007-8 the PIO Manager chaired a special working group that obtained funding for local IYA activities) and other visitor centers and educational organizations (like the Hawai'i State Department of Education in Hawai'i and the University of Chile).

Teacher Workshops: Participation in teacher workshops provides a powerful tool for delivering our messages to students. The primary focus is to provide content related to Gemini discoveries while providing teachers with the knowledge necessary to help students (especially underrepresented groups) explore possible careers in science and technology. See Figure C.2.3 for an example of teacher experiences provided by Gemini.

Classroom Presentations: Classroom presentations are provided for local classrooms upon request with a focus on underrepresented groups with content that provides career pathways for students to consider scientific/technical options.

Community Events: Participation in a wide variety of voluntary community events/organizations included AstroDay, community fairs, Fund-raisers (for non-profit organizations like American Cancer Society, Heart Association etc.), and the Chamber of Commerce.

Virtual Tour: The Gemini Virtual Tour is presented at

Figure C.2.3. Almost two-dozen local Hawai'i teachers participate in a tour of the Gemini North facilities on Mauna Kea.

multiple kiosks in our local communities and distributed broadly via CD (and web) to the public, students and educators. The tour provides a complete interactive "snapshot" of the Observatory environment, including the science and career opportunities available. Modules are currently being modified for web delivery.

Internships: Intern programs both in the PIO department and other Gemini departments provide a direct link for local and beyond who wish to follow up on career options and explore aptitude and interest in an astronomy-related career. PIO staff support these programs by soliciting students and serving as a conduit between students and programs.

C.3 Examples of Gemini Innovation and Leadership

C.3.1 Earthquake Workshop in Chile

Following the October 2006 Hawai'i earthquake that shut down many of the Mauna Kea observatories for weeks, some actions were taken in order to mitigate the risks associated with future earthquakes. First, a workshop was held in Hawai'i in March 2007 to get the perspective of all Mauna Kea observatories on how their facilities reacted to the recent earthquake and what could be done to improve performance and response to future events. Of this group, Gemini is unique in that we have a telescope facility in Chile as well. In December 2007 Gemini Observatory staff led the organization of a *Chile Earthquake Readiness Workshop* involving all of the major observatories with existing and planned facilities in Chile.

The Chile workshop, sponsored by Gemini, AURA-Observatories and ESO was held in La Serena, Chile. The two primary areas of focus were structural design considerations (science and engineering aspects of earthquake risk mitigation) and safety. Sergio Barrientos, the scientific director of the Seismological Services Department for the Universidad de Chile gave a powerful keynote talk at the opening of the workshop, *"New Considerations about Chile's Seismic Hazard.*" The workshop attracted about 80 participants from 21 observatories and organizations.

C.3.2 The NICI Planet Search Campaign

Gemini's latest addition to its instrument suite at Gemini South is the Near-Infrared Coronagraphic Imager (NICI). NICI is the first Gemini instrument designed specifically to search for and analyze the properties of planets orbiting other stars. With an internal 85-element adaptive optics (AO) system, dual imaging cameras with narrow-band methane filters, and an optimized coronagraph, NICI is designed to find exoplanets very close to their parent stars.

NICI is the most specialized of Gemini's instruments thus far, and meeting its science goals also requires a specialized approach. Finding planets will require a large survey of nearby stars conducted over two to three years in order to find a few needles in a very large haystack. In 2005 Gemini announced the opportunity to apply for a large block of NICI time to look for

planets around nearby stars. More than 100 astronomers from across the Gemini partnership submitted letters of interest in the NICI planet search, and three strong international teams submitted applications for up to 500 hours of Gemini time. The team led by Michael Liu (University of Hawai'i) was chosen to conduct the NICI planet search survey. The NICI instrument team led by Doug Toomey of Mauna Kea Infrared (MKIR) joined Liu's team, bringing their NICI expertise and 12 guaranteed nights to supplement the campaign.

The NICI planet survey will search for young, massive Jovian planets around nearby stars. Young planets glow with the residual heat of formation, which NICI will detect. With a census of such planets, the NICI campaign team will address three important questions: 1) What is the distribution of masses and separations of planets in the outer regions of other solar systems; 2) How does the mass of the parent star affect the chances of planets forming; and 3) What are the properties and compositions of the young giant planets? NICI will be able to detect the infrared light from the planets directly, revealing much about their masses, compositions, and temperatures.

Planets are much fainter than their parent stars. To help distinguish real planets from scattered light from the bright star, the NICI team uses specialized filters and observing strategies. Since the atmospheres of giant planets usually contain methane, the filters in NICI have been designed to maximize the contrast between an object with methane in the atmosphere and one without. Companion planets are also difficult to distinguish from background stars, so the NICI campaign will require follow-up observations taken months later. During the time between observations, the nearby star will have moved relative to the background stars, making it possible to distinguish real co-moving planets from background objects.

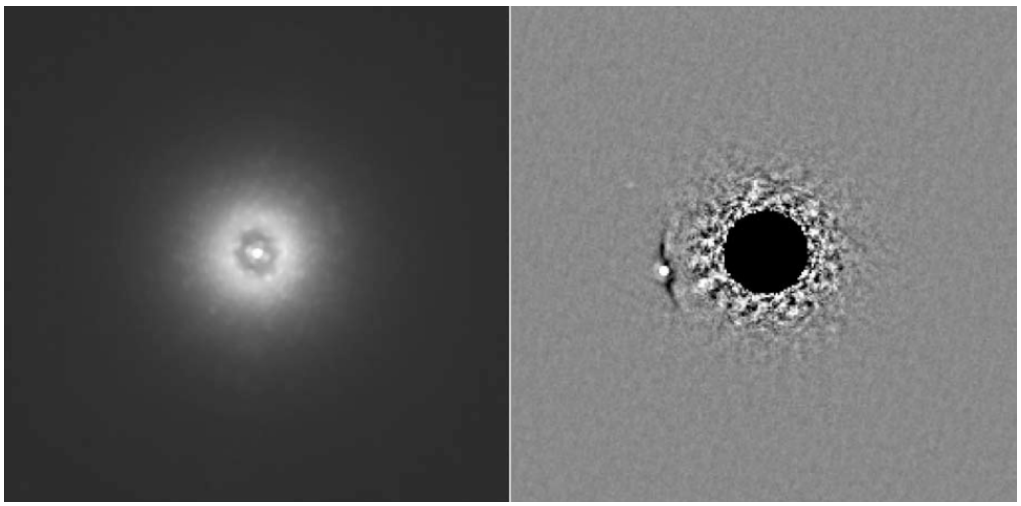


Figure C.3.2.1. NICI images of HD129642 in the 1.6 μm methane 4% filter. The image at left shows the star visible through the semi-transparent 0.3 arcsecond coronagraph mask. The image at right was processed to remove the central star, revealing a faint background star (at the 8 o'clock position).

C.3.3 Target-of-Opportunity programs

Gemini offers two types of Target-of-Opportunity (ToO) programs in the queue. Rapid ToO programs are those that require observations to be taken within 24 hours of the "trigger" coming in from the program's investigators. Many rapid ToO observations require a significantly faster response than 24 hours, and the triggers for these observations are allowed to interrupt the ongoing queue observations. While other telescopes offer a rapid ToO capability, Gemini is unique in that the data taken are available to the Principal Investigator (PI) for download from the Gemini Science Archive (GSA) within minutes (less than 15 minutes on average) after they are obtained. Gemini PIs often take advantage of this feature and we have on occasion had second triggers for follow-ups on the same target *during the same night*.

Standard ToO programs are those for which observations are triggered 24 hours or more in advance of the execution. Standard ToO triggers are not allowed to interrupt ongoing queue observations. They are instead incorporated into the nightly plans by the queue coordinators.

Standard ToO programs were first scheduled at Gemini in semester 2003B, while rapid ToO programs were first scheduled in 2004B. The triggering of rapid ToO observations has been done through the Observing Tool since 2005A. Full software support for triggering Standard ToO observations trough the Observing Tool was put in place 2008A.

The main science area for the rapid ToO programs is for the follow-up of gamma-ray-burst events. The observations executed so far for these programs have contributed significantly to the understanding of both short- and long-duration gamma-ray-bursts, their redshift distribution, metallicities and host galaxies. In the queue the rapid ToO programs are limited to one active program per site at any given time. This is to avoid conflicts between triggers from different programs. Rapid ToO programs are allowed to trigger on all queue nights. Starting in 2009A they will also be allowed to trigger during classical nights as well. Whether a program triggers an observation on a given event is determined by the program's investigators. Each rapid ToO program has a set number of hours available in band 1. Typically, 15-40 hours at each site per semester is scheduled for rapid ToO programs. The triggered time varies from semester to semester, but typically each site receives 2-5 "slew now" triggers per semester. These are the triggers that can interrupt ongoing observations. Another 20-25 observations are triggered from the rapid ToO programs while the targets are still below the horizon, during the day, or as follow-up observations. These observations are either executed by the observer the same night or incorporated into the nightly plans by the queue coordinators on later nights. Once a rapid ToO observation is in progress, the queue observer contacts the PI of the program by e-mail, and the PI has access to the data within minutes through the GSA.

The Standard ToO programs cover supernova follow-up, as well as spectroscopic follow-up of targets (quasars, brown dwarfs etc.) found in imaging surveys on other telescopes. Gemini's queue scheduling makes it possible for survey investigators to have an approved standard ToO program in the queue for follow-up observations that can then be done in a timely fashion. To illustrate the flexibility of the queue for scheduling standard ToO observations, Figure C.3.3.1 shows the time usage of the Supernova Legacy Program. This program has been active on

Gemini at both sites in the period 2005A-2008A. The triggers are based on imaging survey data from the Canada-France-Hawai'i-Telescope. Triggers only happen when imaging is obtained in good conditions and supernovae of the correct type are found. Spectroscopic follow-up requires an 8-meter-class telescope, photometric sky, and seeing better than 0.8 arcsecond in the optical. The average time usage on Gemini in each dark period through 2005A-2008A has been 8.7 hours. The figure (C.3.3.1) shows that there have been dark periods with no time usage, and others with more than 20 hours used. If the program had been classically scheduled at the level of one night per month (the average time usage), the chance of getting the requested conditions would be only ~25% each month.

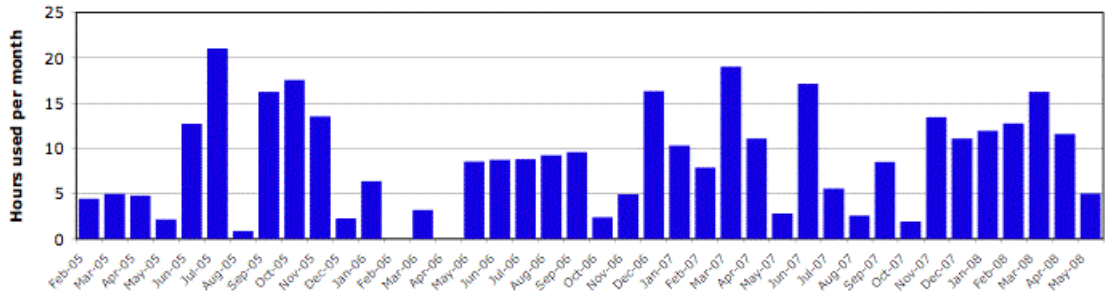


Figure C.3.3.1. Hours charged to the Supernova Legacy program per dark period (month) the program was active.

The allocation for ToO programs in the queue has increased over the semesters, though the fraction of the queue in ToO programs has only increased slightly. In 2003B-2005A typically 150-200 hours were allocated to a total of 5-10 ToO programs, while 60-100 hours were actually triggered and executed. This amounts to ~6% of the charged telescope time. In 2007B and 2008A, we had 16 and 25 ToO programs respectively, with a total of 220-330 hours allocated in each semester. Of these 140-170 hours were executed. This amounts to ~8% of the charged telescope time in these semesters.

SECTION D

ACHIEVEMENTS DURING THE PAST YEAR

D. Achievements During the Past Year

D.1 Operations Metrics

Gemini tracks completion rates for queue programs, open shutter efficiency, acquisition times and weather losses for both telescopes, in an effort to optimize the efficiency of the nighttime operations. The following sections discuss some of these key metrics and compare the current performance to past data. The most central metric is the completion rate of the queue programs scheduled on the Gemini telescopes, as this directly relates to our scientific productivity. The details of these metrics are maintained on the Gemini public web site and accessible to our users at:
http://www.gemini.edu/sciops/telescope/SciOpsStats/sciopsstats.html

D.1.1 Queue Completion Rates

Gemini aims to deliver complete datasets, and in particular, to complete queue programs once they have been started. Therefore the completion rates of queue programs are closely tracked and queue planning is carried out to optimize our completion rates. Full multi-instrument queue planning was put in place at Gemini North starting in semester 2005A, and at Gemini South in semester 2005B. Combined with better reliability of instruments and telescopes, this change has led to a significant increase in the completion rates of programs across all ranking bands. In addition, in semester 2004A, the sizes of the ranking bands were changed from equal size to roughly 20%, 30%, and 50% for band 1, 2, and 3, respectively. At the same time, the national Time Allocation Committees were given the option of granting Band 1 programs rollover status such that it would be active in the queue for a total of three semesters. Starting in semester 2007A, the ranking bands were re-adjusted again to 30%, 30%, and 40% for band 1, 2, and 3, respectively. The latter corrective step was taken to allow all of the major partners to have their appropriate share of Band 1 time.

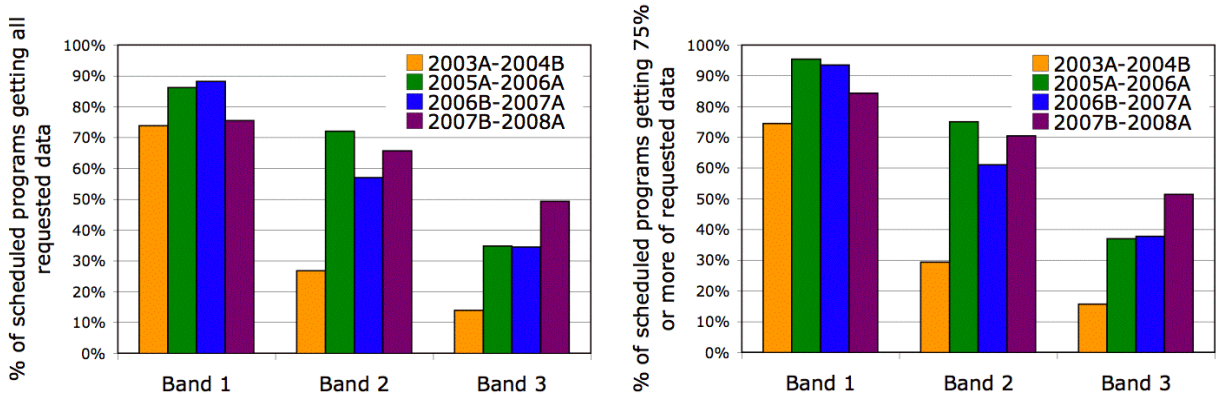


Figure D.1.1.1. Summary of the completion rates by band in semesters 2003A-2004B, 2005A-2006A, 2006B-2007A, and 2007B-2008A for both Gemini North and South. Left panel shows fraction of scheduled programs recieving all requested data. Right panel shows fraction of programs receiving 75% or more of requested data, a level that has

been shown to be sufficient for the production of publications. Note that the most recent band 1 bars (purple) will increase further as rollover programs are completed in 2008B and 2009A (see Figure D.1.1.2).

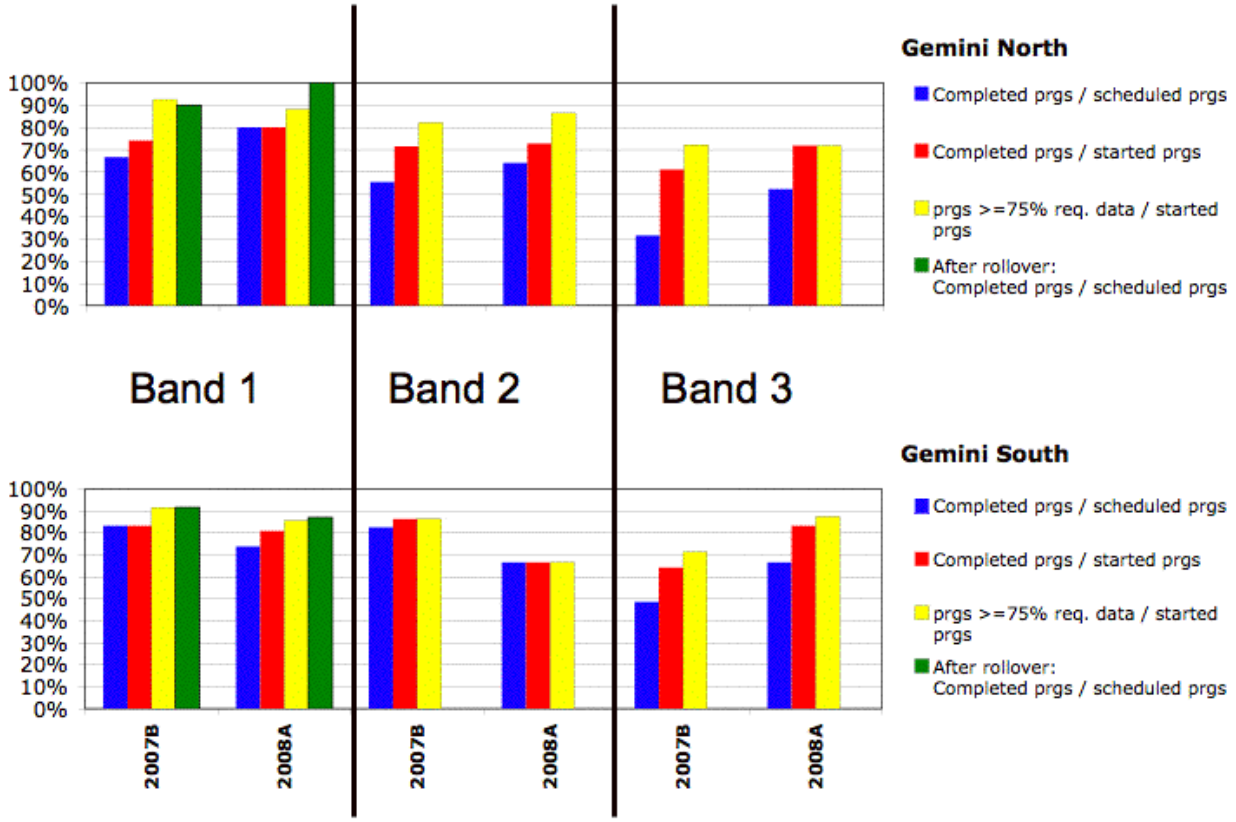


Figure D.1.1.2. Details of the completion rates by band for semester 2007B and 2008A.

Figure D.1.1.1 compares the completion rates in the earlier semesters (2003A-2004B) with those of the semesters 2005A-2006A, 2006B-2007A, and 2007B-2008A. Both Gemini sites are included in the figure. Detailed information for semesters 2007B and 2008A, as of UT October 27, 2008, is shown in Figure D.1.1.2. For semesters 2005A and later, target-of-opportunity programs have been included, and their completion counted relative to the fraction of time the program's investigators "triggered" as requested observations. Target-of-opportunity programs without any triggered time have been excluded from the statistics.

The completion rates in band 1 and 2 in semesters 2005A-2006A were 85% and 72%, respectively. In 2006B-2007A these were 94% and 61%, respectively. The earthquake at Gemini North significantly affected the completion rates at Gemini North in 2006B, affecting primarily band 2 and 3 programs. Gemini South completion rates were significantly affected in 2007A by the failure of GNIRS, particularly bands 2 and 3 (some band 1 programs were completed at Gemini North). The change in ranking band size in 2007A may also have contributed to the decrease in the completion rates for 2007A, as well as the uneven RA distribution of targets in

the queue on Gemini North. In 2007B-2008A the completion rates in band 1 and 2 were 84% and 71%, respectively. It is important to note that there are still active programs with rollover status from 2007B and 2008A, which if completed will bring the band 1 completion rates to about 90% for both semesters, see Figure D.1.1.2 for details.

Given that the queue is overfilled, once losses to weather and technical problems are taken into account, not all band 3 programs can get data. Thus, a critical part of the queue planning is to select band 3 programs to optimize our scientific productivity. As completed programs are more likely to produce publications, the likelihood of completing a band 3 program is a critical component of the decision by the queue coordinators to start a given band 3 program. Figure D.1.1.2 shows that 70-80% of started band 3 programs get at least 75% of requested data. These programs are therefore expected to have sufficient data to produce publishable results.

D.1.2 Open Shutter Efficiency

The open shutter efficiency for Gemini instruments has been tracked since August 2004. The effort (mostly manual) for analyzing the data was temporarily suspended in February 2006, due to the lack of automated software for efficient tracking of open shutter time during multi-instrument queue nights. In mid-2008 we put in place a more automatic method of tracking the open shutter efficiency and processed all of the data from 2007B and 2008A. Here, we focus on comparing the new data with past performance for similar instruments or combinations of instruments.

For each night, open shutter time was extracted from the FITS headers of the obtained observations. For the mid-infrared instruments (MICHELLE and T-ReCS) the tracked open-shutter efficiency includes the overhead from nodding & chopping. This means one should expect the efficiency for these instruments to be similar to those of other instruments while of course the actual exposure times on the target will be lower. Currently with guiding on one side of the beam, the exposure time on the target is a factor 3.73 lower than automatically derived "open-shutter" efficiency for the mid-infrared instruments.

The observing conditions for each night have been classified. This is now done automatically based on the FITS header information. Stable (and good) conditions were assigned to nights when the seeing was stable and the night was either photometric or had very thin (stable) cirrus. Less stable conditions were assigned to nights during which either the seeing and/or the cloud cover varied sufficiently and forced the observer to change observing programs. Unstable conditions were assigned to nights with several changes in the observing program and/or significant time lost due to the weather. In all cases, the open shutter efficiency was derived as the fraction of the usable time during the night, minus any loss due to weather or technical faults. The nights classified as “unstable” are not included in the current data.

Figure D.1.2.1 compares the open shutter efficiency during the period August 2004 to February 2006 with that of 2007B-2008A, for similar instruments or combinations of instruments. The open shutter efficiency for GMOS-North and GMOS-South are now both 70.5% on average. Nights when GMOS is used together with the site’s main near-infrared instrument, e.g. GMOS-

North and NIRI, GMOS-South and GNIRS or Phoenix, have 2.5-3% higher efficiency in 2007B-2008A than seen in the older data. Averaged over all queue nights (excluding those with unstable conditions) the open shutter efficiency is 62.8% at Gemini North and 58.2% at Gemini South. While these numbers are 1-2% lower than in 2004-2006, it is important to keep in mind that they also reflect the demand for the different instruments in the queue. At Gemini North the demand for NIFS has lead to a lower demand for GMOS-North. Thus, more time was spent observing with a near-infrared instrument in 2007B-2008A than was the case in 2004-2006, leading to slightly lower overall open shutter efficiency.

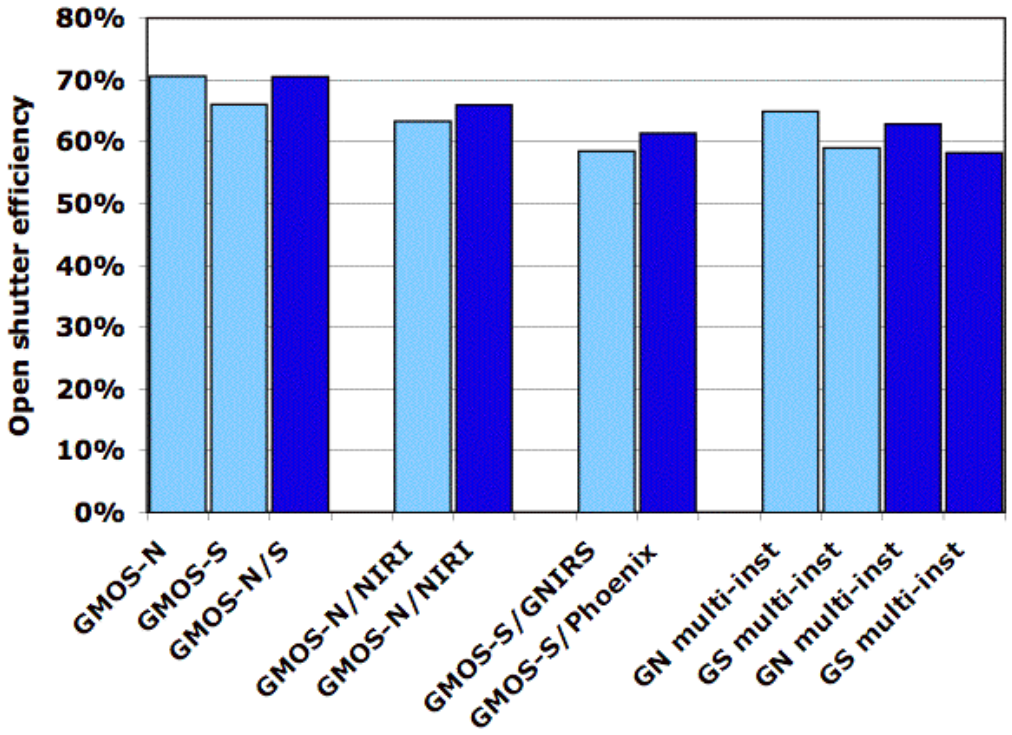
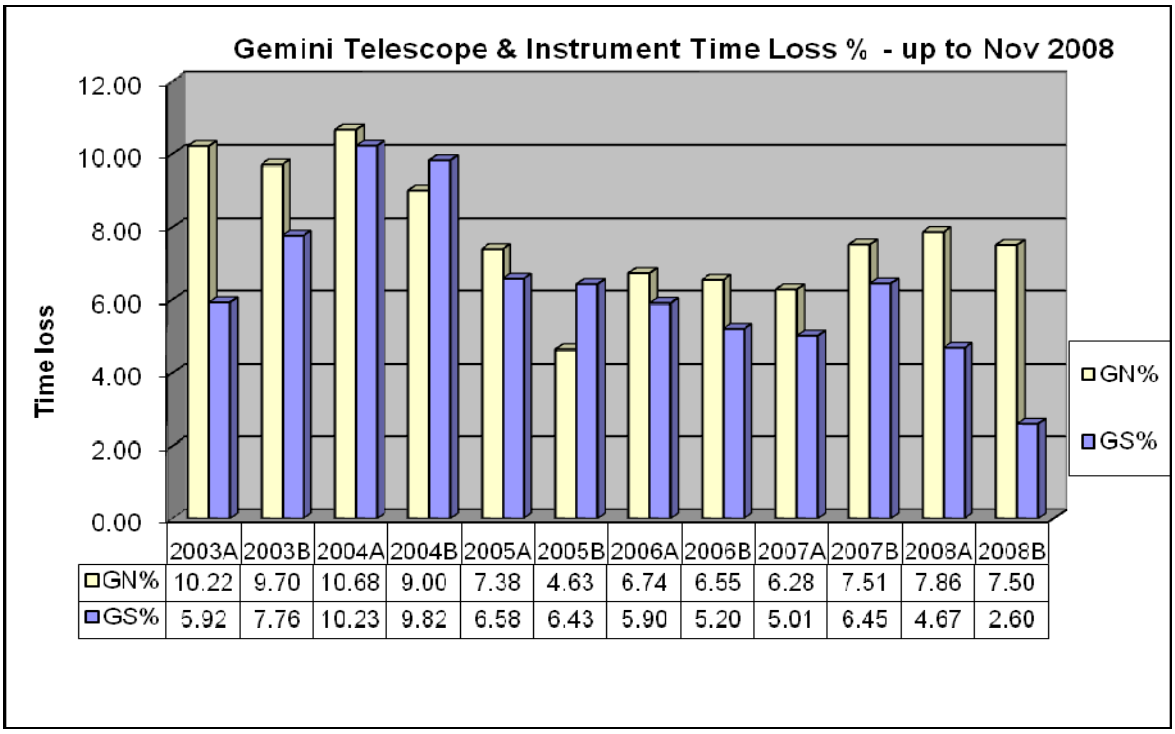


Figure D.1.2.1. Open Shutter Efficiency: light blue: August 2004 - February 2006. Dark blue – 2007B-2008A. For comparable instruments or combinations, the open shutter efficiency has increased slightly, see text for details.

D.1.3 Telescope Down-Time

Telescopes and instrument performance statistics show an interesting evolution. On one side we have Gemini South consistently reducing its time loss percentage year after year, something expected given the maturity of the systems and the experience of our team. On the other side we can see that Gemini North in 2007B and the beginning of 2008 has shown unusual growth in time loss which can be explained by looking at telescope and instrument statistics in more detail.



	2003A	2003B	2004A	2004B	2005A	2005B	2006A	2006B	2007A	2007B	2008A	2008B
GN%	10.22	9.70	10.68	9.00	7.38	4.63	6.74	6.55	6.28	7.51	7.86	7.50
GS%	5.92	7.76	10.23	9.82	6.58	6.43	5.90	5.20	5.01	6.45	4.67	2.60

Figure D.1.3.1. Time loss of both telescopes by semester since 2003A.

If we look at the numbers in terms of hours lost due to faults per semester, (see Figure D.1.3.1) we see that, in the case of Gemini South in 2007B, we accumulated 84 hours and so far in 2008 we have 94.8 hours of time loss due to faults. Similarly for Gemini North in 2007B we accumulated 93 hours, but so far in 2008, we have a total of 179 hours of time lost due to faults.

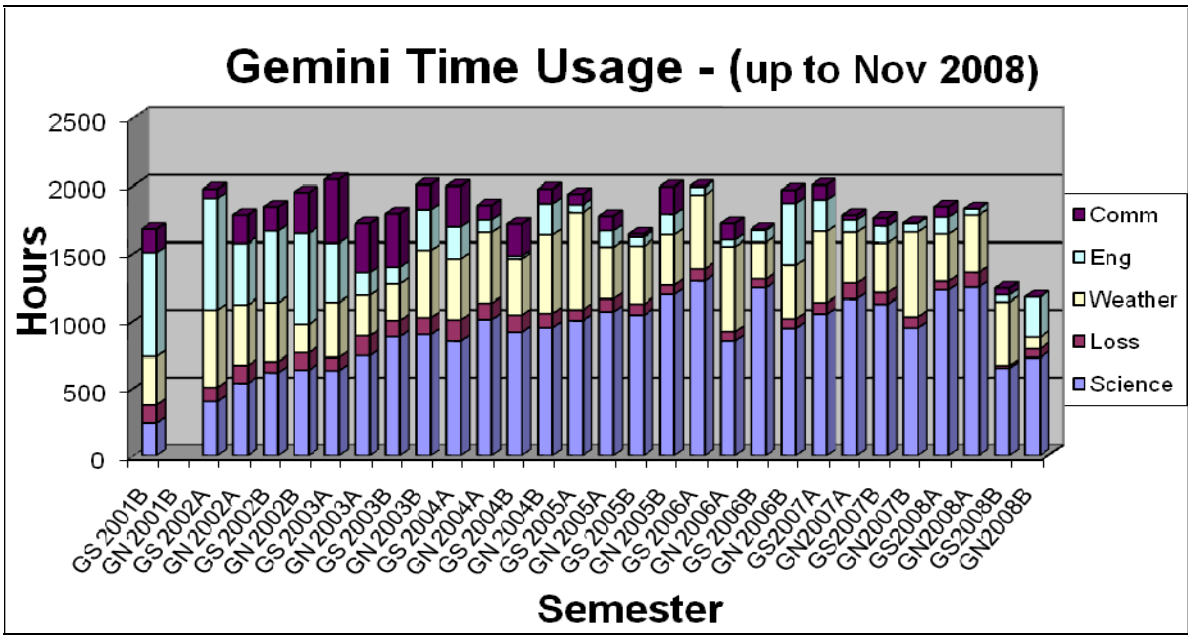
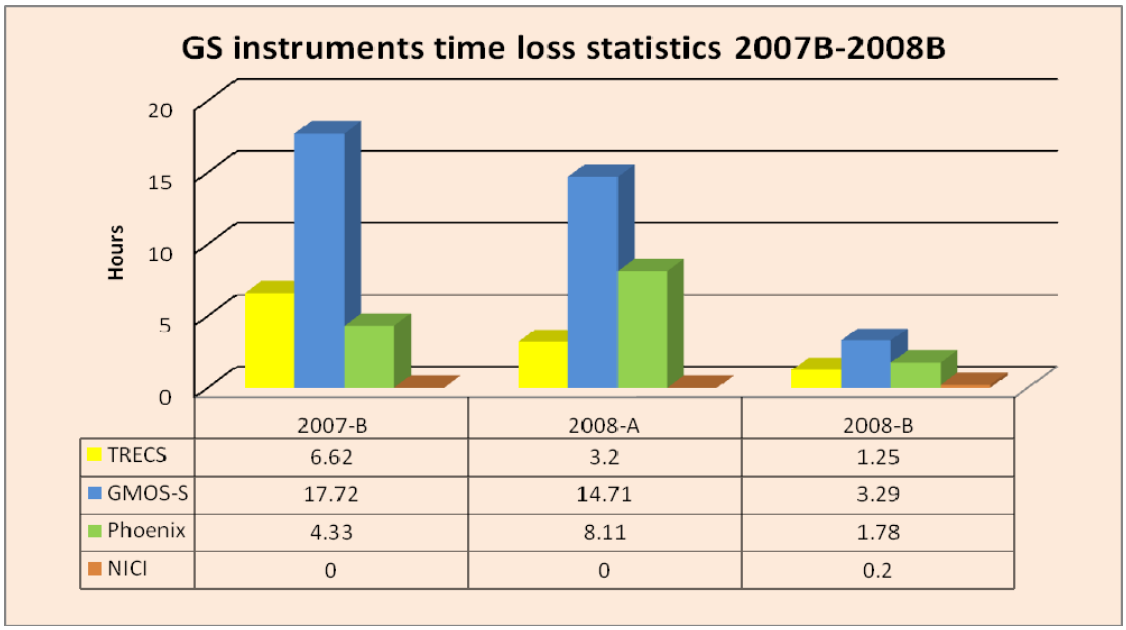


Figure D.1.3.2. Total Gemini time usage since semester 2001B.

Gemini South Instruments time loss statistics show a very distinctive trend in reducing the number of hours lost due to instruments unreliability or intermittent long-standing problems.



	2007-B	2008-A	2008-B
TRECS	6.62	3.2	1.25
GMOS-S	17.72	14.71	3.29
Phoenix	4.33	8.11	1.78
NICI	0	0	0.2

Figure D.1.3.3. Gemini South time loss by instrument (2008B in incomplete due to the period of this report).

In the case of Gemini South telescope systems the situation is very similar. We have been able to reduce the time loss due to faults in a majority of systems. The most drastic change has been in the M2 (secondary mirror) system that went from 16 hours in 2008A to zero (so far) in 2008B. The Acquisition and Guiding system (A&G) went from being an unreliable system a few years ago (for example, in 2004 the time lost due to faults in this system at Gemini North and South was 34 hours on each site) to a system that now has less than four hours of time loss per semester. This is thanks to the maintenance work and upgrades done to the A&G units on both telescopes.

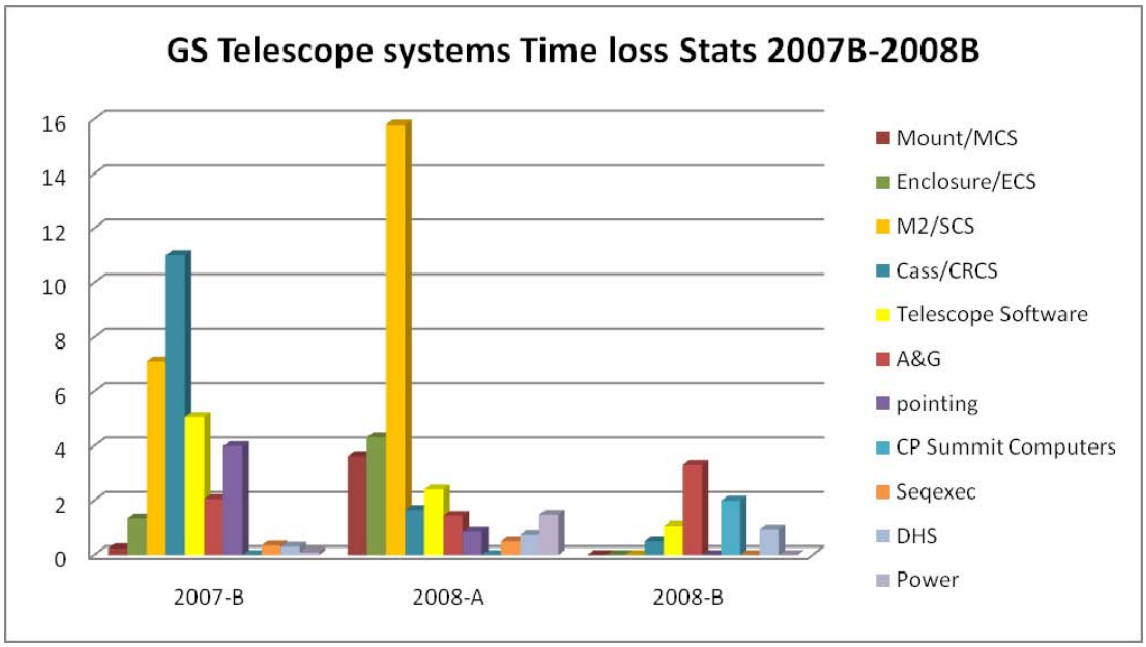
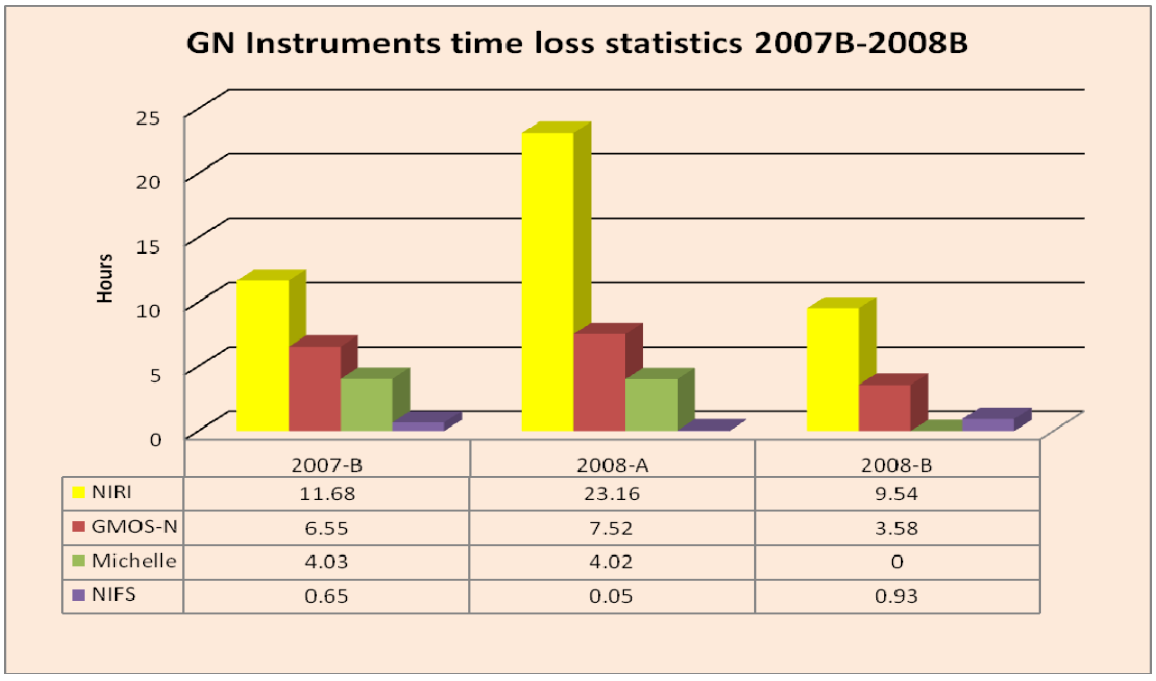


Figure D.1.3.4. Gemini South time loss between semesters 2007B and 2008B (2008B in incomplete due to the period of this report).

Gemini North instrument time loss statistics also shows a good trend in terms of long-term reliability improvements. Nevertheless, NIRI has been our most troublesome instrument, mainly due to a fixed pattern noise that has proven to be exceptionally difficult to solve. As a mitigation strategy, every time the instrument is off the telescope for maintenance we work on detector noise issues.



	2007-B	2008-A	2008-B
NIRI	11.68	23.16	9.54
GMOS-N	6.55	7.52	3.58
Michelle	4.03	4.02	0
NIFS	0.65	0.05	0.93

Figure D.1.3.5. Gemini North time loss by instrument (2008B in incomplete due to the period of this report).

Gemini North telescope systems time loss statistics shows that even though progress has been made in improving the performance of telescope systems we still have systems unreliability issues. Thanks to the new preventive maintenance approach, we have managed to reduce the seven systems that accumulated more than two hours of time loss due to failures in 2008A to five so far in 2008B.

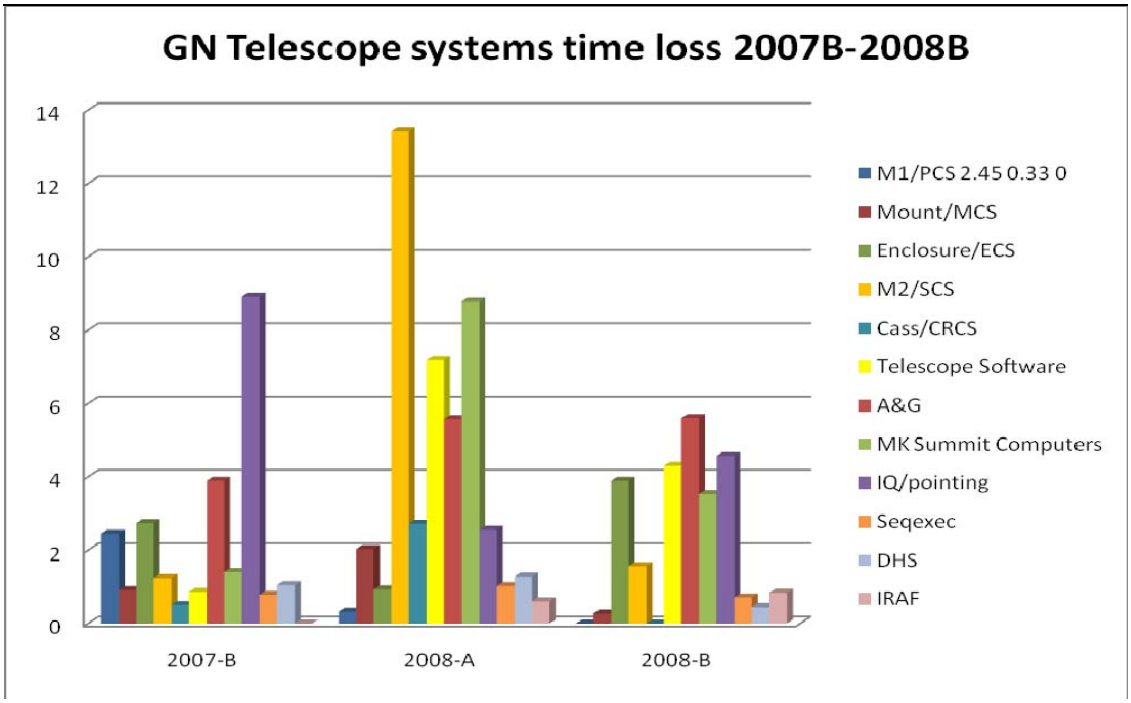
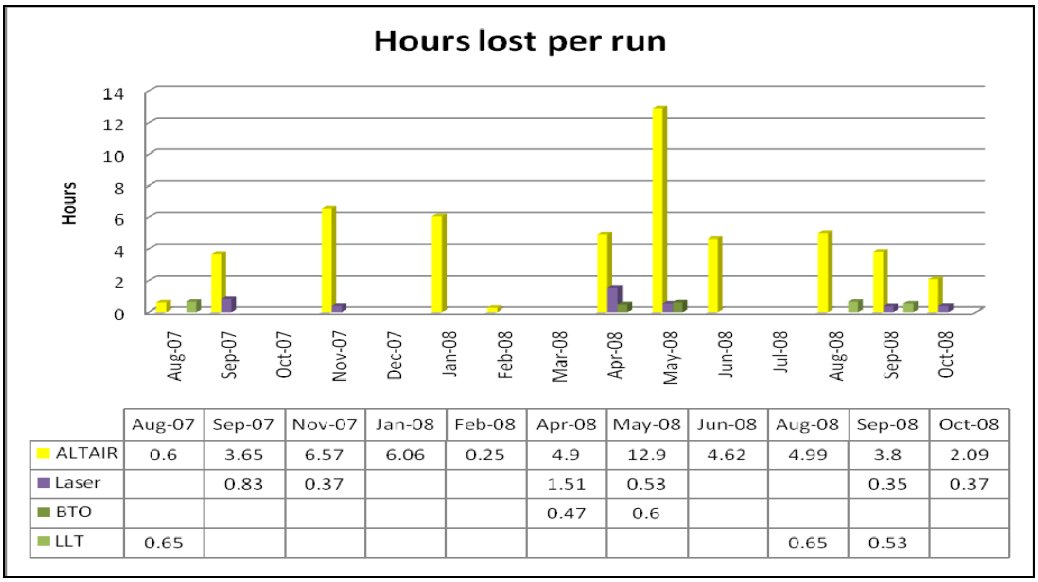


Figure D.1.3.6. Gemini North time loss between semesters 2007B and 2008B (2008B in incomplete due to the period of this report).

The newly commissioned Laser Guide Star Facility has been another source of time loss due to failures. The graph below (Figure D.1.3.7) shows the evolution of this system in terms of hours lost during the year per run. In this case the largest source of unreliability is the Altair adaptive optics system. After several months of work, this system was upgraded by introducing software modifications that dramatically reduced time loss.



	Aug-07	Sep-07	Nov-07	Jan-08	Feb-08	Apr-08	May-08	Jun-08	Aug-08	Sep-08	Oct-08
ALTAIR	0.6	3.65	6.57	6.06	0.25	4.9	12.9	4.62	4.99	3.8	2.09
Laser		0.83	0.37			1.51	0.53			0.35	0.37
BTO						0.47	0.6				
LLT	0.65								0.65	0.53	

Figure D.1.3.7. Hours lost per run for Altair and the Gemini North laser guide star system.

D.1.4 Acquisition Times

The acquisition times are tracked from the records in the observing database. From an earlier study of this topic, it is known that the median time to slew and acquire a guide star for a new target is about six minutes. In addition to the slewing and guide star acquisition time, there is an overhead for the particular mode. For the spectroscopic modes, the measured acquisition time is the time it takes to image the target and align it in the spectroscopic aperture (slit, IFU or MOS mask). For NIRI+Altair imaging, the measured acquisition time is the time it takes to center the target on the NIRI array. For T-ReCS long-slit spectroscopy, the measured acquisition time includes obtaining an image of the object through the slit after alignment.

Here, we focus on the comparison of earlier data from 2005B-2006A with data for 2008A. Between 2005B-2006A and 2008A, we have homogenized the operations of the instruments at night, in terms of both the instrument user interface and the software used by the queue observer for the acquisitions. Table D.1.4.1 shows a comparison of the average acquisition times at Gemini North and South for all spectroscopic acquisitions done in queue, as well as the comparison for the NIRI+Altair (imaging) acquisition times. All acquisition times have improved. In fact, when we compare mode-by-mode as in Figure D.1.4.1, it becomes clear that the average improvement is about three minutes per spectroscopic acquisition. This adds up to saving three nights of observing time at each site for each semester. The improvement is largely due to the homogenized operations of the instruments, although increased familiarity with multi-instrument observing, compared to the earlier semesters, and a focus on training also played a role.

Table D.1.4.1. Statistics on acquisition times, 2005B+2006A compared to 2008A.

Spectroscopic modes		Acq time [min]
Semesters	# acq	
GN2005B,GN2006A	621	**11.6**
GN2008A	597	**8.6**
GS2005B,GS2006A	621	**12.1**
GS2008A	516	**9.8**
NIRI/Altair imaging		
GN2005B,GN2006A	179	**5.0**
GN2008A	188	**4.3**

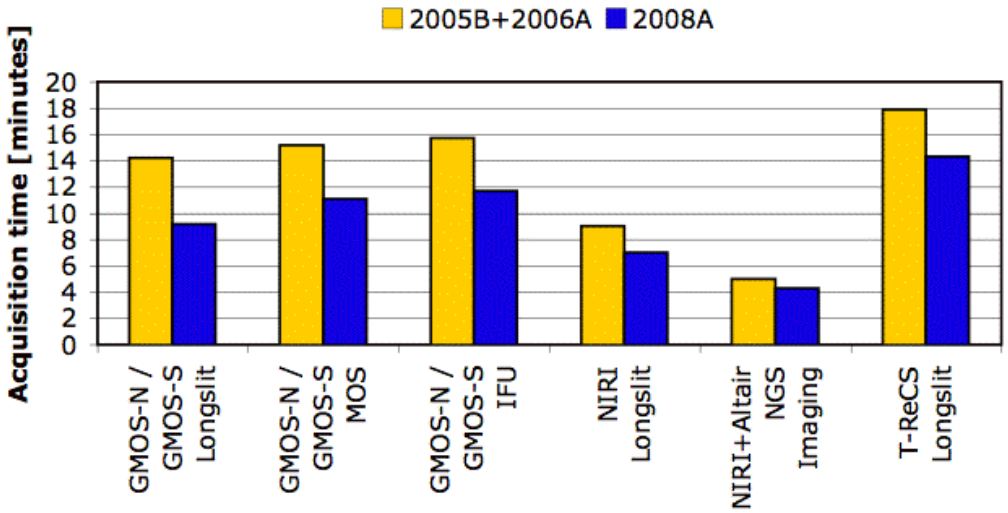


Figure D.1.4.1. Statistics on acquisition times for individual instrument modes, 2005B+2006A compared to 2008A.

D.1.5 Science Time Delivered to the Community

The Gemini Director, in consultation with the Gemini Science Committee and the Operations Working Group (made of representatives of each National Gemini Office), recommended to the Gemini Board the number of science nights be offered each semester. The science queue (and classical nights schedule) is prepared using the number of science nights as approved by the Board. The actual delivered number of science nights can either be larger (if planned engineering or commissioning tasks did not happen) or smaller (if engineering or

commissioning tasks take longer than planned or if unforeseen events happen). In addition, the weather loss for a given semester will affect the completion rates. Table D.1.5.1 summarizes the planned and delivered science nights for 2007B and 2008A, as well as time lost due to weather or technical problems. The technical time loss is derived as a percentage of the time not lost to weather. The fraction of classical time remains very low at both telescopes, primarily due to the user community's choice to have their programs executed in the queue whenever possible. Furthermore, some of the classical nights are exchange nights with the W.M. Keck Observatory. This accounts for a total of five and four nights respectively in 2007B and 2008A. In 2007B, 16 of the classical nights at Gemini North were for the visiting instrument TEXES.

Table D.1.5.1. Delivered science time

Site/ Semester	Number of planned science nights	Total number of delivered science nights	Classical nights	Delivered time in % of planned time	Weather loss	Technical loss in % of observed time
GN-2007B	165	158	20	96%	32%	4.2%
GN-2008A	146	161	9	110%	18%	6.4%
GS-2007B	138	170	0	123%	21%	3.8%
GS-2008A	148	159	14	107%	25%	3.1%

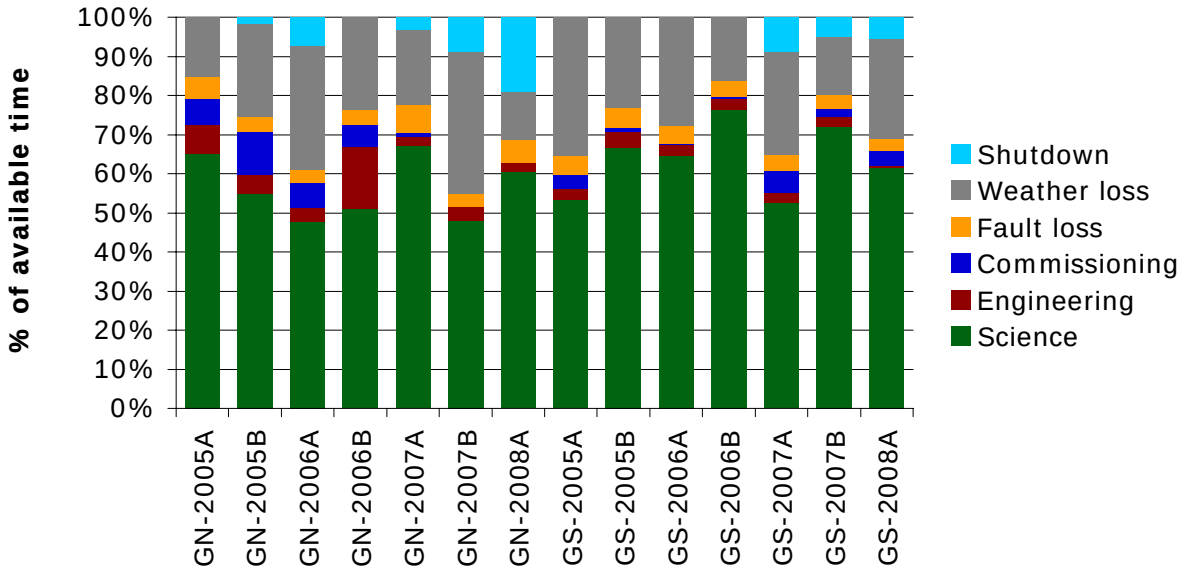


Figure D.1.5.1. Breakdown of the time between Science, Engineering, Commissioning, Weather Loss, Fault Loss and Shutdown for semesters 2005A-2008A.

D.2 Other Achievements

D.2.1 Gemini-North Mirror Coating

In July 2008, the Gemini engineering group conducted a major shutdown to work on key telescope systems and recoat the Gemini North primary mirror (M1). The process took only 20 days, but it was the culmination of more than 11,000 hours of preparation work, making it the third-largest project that the Gemini engineering group would execute during the year. The number of staff members involved was considerable: at one point during the shutdown we had a total of 38 technicians, engineers, and support staff working on the summit, including 13 members of the engineering and safety group from Gemini South in Chile.

It had been four years since the last coating of the Gemini North primary mirror. At the time, it was expected that the coating would last only two years; but careful maintenance and regular cleanings extended the coating's lifetime for two additional years. We have new ideas to develop a silver-coating process that would maintain the same high quality as that of fresh silver for an even longer period of time and will propose to include those activities in future observatory plans. Although the reflectivity of the previous coating had deteriorated by only 5% at 470 nanometers (nm), the less-than-optimal adhesion left Gemini North unable to perform the in-situ washes critical to removing leftover dust particles after the weekly CO_2 cleanings.

Since the previous M1 coating, we have scrutinized our process and procedures in an effort to minimize all identified safety hazards. As a result of these reviews, nearly 20 projects were added to the preparatory work and finished before we shut down for 2008 silver coating process. We added procedures for extractions of people from enclosed spaces, such as our coating chamber, and designed extensions for the mirror lifter, to allow us to work underneath the mirror instead of risking the hazard of a suspended load. The procedure for removing the mirror cell was updated and a permanent high-pressure hydraulic line was installed to support this work. All employees who were involved in the M1 stripping process went through a three-day Hazardous Waste Operations and Emergency Response training course. We also created projects to improve airflow and remove harmful vapors produced during the stripping process. All of these projects created a much safer working environment.

On July 14, 2008, the Gemini North telescope began the shutdown. The initial phase went very smoothly, including the extraction of the mirror, its transportation to the first floor, and stripping. However, we did run into problems with the magnetron that deposits the silicon protective layer. This required us to vent the chamber, find the problem, and fix the magnetron. In the end, the problem was traced to a short in a single faulty insulator. The coating process was resumed and finished smoothly. After reinstallation of the newly coated primary mirror, we were able to go back on the sky for engineering on August 1st, and science observations resumed two nights later (August 3rd).

The mirror's current reflectivity is as good or better than the previous coating. Scotch® tape pull tests show that the adhesion of this coating is superior to the previous one. This may allow us to perform *in-situ* washing of the mirror that will extend the coating's lifetime. Cosmetics are

very good, with no union visible between the magnetron passes. Pinhole performance is similar to the previous coating (~ 6 per 10 cm^2) and is a result of the Mauna Kea non-clean room environment (as expected). Pinholes are caused when dust falls on the mirror after the stripping process. It is not removed by the final CO_2 cleaning as the mirror is inserted into the coating chamber. The total thickness of the coating is only ~ 1,350 Ångstroms, which can be smaller than the dust that is sitting on the surface of the mirror. This leaves us with an uncoated "pinhole" on the mirror. Emissivity measurements have been recently measured at 5.5% for the entire telescope (Primary Mirror + Secondary Mirror + Science Fold).

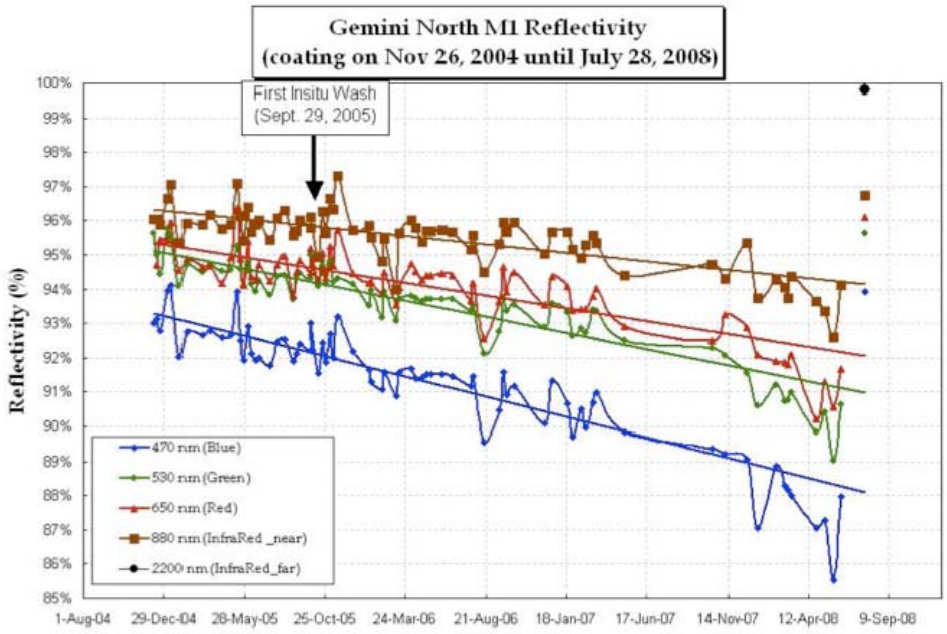


Figure D.2.1.1. Plot of Gemini North primary mirror reflectivity since the previous coating until the new coating in July 2008.

While the unique four-layer silver coating is one of the main focuses of the shutdown, the engineering group took the opportunity to work on many other areas of the Mauna Kea facility and its instrumentation. Running queue-based observing means that we don't let our instruments rest for extended period of time. It is very difficult to do invasive and complicated work when the instruments, and the acquisition and guiding system, must be ready to operate every night. We used this time to do maintenance on the mirror cell and support structure, as well as the mirror covers. Thermal stability of our laser system was also a maintenance priority, and we have seen much improvement in its performance during nighttime operations since the shutdown. Major work was performed on the installation of a new uninterruptible power system that will allow us to be better protected during the power outages that sometimes result from winter storms.

In late 2007 Gemini Observatory selected Project Insight (Metafuse Inc.) as our web-based project management software solution (see also D.2.6). This software package has played a key role in every aspect of this shutdown and has significantly improved our efficiency during both

the planning and execution of the shutdown. It allowed us to plan and track more than 11,000 hours of preparatory work associated with such a large shutdown. The software also allowed us to provide weekly status reports to the Director and the Board, as well as other interested groups within the organization. During the shutdown, the software was used to create daily plans of the work to be performed and provide a centralized location for the engineers to report on finished tasks.

D.2.2 WFMOS Science Conference

The Wide-field Fiber Multi-Object Spectrograph (WFMOS) is being designed to answer fundamental questions about the nature of Dark Energy and the formation history of the Milky Way (see Section E.3.3 for an update on WFMOS). WFMOS is a joint project with the National Astronomical Observatory of Japan (NAOJ), which runs the Subaru telescope on Mauna Kea. In November 2005, Gemini and Subaru hosted a joint meeting titled "Probing the Dark Universe with Subaru and Gemini" to discuss the potential for WFMOS and HyperSuprime Cam in answering fundamental questions about Dark Energy. In May 2008, Gemini and Subaru hosted a second conference, this time to explore the wide-range of science that this revolutionary instrument will address. The meeting, titled “Cosmology Near and Far: Science with WFMOS” was held in Waikoloa, Hawai‘i, and attracted approximately 85 participants from across the Gemini partner countries and Japan. The conference was also supported by generous contributions from the National Optical Astronomical Observatory (U.S.), the Science and Technology Facilities Council (U.K.), Astronomy Australia Limited, and the Japan Society for Promotion of Science.

The May, 2008 meeting focused on the entirety of science made possible by WFMOS. The meeting included about one day for each of the two key science missions relating to Galactic archaeology and Dark Energy, but also included a full day for the many other spin-off science projects made possible by such a unique instrument. Some of the latter topics included galaxy formation and evolution, Dark Matter, neutrino mass measurements, star formation in other galaxies, etc. WFMOS’s unique highly-multiplexed spectroscopic capabilities will open up a wide variety of new science opportunities, and this meeting started a healthy discussion about how WFMOS may be used to answer a wide variety of questions.

Although the science talks were the primary focus of the meeting, many of the participants were keenly interested in the status of the WFMOS conceptual design studies sponsored by Gemini and currently underway. Because the study teams are in competition, some detailed questions could not be answered. Everyone was interested in how the Japanese would be included in the design studies, during WFMOS construction, and in the science surveys. Support for the WFMOS science mission is growing within the Japanese astronomical community, and leaders within the Japanese community indicated that they would seek their community’s input and support in time to make a decision, early in 2009, on Japanese participation in WFMOS. Gemini and NAOJ have started the process of negotiating an agreement to define the sharing of observing time and resources for the construction and operation of WFMOS. We expect to have an agreement worked out by the time the Gemini Board of Directors meets in May, 2009 to decide on going forward with WFMOS construction.

For more information, or to view the presentations made in Waikoloa, please go to: http://www.naoj.org/Information/News/wfmos2008/

Figure D.2.2.1. Participants at the joint Gemini-Subaru meeting "Cosmology Near and Far: Science with WFMOS," held in Waikoloa in May 2008.

D.2.3 Staff Survey

"Open communication and a commitment to constantly seek self-improvement are key attributes of great organizations." This was the first sentence in an August 2008 memo from Gemini's Director to all Gemini staff. The memo went on to explain that one part of Gemini's strategy to achieve both of these goals was through the periodic use of an all-staff survey to evaluate our strengths and weaknesses.

There were two key events that led to the determination that we would like to conduct an employee survey. First, in 2006 shortly after becoming Gemini's Director, Doug Simons undertook to personally interview a significant portion of Gemini's staff in an effort to discover how Gemini's workers felt that things were going. He invited anyone to meet with him and, meeting with fewer volunteers than he had hoped, he sought out individuals who didn't volunteer. In the end, he interviewed about one-third of the staff, a very good cross-section from among the various working groups. And from these interviews he discovered information that led to many changes in the observatory. In 2007, the observatory had three new Associate Directors. Doug was considering doing a series of interviews as follow-up to those he had conducted the year before. All three Associate Directors, however, noted that they were planning to interview their respective staffs as a step to understanding the situation within their groups. It was agreed that these Associate Director interviews would serve as the follow up to Doug's original effort. The result of these interviews was that there was "some" progress achieved addressing issues that had been raised in the interviews the year before, but that there was still "a ways to go." This was not a very precise result, especially for a scientific endeavor.

In 2008, it was decided that Gemini would initiate a regular scientifically-conducted employee satisfaction survey in order to assure that we understand the degree to which improvements are needed, the degree of progress we were making from year to year, and to assess attitudes that would otherwise remain unreported. The survey would provide positive and negative feedback and also serve as a means to measure employee satisfaction. In other words, how are we doing as a company? Most of the questions will be repeated year to year, some which are generic and provided by the vendor, others that are designed by Gemini and address specific Gemini concerns, and still others that are department specific. We conducted the first of these surveys this year and it will serve as the benchmark against which our future progress can be measured.

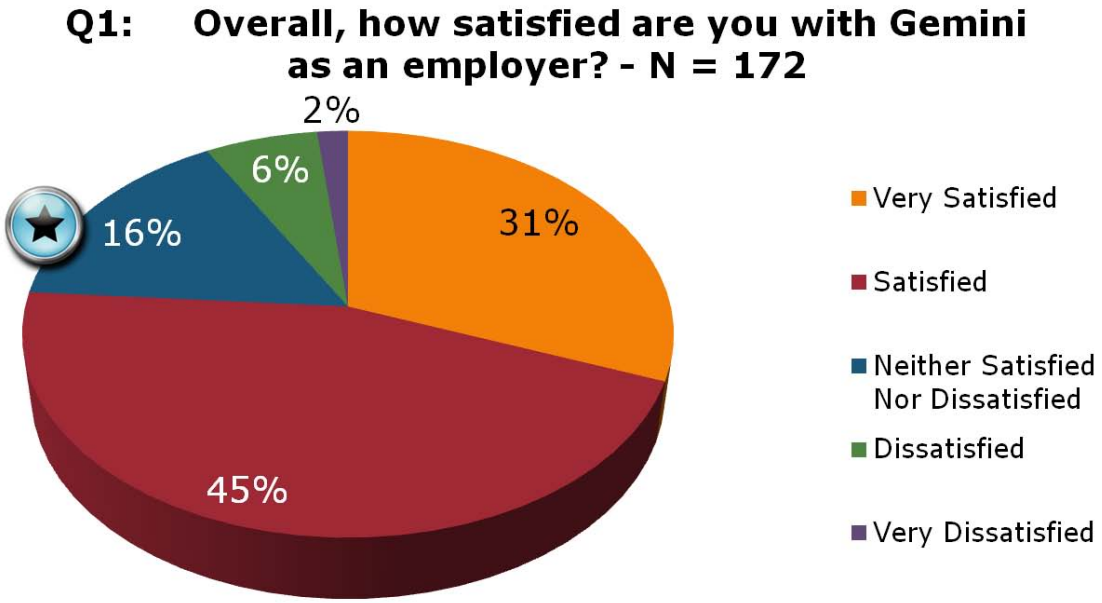


Figure D.2.3.1. Gemini staff survey results on overall staff satisfaction.

The objectives of the study were to: 1) benchmark employee opinion on generic topics; 2) pulse attitudes of specific "hot topics" at the job role level; 3) seek areas of improvement; and 4) identify ways to improve employees' experiences with working at Gemini Observatory.

The survey was conducted online, and completion of the survey was voluntary. 172 employees completed the survey out of 185 who were invited to participate. This 93% response rate indicates that Gemini did an exceptional job of reaching out to its employees to understand their work-related experiences.

Infosurv Inc., the consultancy that conducted the survey on Gemini's behalf, provided initial results and a detailed analysis of the results to the Human Resources (HR) Manager in early October 2008. The results and analysis were conveyed in a PowerPoint presentation containing 99 slides. After initial digestion of the results, the HR Manager gave a presentation on a summary-level to the Directorate in late October. The next steps are a more thorough review

of the results and the development of an action plan that will address issues where we can make the most improvement. The mere conducting of the survey creates a strong expectation from the employees that significant issues will be addressed, thus making the action plan and its successful and prompt implementation of utmost importance. Our goal is to develop our initial strategies to address employee issues by the end of November and to refine these strategies by the end of 2008. Detailed plans for projects will follow.

Although only 76% of all employees were either very satisfied or satisfied with Gemini as an employer, fewer than one in ten employees expressed dissatisfaction. The high percentage of neutral respondents presents an excellent opportunity to quickly improve the overall satisfaction.

D.2.4 HBF-X Completion

Figure D.2.4.1. The HBF extension under construction, from the rear, taken from the bluff behind the building. The original HBF building can be seen behind the new building.

In order to address the continuing space shortage at the Hilo Base Facility (HBF), the Gemini Board approved the design and construction of a two-story, 13,507 square-foot base facility extension in the space to the rear of the existing HBF building. Fairly extensive site excavation activities, cutting into the rock wall behind the existing building to make room for the new building and additional parking, began in April 2007. After excavation, there was a slight hold up in the construction schedule while we waited for all of the necessary permits to be approved by the seriously backlogged County Planning Office. Construction began in late August 2007. After about 13 months of construction that included delays caused by record rainfall, the mysterious workings of the County Planning Office and the normal range of construction snafus, construction was completed in September 2008. We received the Certificate of Occupancy from Hawaii County on October 2, 2008.

Figure D.2.4.2. The new two story extension from the courtyard that the two buildings share.

Meanwhile, the Administration/Facilities and the Information Systems Groups had been planning and working in the background for the eventual occupancy of the new building. Once we got the go-

ahead for occupancy from the County, the redistribution of staff could begin. The plan was complex. It involved moving staff from the existing building to the new building, freshening up the rooms in the existing building by cleaning carpets and taking the opportunity to give the walls a new coat of paint, relocating 17 individuals from the 3,000 square-foot Hale Melemele building that Gemini has been leasing (about a mile from the base facility site), and relocating individuals within the existing building into less cramped work areas. Most of this work was accomplished on weekends, enabling the work of the observatory to proceed uninterrupted.

In November 2008, Hale Melemele (the leased facility) will be returned to the landlord. All Gemini North staff will be housed in one facility for the first time in several years. The extension provides additional office space for staff and visitors, three new conference rooms, two new kitchenette areas, a reading room, an elevator, shower and increased vehicle parking. The new, combined Hilo Base Facility will comfortably accommodate 100 staff and 10 visitors.

D.2.5 Journey Through the Universe

It takes a community to educate a child, and a network of communities to reach a generation. That's the basic philosophy behind *Journey through the Universe (JttU)*, a space-education program originally established by the National Center for Earth and Space Science. For the past four years Gemini has led the *JttU* program in Hawai'i and supported this philosophy, and during the week starting February 1, 2008 the fourth annual *JttU* brought the universe to Hawaii's students, teachers and the public. During this week, the program opened a window on the universe to more than 8,000 students in 21 schools on the Big Island of Hawai'i. Beyond visiting 340 classrooms, our educators and scientists from all of the Mauna Kea observatories shared their knowledge of the cosmos at public lectures, teacher and astronomer workshops, family science nights, and events for community and government leaders.

This year's *JttU* week strove to effectively embrace the community, and as it has in past years,

Figure D.2.5.1. More than a hundred Hawai'i-based teachers attended the JttU teacher workshops held at the 'Imiloa Astronomy Education Center in Hilo.

Gemini's Public Information and Outreach (PIO) office led the coordination of the event. To accomplish this, Gemini's PIO staff worked hand in hand with all of the Mauna Kea observatories, the Hawai'i State Department of Education, 'Imiloa Astronomy Education Center, the University of Hawai'i at Hilo, and the Institute for Astronomy. Fourteen local corporate/business sponsors and numerous ambassadors (individuals who assisted our astronomy educators in the classroom) rounded out the community engagement. Inmates at the local Kulani Prison even hand crafted lei to thank us for teaching their children. These lei were used at a special *JttU* celebration sponsored by the Hawai'i Island Chamber of Commerce.

Journey to the Classroom

Joining the almost 50 educators and researchers from the Mauna Kea observatories, Gemini staff members Doug Simons, Scott Fisher, Tom Geballe, Kathy Roth, Scot Kleinman, Kevin Volk, Anil Dosaj, Koa Rice, Peter Michaud, and Janice Harvey all shared in the excitement by visiting classrooms throughout this year's *JttU* events.

Figure D.2.5.2. Students at Kaumana Elementary participate in a dry-ice mirror cleaning demonstration in their classroom as part of JttU in 2008.

Gemini Director Doug Simons visited Waiakea High School. In an engaging talk he described how astronomers use light to understand the nature of distant objects in the universe. To help convey that message, Doug showed off a photometer that he built in college to demonstrate that light exists in the form of discrete photons by coupling the photometer to a speaker. In this way students could literally listen to individual photons rain on the desktop before them.

Valerie Takata, Complex Area Superintendent of the Hilo/Laupahoehoe/Waiakea school district, commented on the engagement of observatory staff in the program. "One of the most valuable assets of our partnership with Gemini," she said, "is having a pool of expert researchers, technicians, and other career-resource people who are willing to work with our students, teachers, parents, and the community at large. These ambassadors of science are teaching us literally how to reach for the stars—especially by strengthening our science curriculum and integrating other content areas into learning. Thanks to Gemini, we've discovered the power of learning in a synergistic system. Learning is a process; learning is hands-on; and it is fun!"

The children were not the only ones who benefited from the program's educators. More than a hundred Hawai'i teachers attended the Master Teacher and Teacher workshops held at the 'Imiloa Astronomy Education Center in Hilo, led by astronomy education expert Dr. Tim Slater of the University of Arizona. 'Imiloa is an educational resource for students, teachers, scientists and the larger community. According to center director Peter Giles, *JttU* is a perfect fit. "In these hands-on workshops, the teachers learned how to better promote astronomy education in the classroom, so to create a stable of prospective researchers in the future," said Giles.

State and National Recognition

At a December 2007 Department of Education Appreciation Luncheon for Business and Community Partners in Honolulu, Karen Knudsen of the State Board of Education and Valerie Takata presented Gemini Observatory with a community engagement award, primarily for the *JttU* program. As Takata told a *Hawai'i Tribune Herald* reporter, "Public education needs the community to help fulfill its mission to our students," she said. "And programs like this inspire our students to aim for the sky."

This year the *JttU* team also received special state proclamations from Mayor Harry Kim of the Big Island and Hawai'i Governor Linda Lingle. In addition, the team was presented with a State Senate resolution at a thank you celebration held by the Hawai'i Island Chamber of Commerce. Big Island State Senator Lorraine Inouye flew in that evening from Honolulu to personally read the resolution.

"What an incredible team!" said Dr. Jeff Goldstein, founder of the national *Journey through the Universe* program, pointing out that the Big Island's event is the flagship *JttU* site. "Gemini Observatory has impacted thousands of lives, inspiring big dreams in young minds. A vision starts with a champion who arouses a coalition of the willing. Anyone who witnessed the remarkable program held on the Big Island in 2008 knows that that vision has now been realized. Gemini's scientists and engineers live on the frontier. They have become heroes to the next generation."

Into the Future

Looking forward to 2009 (and the *International Year of Astronomy*), the Gemini-based *JttU* team plans to increase the number of teachers trained, add more classroom visits, and hold an additional *Family Science Night* at the 'Imiloa Astronomy Education Center.

Doug Simons also thinks that Gemini can help *JttU* widen its vision. "In my 1,000,000+ miles of travels with Gemini around the globe," Simons explained, "I have never heard of anything that matches the *JttU* program in its scope. Yet it remains something of a secret on the mainland and beyond. Given the impact we are making in Hawai'i, our little secret will surely be noticed far beyond the shores of the Big Island in the near future."

With that goal in mind, Gemini is now looking at the possibility of combining *JttU* with the Astronomical Society of the Pacific's *Project ASTRO*, a national program that provides opportunities for professional and amateur astronomers to contribute to science education in

their local communities. Together, the two groups hope to inspire more students and create a model for Gemini's international partnership.

D.2.6 Project Insight Based Planning System

Gemini's planning systems improved enormously during this reporting period in large part to the use of a central web accessible database called *Project Insight* (PI) that is available to everyone on the staff. The transition from the use of a combination of separate applications (Excel, Project, and Word) to a single central database-driven system has streamlined project definition, reporting, and tracking enormously compared to the previous more cumbersome approach used initially in Gemini's planning process. The 2008 observatory plan contains a little over 100 different projects which are all described in the PI database in terms of an overall project description, the project managers and those responsible for conducting the work, the effort estimated to go into each project, and various tracking metrics (hours completed and/or percent complete). The generation of custom reports is straightforward and they can be configured to show a wide range of variables. In fact, due to the open nature of the PI database and training provided to the Gemini staff, instead of reports being issued on a regular basis to the staff (as in 2007), the staff are free to query the database at any time to gauge the progress on projects of particular interest to them. In this sense, PI is a clever communication tool, allowing critical information to be broadcast only to those interested while not clogging the e-mail inboxes of those less inclined to delve into the details of the observatory plan.

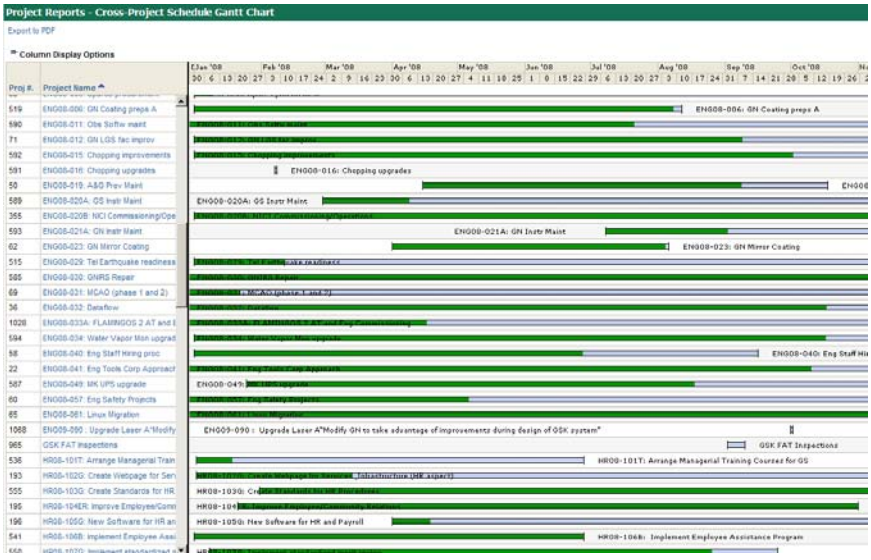


Figure D.2.6.1. A typical real-time report generated by *Project Insight* is shown which, in a snapshot, illustrates the overall status of projects being executed across the observatory.

In practice the reporting functions of PI allow managers to track progress and adjust resources or priorities within the constraints of their budgets (labor and capital) over the course of the year. Consistent with that approach the Director holds weekly meetings with each branch leader (the three Associate Directors and Head of Instrumentation) to track progress, discuss issues, and make adjustments as needed to fulfill the commitments made at the beginning of the year for each of the projects loaded into PI. This year, for the first time, PI was used in real-time during Gemini's annual planning retreat to evaluate resource demands as a function of various project scenarios and priorities. Once each project has been adequately

resource loaded, when used this way PI is an extremely powerful tool to support Gemini's dynamic planning processes.

The figure D.2.6.1 shows a typical report which can be generated in real-time based upon the current data loaded into PI. This highly simplified view of each project simply shows the percent completion along with the start and stop times of each project. Details of each project are a few clicks away, so that rolled up Gantt charts can be expanded into much more detailed analyses that facilitate tactical changes in the execution of the observatory plan. While enormous progress was made in 2008 with Gemini's planning systems, we are not done yet in improving the system. Changes we look to achieve in 2009 include a mechanism to support year-round planning, to ease the impact that the annual planning process has now, and the use of a planning coordinator to help ensure plans are up-to-date, project description data are complete, and reports are accurate.

SECTION E

GEMINI OBSERVATORY PLAN
2008
OVERVIEW
AND
STATUS REPORTS

E. Gemini Observatory Plan – 2008 Overview and Status Reports

The following reports provide a comprehensive status report from each of the observatory's operational units on specific elements of the observatory's 2008 operational plan. As a preface to these individual reports a summary of full-time equivalent (FTE) distributions among units is presented to provide an overall staffing snapshot of the observatory at the close of this report. Each of the reports that follow the FTE distribution includes a summary of key activities and a status report for each unit from the 2008 planning process.

E.1 FTE Distribution

The Table E.1.1 shows the staffing plan for calendar year 2008 in FTE person-years. The column labeled "Actual" represents a projection of staff presence from January 1, 2008 through December 31, 2008 based on what actually occurred through October 31, 2008, the departures and arrivals known for the last quarter of the year, and the likelihood of new workers filling open positions before year-end based on the recruitments underway.

Table E.1.1. Observatory FTE Budget and Actuals

FTE BUDGET AND ACTUALS 2008				
O&M	2008			
Function	Budget	Actual	Delta	% Delta
Administration	30.67	30.32	0.35	1.14%
Information Systems	14.75	14.08	0.67	4.54%
Public Information Office	8.33	8.41	-0.08	-1.00%
Engineering	74.07	66.93	7.14	9.64%
Science	53.79	49.59	4.20	7.81%
Safety	3.37	2.59	0.78	23.07%
Instrument Development	3.00	2.96	0.04	1.33%
Directorate	8.00	8.00	0.00	0.00%
Totals	195.97	182.88	13.09	6.68%

The difference of about 13 FTEs can be split into two main categories: *hiring lag*; and *positions on hold*.

The largest category, *hiring lag*, can be caused either by a delay in filling a position for the first time or by the time required for recruitment in the case of an unplanned departure of an incumbent. *Hiring lag* accounts for about eight FTEs of the difference. The eight FTEs are spread across the work categories, with about one FTE attributable to the Administration and Information Systems categories combined, about 3.6 FTEs in the Engineering group, 2.7 FTEs in Science and 0.8 FTE in the Safety Program.

The second largest category, *positions on hold*, accounts for most of the remaining difference and amounts to about 4.9 FTEs. More than half of this amount derives from the postponement of the need for aircraft spotters for our laser program in Chile. There were 2.8 FTEs budgeted

for the Chile spotter program which has been delayed until 2009. An electronic engineer position that had been budgeted for 0.75 FTE will not be filled until 2009. Likewise, a support scientist position that was slated to begin in 2008 and had 0.33 FTE budgeted, will not start until 2009. The science visitor program also did not have paid activity in 2008 and was budgeted at 1.0 FTE.

We have basically reached steady state operations in 2008 with most positions having been filled for the first time. Please see section E.2.2, Human Resources, for a more detailed report of recruiting success and turnover rates.

E.2 Administration Program

The mission of the Administrative Program is to provide administrative services, and facility, fleet and electronic infrastructure for the employees and users of Gemini Observatory, enabling Gemini to be a transformational discovery machine. The working groups that comprise the Administrative Program include the Administrative Support and Facilities Group, Human Resources, Information Systems, the Controller Group and Procurement.

In 2008, the Administrative Program began work on the portion of our long-range plan that focused on improvements in our customer communication and our overall efficiency. While the Administrative Groups are all very good at providing reliable services and infrastructure promptly to its customers, there is a strong feeling that we can, through clever planning and organization, invite more serenity into the process. In order to do this, we identified the basic elements of our vision and the initial steps toward our vision that we would undertake in 2008. The basic elements of our vision are as follows:

- we are a service group that knows exactly what our customers want;
- our customers know what to expect from us, and;
- we are able to deliver what our customers need.

The Administrative Group chose to undertake five projects in 2008 that we felt would help us to make progress toward our vision. The five projects are listed below, along with a description of the considerable progress made during the year.

1. **To set up our on-going planning process and ensure that projects are managed uniformly across the Administration Program via the same software package:** Gemini selected *Project Insight* as the uniform planning tool to be used by all groups within the observatory. All Administrative Managers and some selected staff members within each group attended at least eight hours of training in the use of the software. We achieved our dual objective of providing weekly progress reports via *Project Insight* while enjoying a much calmer annual planning season for 2009 than the one we experienced in 2008. We look forward to further enhancements in 2009 that will include ongoing “anytime” additions to suggested projects for 2010 and the future.
2. **To undergo a systematic review of forms, documents or procedures that seek information on customer requirements:** All group managers created a web page on our

internal web site that lists all requirements documents and provides links to each. This web site is not yet ready for our customers to access and is serving at this time as a useful place for us to organize our process. Our review has revealed that existing documents are doing a pretty good job at obtaining the required information from our customers in an acceptably, friendly way. However, there are several documents that can be improved and procedures that could be streamlined or put into a better electronic format. Notable successes in this area are a Project Initiation Document (PID) developed by the Information Systems Group and a revised Travel Request Form that is uniform between the North and South for the first time ever. The Travel Request Form revision is an example of "form housekeeping," taking a decent form and making it better or improving uniformity between the sites. The development of the PID is an example of the creation of a form and process that satisfies a previously unfulfilled need for a request for service. Prior to the development of this form, all requests, no matter how large or small, how revolutionary or insignificant, came in to the ISG through the Remedy Fault Reporting System. The Fault Reporting System is really for notification of problems with existing systems and does not provide a framework for the gathering of information related to a new undertaking. The introduction of the PID provides a mechanism to request services that include detailed requirements, estimates of resources required and a justification for the request that can be routed to the Observatory Project Change Review Board. This initiates a formal process that determines whether the effort should be undertaken and, if so, when.

3. **To design an internal education program for our customers so that they know how to obtain services or perform certain administrative tasks:** We have not made any formal progress on creating a long-range schedule for a customer education schedule. However, the simple change in our focus spawned several customer training sessions that took place this year. Notable examples of training programs offered 2008 are: the *Microsoft Office 2007*® training provided by the Information Systems Group in conjunction with our upgrade to *Microsoft Office 2007*® from earlier versions and represented a big change in the interface that was not necessarily intuitive; the training the Human Resources Group provided for managers regarding writing evaluations and the evaluation process itself, and; individual training for managers provided by the Controller Group on the new on-line financials interface.
4. **To plan our administrative web presence, with the ultimate goal of creating a high-quality, unified, easy-to-use Administration website:** Administrative Managers received an introductory training in Drupal, an open-source software content management system that allows them to manage the internal web-site content for their groups. The first step was to create a web-page with requirements documents (see item 2 above). The work has begun and will maintain a major focus in 2009.
5. **To identify and publish our service standards so our customers know what to expect:** The Administrative Groups have identified the administrative processes undertaken by the individuals in their groups. We have yet to decide standards for each and to decide which should be published.

The Administrative Groups have made considerable progress on all five initiatives. In addition to this, 2008 was a year of reviews. The Administrative systems underwent an NSF Cost Review Site Visits by LMI, the consultancy hired by the NSF, at both our Hilo and La Serena sites. There was also a significant administrative component to the Gemini Visiting Committee and the Mid-term Reviews of Gemini operations. In connection with these reviews, the Administrative Group threw themselves wholeheartedly into the process of researching and creating an Administrative vision for the year 2020 and, subsequently, identified elements of the vision that we will begin work on in 2009. Preparations for the reviews took a significant amount of time in addition to the time spent with the teams on site. In the final quarter of 2008 we will be engaged in early activities for the NSF Business Systems Review, including the get-acquainted site visit in Hilo for some members of the NSF team in December and the development of the web-site shell for the desk review and early population of the web-site with agreed documentation.

And, finally, in addition to the Administration team goals and the external reviews, each of the five Administrative groups had group-specific goals. The groups within the Administrative Program are described in more detail below, along with a brief report on their calendar 2008 projects to date.

E.2.1 Administration Support and Facilities

The Administration and Facilities Group (AFG) is tasked with the responsibility for all day-to-day administrative matters in Hawai‘i and Chile including administrative support to the Directorate, visitor support, travel services, general administrative and secretarial services and the management of all “outside the dome” facilities and infrastructure, including the vehicle fleet at both sites.

During this period, the Administration & Facilities Group (AFG) achieved success with a number of important initiatives and projects, continued to provide assured control of its internal services, developed new services and began to study longer-term trends about how administration and facilities work will develop over the next decade or so, with a view to anticipating these challenges and proactively supporting the observatory’s leadership goals.

Undoubtedly the most significant single project that consumed AFG resources during the period concerned the Hilo Base Facility’s (HBF) extension, which is referred to in section D.2.4. AFG’s planning for this move began several months before the construction work was completed and the occupancy was approved. Initially the team addressed office planning, budgeting and logistics exercises. They followed up these efforts with fine-tuning their plans and began research that led to the procurement of goods and services related to the staff’s occupancy of the new building. Many of the goods and services purchased had long lead times associated with them and required that planning be done well in advance and in sufficient detail to produce an excellent result. Logistical elements of the change also involved the control of a great deal of small detail in order to ultimately bring the new extension into operation and to

achieve the successful, closely-coordinated movement of seventy-seven staff in stages over several weeks during the fall of 2008.

Although not on the same scale, AFG also participated in significant facilities changes elsewhere. For example, while not responsible for the site, which is an (AOSS) building, AFG at Gemini South played an important liaison role with AURA Observatory Support Services (AOSS) in Chile to ensure that the operational opening of their new dormitory facility on Cerro Pachón met user requirements within a short timeframe. Additionally, the AFG managed construction work at the South Base Facility (SBF) in La Serena that created new office space and additional seating in the building through the conversion of space previously used for archives and printing and also upgraded the HVAC in the SBF computing room.

The opening of the Cerro Pachón dormitory early in the second quarter of 2008 meant that for the first time in Gemini South history, nighttime staff did not have to drive to and from accommodations at Cerro Tololo before and after their shifts. AFG took the opportunity of this change to review the standard pattern of fleet use and proposed a common transport service to the mountain. This service was developed with user input and trialed using a combination of Gemini fleet vehicles and temporary agency drivers for a few months before being the subject of a formal bid process involving transport providers who work locally and for other Chile-based observatories. As this document goes to press, the bid process is complete and it is hoped that this new service will soon become a permanent feature at Gemini South, enhancing staff safety, comfort, productivity and lowering costs; a model for future consideration at Gemini North. As a footnote, on Sunday October 5th, 2008, Gemini South reached a total of 848 days between road accidents; this milestone is the longest accident-free period for observatory vehicles at the telescope, indicating that this serious risk factor continues to be managed attentively and considered important by staff.

The AFG expanded its menu of services during 2008 to provide more direct administrative support to senior science operations managers and science staff with assistance in developing the astronomer and SSA schedule for both sites, assisting science project management and review processes and other administrative tasks. Responsive to user requests, it also brought the cleaning service at Gemini North in-house, reflecting a long-term practice at Gemini South and producing a corresponding improvement in quality of service. AFG continued to seek efficiencies and collaborated closely with the Information Systems Group in producing significant reductions in the cost of landline long-distance and international calls from the Chile site. Opportunities for cost savings in travel ticketing have been identified and, although at the time of going to press there are still some logistical hurdles to overcome, it is planned that these will be soon realized.

In August, AFG developed the “Gemini Green Blog” for the Gemini Director to encourage staff to use this communication channel to establish an internal knowledge base on energy efficiency issues of relevance to the observatory. Seeking high levels of staff knowledge-sharing and collaboration, the blog’s content grew to include reference to many topics, all of which will be reviewed as part of a longer-term, cross-departmental sustainability plan in 2009 (including

energy efficiency, materials use, sustainability, water management, lighting, heating and air-conditioning, travel and our "carbon footprint," green resources, energy efficiency certification processes etc).

In summary, both continuity and innovation were key concepts for AFG in 2008. Continuity was particularly important for AFG at Gemini North this year, as the group's Team Leader, Steve Zodrow, left the organization after providing an excellent contribution to the recently formed group there. Sarah Blanchard, his replacement, arrived just at the time of the move-in to the HBF expansion. The smoothness with which the move was achieved exemplified the contributions of both people and the solidity of the Administration & Facilities Group's service provision.

Table E.2.1.1. Summary of Band 1 2008 projects for AFG showing progress as of December 31, 2008.

PROJECT TITLE	PROJECT DESCRIPTION	% COMPLETE
AFG08-A4 : In-house travel ticketing	Eliminate travel agency use by performing travel booking both North & South in house.	35%
AFG08-A1 : HBF-X and HBF move in	Ensure smooth move in once HBF-X is complete.	100%
AFG08-A2 : HBF redecoration (including lobby)	Specify, quote and execute the redecoration of the HBF, including lobby.	100%
AFG08-A3 : SBF-X planning	Review projected staff numbers for GS base facility use 2011-2016 & evaluate requirements.	100%
AFG08-A5 : Internal efficiencies	Consider means whereby staff can share information in simpler, more efficient ways.	100%

In-house travel ticketing will be carried over into 2009 as will the project to continue to work on ways for staff to share information in simpler, more efficient ways. The SBF-X planning project has changed considerably due to the anticipated availability of funds for a full expansion of the SBF facility. 2008 activities are complete, and the remainder of the project will be re-scoped for 2009 in order to consider various options for base facility alterations in the next three years.

E.2.2 Human Resources

E.2.2.1 Overview

The Human Resources (HR) group has responsibilities that include: employee recruitment and relocation; visa processing; employee benefits and compensation; employee training, and; all other employee services. Human Resources attained its full complement of staff in January 2008, after many months of being without a recruiter. This allowed the group to undertake a reorganization effort that has resulted in increased efficiency. The staff is now cross-trained in

all areas so that any member of the HR group is able to assist Gemini staff with any question they might have about HR issues.

In 2008, the AURA Corporate Office led an effort to identify new payroll and human resources software for use by all three AURA centers. The software chosen and purchased will allow for web-based access for all staff, enabling a greater degree of on-demand, self-service review of their own employment records and the ability to obtain answers to routine HR questions at any time of the day. Initial preparations for the transition to the new software have begun and will continue in 2009. The software will be implemented by January 2010.

E.2.2.2 Recruitment

Neil Barker was hired as the full-time recruiter in January 2008. His primary focus is to work with the hiring managers in a proactive manner to ensure that positions are filled with the most qualified individuals.

As of October 31, 2008, Gemini has a total staff of 197 employees, including Chilean nationals and those who are considered temporary and/or part-time staff. This count is up from 181 last year due in part to the increase in the recruiting efforts. The employee head count at Gemini North (Hilo) is 107. There is one employee in the Tucson Gemini office. The Gemini South (La Serena) staff has remained constant at 89. Overall, Gemini Observatory employs 95 United States citizens (or green card holders), 53 Chilean hires and 49 hires from other countries. Gemini has staff from 18 countries, including the United States and Chile.

The turnover for the past fiscal year, ending September 30, 2008, was at 12.03% compared to 14% last September 30, 2007. This percentage does not include those hired on a temporary basis. The most common reasons listed for leaving Gemini were: individuals moving from Hawai‘i or Chile, most often to be closer to their families or so that spouses could find employment (25%); ending of contract (25%); found employment elsewhere (25%).

Gemini has hired 55 individuals during the calendar year January - December 2008 (data current through October 2008). These 55 include interns (15) and outside agency staff (4).

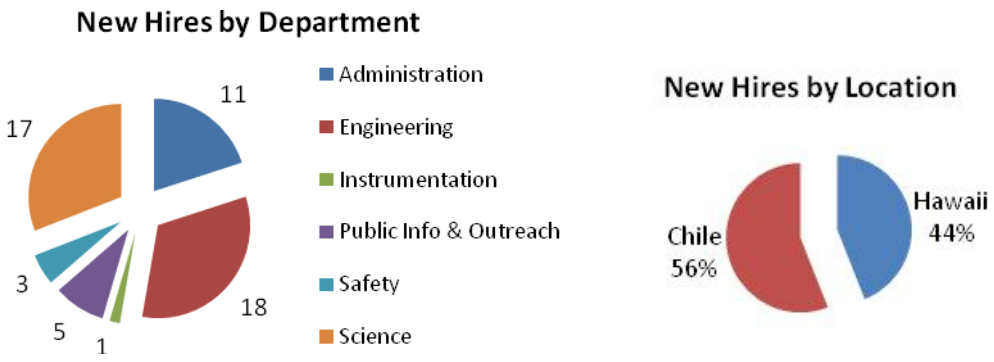


Figure E.2.2.2.1. Details on new hires by department and location at Gemini.

Of these, eighteen were relocated from areas outside Hilo or La Serena. Due to dissatisfaction with our existing relocation service provider, we initiated a trial with an alternative relocation company this year but encountered unacceptable service issues. We returned to the original provider. Overall, there have been fewer service issues than last year, and we continued to handle any difficulties in a proactive, prompt manner. The largest issue in this area is the rising cost of relocations and the ability to offer a competitive relocation package to those recruited.

The average the number of days taken to hire new employees has been reduced steadily by 19% during the year. This can be attributed to improvements in the hiring process and identifying new candidate sourcing options. Open vacancies have come down from a high of 23 to a low of 8 during the year.

During the year, seventy-five percent of candidates (excluding interns) to whom Gemini has extended employment offers have accepted the offer. The single-most significant issue for those individuals who declined offers was the concern regarding there being too little research time for Science Fellows.

Human Resources continue to be assertive in requesting prompt and efficient information throughout the recruiting process and to offer outstanding service to our recruited staff. Challenges however remain in attracting and rewarding high-caliber employees to remote locations, in particular to Hawai‘i with its high cost of living relative to the mainland United States. The lack of a qualified applicant pool presents a challenge in recruitment for local hires both in Hilo and La Serena.

E.2.2.3 Visa Processing

This year (to date), Human Resources processed 17 employment visas, including Permanent Resident Cards (green cards). The Table E.2.2.3.1 indicates the current visas that we hold for staff.

Table E.2.2.3.1. Current visas held for Gemini staff.

Visa type	2008 October holders
H-1B	12
J-1	3
L-1	29
O-1	1
TN	6

Gemini successfully obtained L-1B (Specialized Knowledge) visas for many of the individuals on staff that travel frequently to the U.S. These visas were mainly obtained for engineers, scientists and information technology staff. The HR group continues to process U.S. employment visas in house, thereby keeping costs to a minimum.

Gretchen Magnuson has begun the paperwork on petitioning for permanent residency on behalf of two employees. In past years, this process was completed by an immigration attorney because of the enormous amount of paperwork and numerous follow-ups with immigration. Gretchen has accepted this challenge to process these permanent resident cards without utilizing the services of our attorney. This will lower Gemini's expenses and it is anticipated that it will expedite the process. To date, she has assisted these employees with obtaining crucial letters of reference, as well as assisting with document collection such as citation rates on papers and advising on medical exams and other essential parts of the Green Card process.

E.2.2.4 Benefits and Compensation

In 2008, performance evaluations were completed for ALL eligible staff. In past years, a good number of eligible staff did not receive performance evaluations. Human Resources conducted training for managers on the performance appraisal process. At the conclusion of the performance appraisals, several feedback sessions were held with a representative group of both managerial and non-managerial staff. In 2009 an online appraisal system will be implemented.

Through extensive research and comparisons, Jeracah Holland added value to the benefits in both life insurance and medical coverage. For all U.S.-paid staff, the basic life insurance benefit increased from a flat $40,000 for full-time employees and $20,000 for part-time employees of basic life to a benefit of one times the employee's annual salary with a minimum coverage amount of $40,000 for full-time and $20,000 for part-time employees. In addition, Accidental Death & Dismemberment coverage was added in the same amounts as the basic life. While dramatically enhancing the benefit, the premiums decreased by 20% saving Gemini almost $4,000 per year. In addition, flat rates were secured for the employee's voluntarily elected additional life insurance which, when combined with the new employer-paid coverage level, resulted in a decrease in premiums for 93% of our staff electing this coverage.

In 2008, an Employee Assistance Program (EAP) was included for all Gemini North and U.S. paid Gemini South Staff. The EAP was included in the Long Term Disability Plan for those at Gemini North at no cost to Gemini. Cigna Medical Insurance included it in their plan for the Gemini South staff at no cost. This program was requested by many staff at both locations.

In response to request from the Gemini North Staff, chiropractic, massage therapy and acupuncture was included in the HMSA plan at a very minimal costs. In addition, in response to another request for an additional medical coverage carrier, Kaiser Permanente was added to the medical plan choices for Gemini North.

In an effort for the three AURA centers to be consistent in many practices, the Human Resources Managers met in March to review and revise many of the AURA corporate policies. In two days, the manager updated and reworded many of the policies to be more concise and clear, clarifying the interpretations associated with these polices. The AURA Center HR managers will participate in this process on a regular basis in the future.

The Pension Plan committee, lead by Pat Phelen of AURA, and comprised of the three center's Human Resources Managers, met in November to discuss the plans that are currently offered. Because of the various changes in the 403b laws, the meeting focused on how these changes will affect the AURA plans. As an immediate change, the 401a Plan was amended to include a default plan to Fidelity's Life Cycle Funds for those individuals who do not designate their choice during their enrollment. This change benefits those staff who do not have time to consider the options and yet they receive the 10% Aura-paid contribution.

E.2.2.5 Training

One-day basic communication and managerial training continues at Gemini North. It continues to be a challenge to find qualified trainers that speak both Spanish and English for the Gemini-South Staff. Unfortunately, little training has taken place in the South. As indicated below, this was a priority for this year. Several universities and outside training companies were contacted meeting with little success.

The 3.5 day retreat conducted by Vanto Group, formerly Landmark Education Business Development, continues. A second retreat was conducted in January 2008 and a third retreat will be held in November 2008. The goal is to have all staff participate in this communication and awareness retreat.

The following new initiatives were executed during 2008. Due to the cycle of planning/execution these projects are all scheduled to be completed by the end of calendar-year 2008. The table below lists these initiatives and the current percentage of completion as of December 31, 2008.

Table E.2.2.5.1. Staff training provided during the calendar year 2008 at Gemini.

PROJECT TITLE	START DATE	END DATE	% COMP.
HR08-301G: Conduct Employee Satisfaction Survey	Dec 3, 2007	Aug 1, 2008	100%
HR08-211ER: Host Quarterly Breakfast with Summit Crews	Jan 21, 2008	Jul 31, 2008	100%
HR08-107G: Implement Standardized Merit Review	Jan 8, 2008	Sep 24, 2008	100%
HR08-106B: Implement Employee Assistance Program	Jan 1, 2008	Jun 27, 2008	100%
HR08-105G: New Software for HR and Payroll	Apr 1, 2008	Dec 31, 2008	10%
HR08-104ER: Improve Employee/Community Relations	Jan 21, 2008	Oct 31, 2008	100%
HR08-103G: Create Standards for HR Procedures	Jan 31, 2008	Dec 30, 2008	100%
HR08-102G: Create Webpage for Services & Infrastructure (HR aspect)	Jan 2, 2008	Dec 30, 2008	20%
HR08-101T: Arrange Managerial Training Courses for GS	Jan 2, 2008	Jun 27, 2008	10%

E.2.3 Information Systems Group

During the period covered by this report the Gemini Information Systems Group (ISG) has focused mainly on its principal role of staff support: responding to HelpDesk tickets. This activity alone consumes close to 75% of the ISG human resources. Nevertheless, many projects have also been completed. Table E.2.3.1 summarizes the band 1 tasks worked on by the ISG group. A summary of projects follows:

MS Office Upgrade: This year the ISG took the important step of making sure that the Gemini staff Microsoft Office® productivity tools were up-to-date. The task was by no means trivial, since it also involved the upgrade of computer hardware to support the latest software as well as staff training classes that needed to be set up and coordinated.

20 Units Cerro Pachón Dormitory: The ISG worked in collaboration with CTIO to outfit the new Cerro Pachón dormitory with high-speed network and IP phone services.

Hilo Base Facility Extension: Another important milestone is the completion of the extension to the Hilo base facility. The ISG procured and supervised the installation of the building structured cabling, installed and configured the network hardware, wireless access points and IP phone system, outfitted conference rooms and spent many hours preparing for and executing the smooth transition of staff and their computer equipment into this new facility.

Table E.2.3.1. Summary of Band 1 2008 tasks for the Information Systems Group showing progress as of December 31, 2008.

PROJECT TITLE	PROJECT DESCRIPTION	%COMPLETE
MS Office Upgrade	Upgrade of all staff MS Office productivity tools.	100%
Deploy Certificate Services - NSF	Build in-house Public Key Infrastructure (PKI) with the objective of managing and issuing digital certificates for authentication.	85%
20 Units – Cerro Pachón Dormitory	Collaborative effort between Gemini & CTIO to outfit the new dormitory with network, Polycom and phone service.	100%
IS Security Polices – NSF	Write IS Polices, email, backup, passwords, the Federal Export Administration Regulations (EAR), the International Traffic in Arms Regulations (ITAR), etc .	33%
Harden Network & Computing Infrastructure – NSF	Ban the use of non-secure protocols like Telnet, FTP. Deploy ssh, close down unnecessary services etc. Impacts NSF audit.	15%
Dynamic Phone Directory	Create a unified electronic phone directory that queries the Gemini Active Directory.	100%
Deploy Certificate Services – NSF	Provide the ability to issue and maintain staff digital certificates.	85%
HBF-X Network, Polycom & Phone Services	Purchase, configure and install IP phones, cabled and wireless network throughout the new HBF extension. Outfit new conference rooms with VC equipment.	100%
Network Redundancy	Deploy redundant network infrastructure to provide high availability to critical systems.	53%

RedHat Proxy	Deploy RedHat proxy server as an in-house repository for RedHat Linux updates and patches.	100%
Deploy WinInstall	Deploy the WinInstall as the standard tool for pushing Windows software, patches & updates to Windows clients.	100%
Implement Single-Sign-on Solution - NSF	Integrate all Gemini systems authentication schemes into a single authentication platform that queries the Gemini Active Directory.	0%
VoIP Enhancements	Add new features, investigate potential cost savings.	100%
Helpdesk/Fault Report Enhancements	Make improvements to the User Interface and database search engine.	53%
Increase Base facility storage system	Upgrade Netapps control-head and add additional disk shelf.	100%
Increase Summit Storage	Upgrade Netapps control-head and add additional disk shelf.	100%
Web applications – Request for Leave	Convert common paper systems into web based applications.	100%
External Web redesign	Apply new templates, style sheets and convert legacy content.	100%
Internal Web redesign	Apply new templates, style sheets and convert legacy content.	100%
Network and Computing Standards - NSF	Develop Gemini network & computing standards, such as defining the in-house officially supported Linux distribution.	20%

Network Redundancy: The ISG invested a significant amount of money during the period of this report to add redundant network hardware to eliminate single points of failure and provide high availability to critical telescope and operational systems.

Figure E.2.3. Netapp filer for tier 1 storage needs.

Summit & Base Data Storage: The ISG has further increased its investment in the Netapps “filers” for its “tier 1” reliable storage system on spinning disks; infrastructure that has been successfully used to store important science & operational data. In addition, a 24TB “tier 2” storage array has been installed at the base & summit facilities of both sites.

NSF Security Preparations: Many Band 1 projects are linked to the pending National Science Foundation (NSF) security review. This year saw the insertion of “Article 51” into the Gemini cooperative agreement. Efforts have focused on writing an initial report (based on our own risk assessments) that describes the Gemini Cyber Security program and how it expects to prepare for compliance. The technologies and changes required for compliance will be the ISG main focus in early 2009.

E.2.4 Controller Group

The Controller Group responsibilities include all accounting, budgeting, financial reporting, forecasting, and compliance functions of the observatory. Our group's daily work consists of such tasks as payroll, paying bills, reporting and paying our taxes, developing, monitoring and revising our budget, creating financial reports for management and oversight groups and vigilance to make sure that we are complying with laws, rules, regulations and the requirements of our cooperative agreement and other governing documents.

Staff: The staff consists of a Controller, a Senior Accountant, a General Ledger Accountant, a Payroll Accountant, an Accounts Payable Clerk, and a part-time Clerk assisting with payroll and purchasing.

Challenges: Our challenges this year related mainly to a heavy workload. The accounting team has only a few members, making any extended vacancy difficult to manage. While we are fairly broadly cross-trained in our respective areas, the workload is such that any absence makes it challenging to keep up with the most essential daily work. There was one position vacancy requiring shifting essential tasks to the remaining individuals which added to their already heavy workload. There was a four-week vacancy in the Accounts Payable Clerk position, a position whose tasks must be covered immediately. We were also in a transition state as a new Controller was hired in mid-November 2007. This is a key position that requires a substantial amount of training in the general and financial operations of and interactions between the Gemini Cooperative Agreement, the AURA Corporate Office (United States), and AURA-O (Chile).

Band One Controller Group Initiatives: The daily, essential work of this group takes about 95% of the staff's available time, leaving little project time for innovations and improvements. Nonetheless, we subscribe to the value of continuous improvement and each year we select projects that we feel will have the largest effect on our efficiency and the overall productivity of the entire observatory.

The following chart shows the projects chosen for the calendar year 2008 and the percent completion status as of the end of December 2008. Setup UltiPro is an AURA-wide project, and is being spearheaded by STScI. We have begun the earliest stages of planning the set-up and implementation of the software. The current target date is to go live on or before January 1, 2010. This project will be transferred into 2009.

Table E.2.4.1. Summary of Band 1 2008 tasks for Controller showing progress through December 31, 2008.

PROJECT TITLE	PROJECT DESCRIPTION	%COMPLETE
Expat assistance software	NRA Assistance Software purchase, training and implementation. Allows foreign nationals to answer questions and perform substantial presence test and treaty analysis on line.	100%
Research Viability of ETER	Research the viability of an electronic travel expense reporting system. This would allow employees to complete their expense reports, their supervisors to approve, and accounts payable to process them electronically, reducing the cost of paper and time to process.	100%
Managerial Access to Financial Reporting	This would allow our budget managers electronic access to up-to-date financial information with the capability to access the underlying expenses.	92%
Research Viability of UltiPro	Continue investigation of this program with the goal to replace inefficient HR/Payroll/Timecard system with integrated state of the art software that also contains employee self service abilities.	100%
Setup UltiPro or research other programs	If UltiPro proves viable, work on the conversion of data and structural setup of the program for use in 2009. If UltiPro is not viable, research other options.	0%
Web-based time cards for AOSS Gemini employees	AOSS employees migrated to Web-based time cards. Allows for approval from WTS system, same as for Gemini North paid employees. Easier reports.	100%

E.2.5 Procurement Group

The Procurement Department is responsible for all procurement of goods and services (whether by contract or purchase order), contract administration, grant administration, coordinating Gemini's compliance with our Cooperative Agreement, coordinating Gemini's compliance with export regulations, and property control.

Staff: The staff consists of a Procurement Manager, a Purchasing Manager, a Contracts and Property Specialist and a Purchasing Agent.

Challenges: In November 2007 a new Contracts and Property Specialist position was created in the Procurement Department and a number of responsibilities that had formerly been handled by the Accounting Department (property control and contract invoice processing) were shifted over to this new position. The addition of these duties to the newly filled Contracts and Property Specialist position presented an added learning curve for the individual and for the group. The transition was successful and the group has already implemented some improvements by automating some of the invoice processing procedures. We are currently researching ways to improve the automation of the property tracking system.

Procurement Band One Projects: Our philosophy is to regularly put resources into improving our efficiency and effectiveness, and we did this in 2008 through our Band One projects. Below is a list of the 2008 Band One projects with discussions on progress so far this year.

Reqless Upgrades. Reqless is a web application, adapted from a system developed by NOAO, for submitting and approving purchase requisitions online that was adopted by Gemini in 2007. In 2008 we worked with the Reqless developer to implement a number of significant improvements to the system which saved time for both general staff and the Procurement Department staff. Although substantial progress was made in improving the existing system, not much progress was made in the planned investigations of expanding Reqless to cover travel requests and check requests, and no progress was made in developing a module to automate the handling of the delegation of authority approval.

Cooperative Agreement Compliance System. The Gemini Cooperative Agreement with the NSF contains hundreds of provisions that regulate how Gemini operates. In the past there was no particular process for making sure that Gemini managers were aware of the Cooperative Agreement provisions that affected their areas of responsibility. The purpose of this project was to assign responsibility for each provision to the appropriate Gemini manager so that Gemini would more reliably comply with the requirements of the Cooperative Agreement. This project was successfully completed in 2008, and there is now a site on the Gemini internal web server that shows who is responsible for each Cooperative Agreement provision and its compliance.

Hazmat Shipping. The purpose of this project was to train the Gemini personnel responsible for preparing shipments in the proper labeling and paperwork for shipments of hazardous materials. This project was completed in 2008 by hiring a professional trainer in this field to conduct a training session for the staff who deal with shipping.

PO Browser Upgrades. The Purchase Order Browser is a web application that allows users to look up detailed information about every purchase order (PO) in the accounting system. This application was launched in 2007, and in 2008 a number of new features were added that reduced the time spent by staff looking up information related to POs.

The Table E.2.5.1 shows progress on the Procurement Band One Projects through December 31, 2008.

Table E.2.5.1. Procurement Band One Projects through December 31, 2008.

PROJECT TITLE	PROJECT DESCRIPTION	%COMPLETE
Reqless Upgrades	Various improvements to web purchase requisition application.	40%
Cooperative Agreement Compliance System	Create cooperative agreement website and assign provisions to managers.	56%
Hazmat Shipping/Handling	Conduct training for all personnel responsible for preparing shipments of hazardous materials.	100%

Streamline Purchasing Electronic Filing	Eliminate redundant PO filing.	16%
PO Browser Upgrades	Improve customer ability to efficiently browse the electronic purchase order system.	49%

E.3 Development Program

E.3.1 The Instrument and Facilities Development Program Mission

The Instrument and Facilities Development Group (henceforth the Development Group) plays a key role in achieving Gemini Observatory's mission to explore the universe by providing our astronomical community with the tools necessary to answer fundamental astrophysical questions. Advancement in astronomy depends on new technology. Proper use and application of new technologies in astronomical instrumentation are essential to ask – and answer – new and detailed questions about the nature of the universe, often with surprising results. The development of new facilities and instruments for Gemini continued to be a central function of the observatory during 2008, as critical to its long-term success as the nightly collecting of photons with the existing facilities.

The Development Group's mission is to provide the Gemini user community with the facilities and instruments needed to answer the most important questions in astronomy within the budget allocated. This includes making upgrades to the instruments and observatory infrastructure, enabling new observing modes, providing access to visitor instruments (when scientifically justified), procuring new instrumentation, conducting exploratory feasibility studies for promising instrument concepts, and developing the procedures and infrastructure needed to execute large "campaign" surveys to address questions that would otherwise be beyond the ability of a single team or Gemini partner to answer.

The Development Group team works closely with the engineering, science, and administrative groups, with instrument builders, managers, and engineers across the partnership, and with the governing agencies, boards, and committees that provide the direction, funding and authority needed. The Development Group engages in strategic planning with our oversight committees to make the long-term goals of the Gemini community a reality.

To produce forefront science and continue to compete in the global market of astronomy, we worked in 2008 to update our instrument suite. The last of the second-generation of facility instruments is now nearing completion. The Near-Infrared Coronagraphic Imager (NICI) was delivered to Gemini South in January 2007. The near-infrared multi-object spectrograph FLAMINGOS-2, after extensive delays, is expected to arrive at Cerro Pachón in early-2009. The Gemini Near-IR Spectrograph (GNIRS) is being repaired and will return to service on Gemini North in mid-2009. The Gemini South Adaptive Optics imager (GSAOI) is ready for use with MCAO, which is currently being commissioned.

The Development Group is managing and supporting the design studies and the construction of the next generation of Aspen instrumentation. The Gemini Planet Imager (GPI) is designed to find and study extrasolar planets. The Wide-field Fiber Multi-Object Spectrometer (WFMOS) will provide a revolutionary new capability to study the formation and evolution of the Milky Way Galaxy, and millions of others like it, reaching back to the earliest times of galaxy formation. WFMOS will also shed light on the mysterious Dark Energy that is responsible for the accelerating expansion of the universe. Finally, the Ground Layer Adaptive Optics (GLAO) capability being explored for Gemini North will improve image quality and enhance the performance of all instruments across a large field of view.

E.3.2 Phase 2 Instruments (GNIRS, NICI, FLAMINGOS-2)

GNIRS

During 2008, Gemini engineers made good progress getting many GNIRS components repaired, cleaned and tested in preparation for reassembly and re-commissioning on Gemini North. As reported last year, GNIRS overheated due to a temperature controller failure in 2007. Gemini is now carefully repairing the extensive damage. Since GNIRS was one of the most productive and popular instruments at Gemini South prior to the accident, we are confident that its restoration is worth the time and effort.

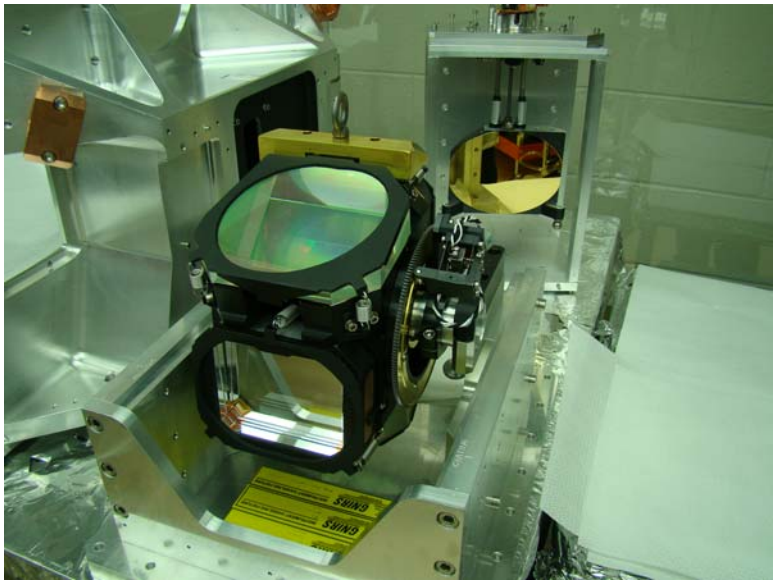


Figure E.3.2.1. GNIRS cross-dispersing prism reinstalled in the turret mechanism.

Two potential replacement Aladdin-3 science detectors have been produced by Raytheon Vision Systems and are being tested by our colleagues at NOAO. We are awaiting test results to determine which will be installed in GNIRS. A replacement HAWAII-1 array has been provided for the on-instrument wavefront sensor (OIWFS) by the University of Hawai‘i, and the detector and mount are now ready for testing. Much of the work needed to get the OIWFS back up and running is nearly complete. The detector procurements are some of the longest lead-time tasks on the GNIRS recovery plan.

Several of the new and refurbished optics have now been received from various vendors. We have the re-polished prisms and the new flat mirrors, which have now been reinstalled in their housings. Two of the three new diamond-turned mirrors have been received, and the third is

expected soon. Unfortunately, two of the lenses cracked during the recoating process following repair of edge chips, and will have to be replaced. We expect that two new lenses will take until the end of 2008 to procure. The other optics procurements are proceeding as planned.

Back in Hilo, Gemini engineers continue to clean and repair the mechanisms. The dewar shell and shields have been cleaned, reassembled, and are undergoing vacuum testing with the refurbished vacuum and cryocooler systems. The mechanism control software and computers are assembled and ready for further testing. The optics are being tested, installed, and realigned as they arrive. We expect to have the detectors by the end of the year, and be ready for full system integration and testing early next year. In spite of delays with the detector and optics vendors, we still expect to be re-commissioning GNIRS on the Gemini North telescope in semester 2009A, and offer it for science use in 2009B. We expect that GNIRS will once again become one of the most popular and productive instruments at Gemini, particularly when it is commissioned with the Altair adaptive optics system. In the meantime, Gemini engineers are working hard to bring this important instrument (GNIRS) back to life.

NICI

NICI is a near-infrared coronagraphic imager built by Mauna Kea Infrared (MKIR). It has been undergoing an extensive period of commissioning, instrument performance characterization and optimization, which is expected to be completed by the start of 2009A. Recent commissioning runs have demonstrated that NICI can achieve the high contrast sensitivity needed to detect young planets around nearby stars.

NICI has a specialized dual-channel camera with a dedicated Lyot coronagraph and an 85-element curvature adaptive optics system optimized to directly detect massive self-luminous extrasolar planets around nearby stars. NICI spectrally differences two images taken simultaneously at two slightly different wavelengths bracketing the strong near-infrared methane features found in substellar (planet-mass) objects. The NICI design philosophy tightly integrates the three major subsystems (AO system, coronagraph, and dual-channel camera) to minimize non-common path aberrations so that planets will not be confused with diffracted speckles produced by the optics in the instrument itself. Both cameras are equipped with 1024×1024 ALADDIN indium antimonide arrays sensitive from 1 to 5 microns. The imaging field of view is 18

Figure E.3.2.2. NICI being serviced in the instrument lab on Cerro Pachón in Chile.

arcseconds across.

NICI will be the first Gemini instrument to be used in "campaign" mode. The NICI planet search team has been awarded up to 50 nights over three years to look for extrasolar planets (see Section C.3.3). Campaign observations are planned to start before the end of 2008. NICI is also being offered for non-exoplanet AO imaging and coronagraphy starting in 2009A. While the instrument commissioning has not been completed yet, the measured performance for the characterized observing modes exceeds specifications.

When the Gemini Board of Directors authorized an allocation of up to 50 nights to the NICI campaign team, they required that the Gemini Science Committee (GSC) provide technical oversight of the campaign on an annual basis. They also required that the GSC assess NICI performance prior to starting the campaign. The GSC has organized the Planet Finding Science Working Group and charged it to review NICI performance prior to beginning the NICI Campaign. The working group and the GSC met in September and October 2008 to review NICI performance and provide feedback to Gemini and to the campaign team. The GSC defined two basic criteria to establish NICI's performance. The first is that NICI must be capable of achieving the science goals set out in the campaign proposal submitted by Liu's team. The campaign proposal was based on certain performance estimates and assumptions defined by Gemini as part of the campaign's Request for Proposals (RFPs). To go forward with the campaign, Gemini must first establish that NICI performs at least as well as anticipated in the RFP. Secondly, NICI must perform at least as well as NIRI and Altair, Gemini's comparable AO imager without an optimized coronagraph.

During commissioning, the NICI instrument team found that Strehl ratios at 1.6 microns were typically 35% to 40% during median or better seeing, matching expectations for guide stars brighter than V<13 as a function of natural seeing and guide star brightness. The delivered contrast ratio as a function of radius from the guide star exceeds the RFP predictions by a significant margin inside a radius of ~1 arcsecond, and is at least as good if not better than the best NIRI observations at small radii. The coronagraph is working as designed, and the unique dual-camera speckle-suppression system adopted for NICI will yield the best contrast ratios of any current instrument when observing within an arcsecond of the primary star.

There is still some work required to fully prepare for the start of the NICI campaign and other science observations. The most important task to complete is the repair of the dual detector controllers. For the last few months Gemini, MKIR, and University of Hawai'i staff members have worked to reprogram the detector controllers to improve reliability, remove interference patterns and dropped rows, and to decrease read noise. Completion of the Gemini high-level software is also needed for NICI campaign observations to be conducted during regular queue operations by Gemini staff members who are not expert in NICI operations. This work is scheduled to be completed and the campaign started before the end of the year.

FLAMINGOS-2

One of the most exciting new instruments to be built for Gemini is the FLAMINGOS-2 near-infrared multi-object spectrograph. It will image a field of view 6 arcminutes across and take up

to 80 spectra at a time. FLAMINGOS-2 will be the first of its kind in the southern hemisphere, allowing Gemini observers to address a wide variety of science questions. It will also take advantage of the new multi-conjugate AO system once it comes on-line later in 2009.

Since last year's report, a number of important milestones have been passed. The most important was the beginning of acceptance testing in August 2008. A large team of Gemini scientists and engineers traveled to Gainesville to test FLAMINGOS-2 and be trained by the University of Florida (UF) instrument team. UF provided extensive support and are now working hard to complete punch-list items identified during the testing. About half of the tests were completed successfully, particularly the software tests and mechanical interface measurements. The team demonstrated the warming and cooling of the multi-object spectrograph dewar and performed a full mask exchange cycle. The documents were reviewed and safety procedures discussed. Unfortunately, the camera cryocooler failed the day before the tests were scheduled to begin, so we were unable to complete the camera mechanism tests or measure detector performance. These tests have been successfully run before, so we expect FLAMINGOS-2 to complete acceptance testing by the end of 2008.

Figure E.3.2.3. FLAMINGOS-2 assembled and ready for acceptance testing in its frame in the lab in Gainesville, Florida.

Once FLAMINGOS-2 is commissioned, we plan to use specialized narrow-band filters to look for the first luminous galaxies at redshifts between 7 and 10. At redshifts greater than 7 the Lyman-α emission from hydrogen is shifted into the near-infrared J and H bands (1.1 and 1.6 microns, respectively). A team led by Roberto Abraham at the University of Toronto has built a special tunable filter composed of two Fabry-Pèrot etalons in series. The tunable filter is complete and awaits integration with FLAMINGOS-2 and MCAO at Gemini-South. We also procured a set of very narrow-band, wide-field fixed wavelength filters in 2008 to take advantage of the dark gaps between bright atmospheric OH emission lines in the J-band. The narrow-band filters will allow Gemini users to search for high-redshift galaxies with a variety of complementary approaches as soon as FLAMINGOS-2 is commissioned.

E.3.3 Aspen Instruments (GPI, PRVS, WFMOS, GLAO)

Gemini Planet Imager

The Gemini Planet Imager (GPI) is being designed and built by a collaboration led by Bruce Macintosh of the Lawrence Livermore National Laboratory (LLNL). A large consortium of institutions in the U.S. (LLNL, the University of California at Los Angeles, the University of California at Santa Cruz, the American Museum of Natural History and the Jet Propulsion Laboratory, JPL) and Canada (the Herzberg Institute of Astrophysics and the Université de Montréal) is involved in building a specialized high-order AO coronagraph designed to detect self-luminous planets around young stars. GPI is a coronagraphic instrument with its own on-board high-order AO system and apodized masks. GPI will also have a sophisticated interferometer incorporated into the AO system to further reduce wavefront errors. Finally, GPI will have a unique integral field spectrograph to help identify planets and characterize their atmospheres.

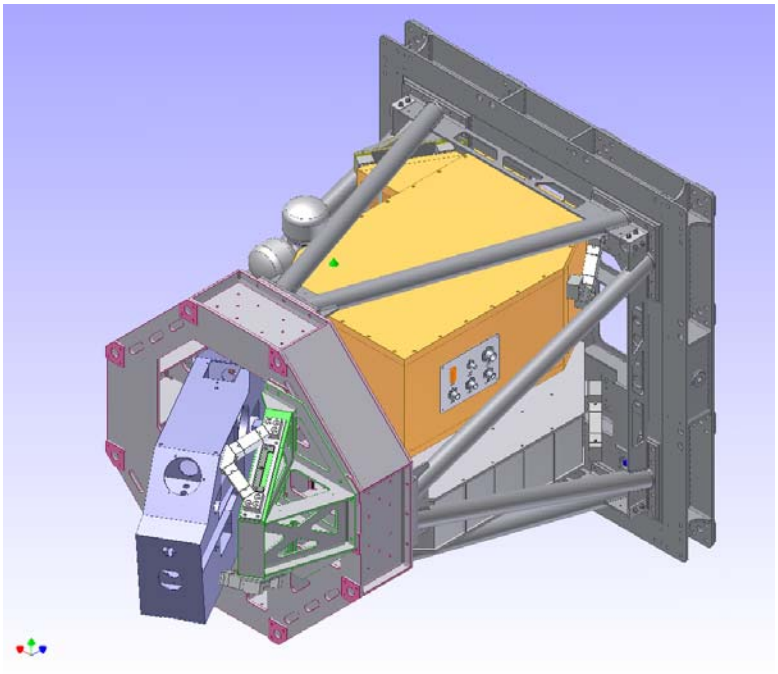


Figure E.3.3.1. Final mechanical design of the GPI instrument. The integral field spectrograph is the orange box on top; the AO bench is immediately below it. The calibration system is the blue subsystem projecting from the rear of the stiff support ring.

GPI is the first of the Aspen instruments to advance beyond the conceptual design phase. During May 2008, the GPI team passed its critical design review (CDR) and is now finalizing the design, resolving some high-risk areas of concern with test-bed measurements, and beginning the procurement process for a number of key elements and subsystems. The current schedule is for GPI to be completed and ready for testing on the Gemini South telescope by mid-2011.

In the process of preparing for CDR, the JPL team identified serious cost overruns affecting their ability to deliver the calibration interferometer on schedule and within budget. The CDR committee concluded that the calibration system was essential to GPI meeting its performance requirements. The GPI project management team has now implemented a recovery plan that includes conducting a “delta-CDR” to review JPL progress, and the allocation of a significant fraction (about one third) of the project-wide reserves held by Gemini. While significant, the total reserve for the project (contractor and Gemini-held) is still approximately 30% of the cost to completion. In addition to the delta-CDR scheduled for February 2009, LLNL and Gemini staff regularly participate in weekly telecons and quarterly in-

person progress reviews. The added oversight has been supplemented by a full-time project manager at JPL and increased accountability at JPL. During the four months following CDR, these added management activities have resulted in much better progress at JPL, consistent reporting and accounting, and much better morale within the GPI team. We are confident that JPL will deliver a working calibration system without further cost overruns.

The CDR committee identified a number of other areas of concern, which the LLNL and Gemini management team is carefully tracking. A detailed risk management plan is now in place to minimize the chances that anticipated risks become problems in the future. Areas of technical risk that have been addressed with early procurements and bench testing include the MEMS deformable mirror, apodizers, AO algorithms, and the calibration system control loops and wavefront sensors. Further testing of infrared wavefront sensors has begun at JPL, and Gemini is considering funding further infrared sensor development both for GPI and for a future acquisition and guidance system for the telescopes. The CDR committee also expressed concern about vibrations, so Gemini is working with the GPI team to collect additional vibration data and the GPI team has conducted additional finite element models to stiffen and improve GPI's components.

The GPI science goals are being developed along with the instrument, and the design decisions made thus far have been tightly coupled to the requirements of the science case. A survey of several thousand stars is expected to result in the discovery of hundreds of new planets, thereby helping us understand how and where planets form in systems like our own solar system. The science team that will carry out the planet search will be selected in 2009, under the direction and guidance of the Gemini Board.

Precision Radial Velocity Spectrometer

The Precision Radial Velocity Spectrograph (PRVS) procurement was canceled by the Gemini Board of Directors early in 2008 due to funding uncertainties.

Wide-field Fiber Multi-Object Spectrometer (WFMOS)

WFMOS is the highest-ranked instrument to emerge from the Aspen process, a priority that has been consistently reiterated by the Gemini Science Committee and Board. A feasibility study for WFMOS was conducted more than three years ago by the Anglo-Australian Observatory (AAO). The baseline concept for WFMOS has about 4,500 simultaneous spectra taken across a 1.5-degree field of view. This multiplex gain makes WFMOS a truly transformational instrument that will be used to answer key questions in the areas of Galactic evolution and understanding the nature of Dark Energy.

During the WFMOS Feasibility Study, Gemini and the Subaru Observatory (operated by the National Astronomical Observatory of Japan, NAOJ) agreed to explore the possibility of collaborating to build and install WFMOS on the Subaru telescope, a much better platform than Gemini for such a massive, wide-field prime focus instrument. In exchange for WFMOS observing time on Subaru, Japanese astronomers will have access to observing time on Gemini. Gemini and NAOJ would share the costs of constructing WFMOS. Some infrastructure

development would be shared with the Subaru instrument known as HyperSuprime Cam (HSC), leading to further cost savings. The HSC design is now quite mature, and work has begun on the wide-field corrector that will feed both HSC and WFMOS. Support for HSC and WFMOS within the Japanese astronomical community is growing. Initial discussions with representatives from NAOJ about how to structure an agreement between Gemini and NAOJ have recently begun.

After a two-year delay, the two competing WFMOS Conceptual Design studies finally got under way in February 2008. One international team is led by the Anglo-Australian Observatory, and the other by the Jet Propulsion Laboratory. The conceptual design studies will be completed in February 2009. We expect that the results of the down-select review in February will be presented to the Board for approval in May 2009. In the meantime, Gemini should conclude negotiations with NAOJ to define the organizational models that will be needed to coordinate WFMOS construction across a number of institutions around the world. An instrument as expensive and complex as WFMOS demands new ways of working together within the Gemini partnership, cooperating with the Japanese, and engaging with institutions around the world.

Ground Layer Adaptive Optics

The next generation adaptive optics (AO) system proposed in Aspen for the Gemini North telescope is a ground-layer system that uses multiple laser beacons and an adaptive secondary mirror to correct the turbulence very near the ground on Mauna Kea. GLAO will provide a corrected field of view seven arcminutes on a side with 0.2- to 0.3-arcsecond resolution full-width-half-maximum (FWHM) across the field. Although not a high-order, high-Strehl AO system, consistently improving image quality over a wide range of wavelengths can reduce integration times for optical and infrared instruments, making the telescope more efficient and productive. Some science projects that would otherwise require prohibitively long exposures, such as deep imaging of very faint distant galaxies, will become possible with GLAO. As an additional benefit, the Strehl ratio and sensitivity in the mid-infrared will be significantly improved using the adaptive secondary mirror. The baseline GLAO system was defined during the course of a feasibility study conducted in 2004 by the University of Arizona, Herzberg Institute for Astrophysics in Canada, and the University of Durham.

The feasibility study team's initial computations of the effectiveness of a GLAO system were based on atmospheric data from Cerro Pachón. To measure the ground layer turbulence on Mauna Kea, Mark Chun (UH) and his colleagues at the University of Durham and the Universidad Nacional Autónoma de México collected 18 months of turbulence data with high vertical resolution in the first 100 meters above the ground. The study was completed in mid-2008, and the results were fed into numerical models originally constructed by the feasibility study team. The results are even better than expected. At 1.6 microns (H-band), the baseline GLAO system would produce improvements of 0.2 arcseconds in FWHM under almost all seeing conditions. The ensquared energy in a 0.2 arcsecond aperture increases by a factor of 1.5 to 2. At optical wavelengths (R-band), the results are only slightly worse. These results suggest that a GLAO system on Mauna Kea would be highly worthwhile. No other observatory is currently developing a GLAO system, although future extremely large telescopes will probably require some type of ground-layer compensation. Gemini can therefore play an important role in the

development of this new AO technology. A conceptual design study for GLAO could begin once a decision on resource commitments for WFMOS is made. Also, since GLAO design studies will depend heavily on Gemini expertise, in particular for the new acquisition and guidance systems that would be required, serious GLAO design study work may not begin until 2010 after multi-conjugate adaptive optics MCAO work is complete.

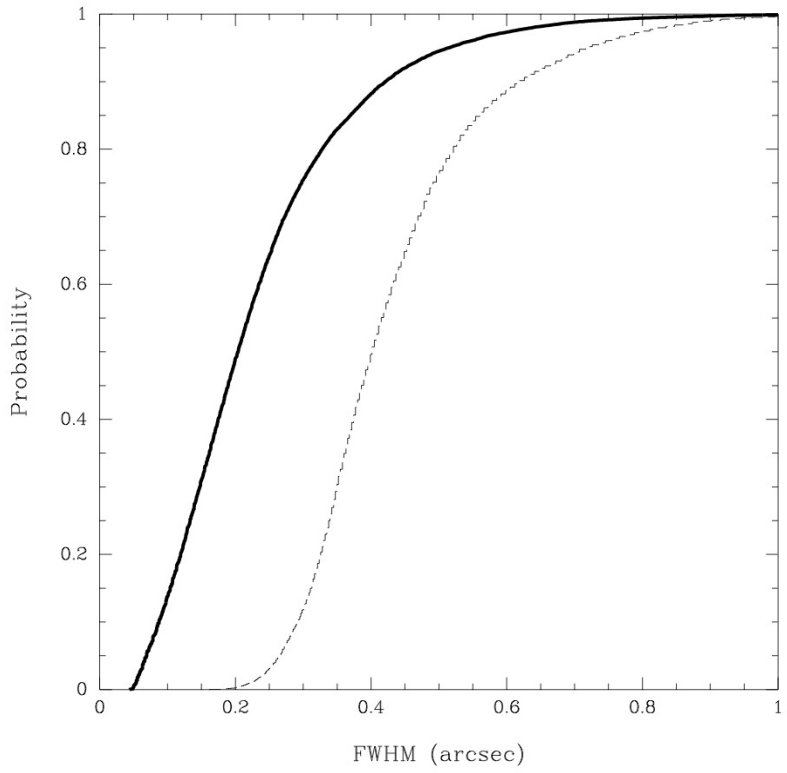


Figure E.3.3.2. H-band cumulative probability distribution of seeing-limited (dashed line) and GLAO (heavy solid line) image quality, as measured by FWHM.The FWHM is reduced by 0.2 arcseconds in most cases. Under the very best conditions, GLAO will produce a near diffraction-limited core. The diffraction limit in H-band is 0.04 arcseconds. The improvement at R-band is almost as good.

E.3.4 2008 Instrument and Facilities Development Tasks

Table E.3.4.1 details the development tasks for 2008. Most tasks show good progress, and we anticipate being able to finish almost all of them during the 2008 calendar year. Two particularly large projects (GPI support and WFMOS conceptual design studies) will continue into 2009. The GLAO modeling task has already been completed, and the contract for F2T2 (FLAMINGOS-2 Tandem Tunable Filter) will be in place shortly. Because of delays in delivery of FLAMINGOS-2, it is not critical that this task be completed before the end of the year. The planning phase for the procurement of CCDs for GMOS-North is well advanced, and we plan to begin this project early in 2009. Note that many of the tasks associated with new

instrumentation, such as FLAMINGOS-2 commissioning, are included in the engineering or science group plans. Please refer to the tables in those sections for details.

Table E.3.4.1. Summary of Band One Instrument Development task completion status as of December 31, 2008.

TASK TITLE	TASK DESCRIPTION	%COMPLETE
GPI support	Management oversight of GPI contracts, execute CDR, provide engineering support for software and design development, provide data on Gemini performance	93%
WFMOS design study support	Contract management for conceptual design study contracts. Provide competing teams with systems engineering support, and manage communications with Subaru	100%
Procure FLAMINGOS-2 narrow band filters (F2T2 and UNB)	F2T2 is being built in Canada, but requires Gemini and UF support to integrate into F-2, and later to install for operations. Only the procurement is currently scheduled for 2008. Ultra-narrowband filters just need to be installed and tested.	85%
GLAO modeling	Modeling effort to understand the implications of the Mauna Kea Site Monitoring results in the context of the GLAO feasibility study	100%
GMOS CCD procurement	Begin the process of procuring new CCDs for GMOS N and/or S, by establishing the needed work, getting hardware, exploring contract options, finding funding, and possibly procuring detectors.	96%
Mauna Kea Site Monitoring Extension	Extend Mauna Kea ground layer monitoring by 6 months	100%
WFMOS Science Conference	Organize WFMOS science conference with Subaru	100%

E.4 Engineering Program

E.4.1 Engineering Group's Mission Statement and Overview

The Engineering Group's mission is to work professionally, safely, creatively and efficiently to contribute in achieving the observatory's goals that will allow us to operate at a world-class level while encouraging technological development and constant improvement to our facilities. Our work will provide the scientific users in Gemini's partner countries with the necessary tools to conduct their research.

During the period covered by this report, the Gemini Engineering Group has accomplished a wide variety of projects. These projects were approved during the annual planning process retreat and they directly support the short-, medium- and long-term Observatory Mission.

To be able to execute the 2008 set of projects the team is organized as follows:

- Chief Engineer
- Deputy Chief Engineer
- Electronics and Instrumentation Group

- Mechanical Systems Group
- Software Group
- Optical Systems Group
- Systems Engineering Group
- Cerro Pachón Site Group
- Mauna Kea Site Group

During the period of this report, Mike Sheehan (former Mechanical Systems Group Manager) was promoted to Deputy Chief Engineer. This is a new position based in Hawai'i that was created to develop Engineering Group leadership at Gemini North. In addition, Mike has been working side-by-side with the Chief Engineer to elaborate on strategies that will help improve our overall technical performance. Steve Hardash, former Mauna Kea Site Manager, became Mechanical Systems Group Manager. In October 2007, Vasudeva Upadhya was hired as the Software Group Manager – a position that had remained unfilled for almost seven years. In September 2008, Mario Calderara joined Gemini to take the Mauna Kea Site Manager position.

The Systems Group is now composed of a manager, two systems engineers and one software developer. This change will allow us to better execute several classical systems engineering tasks that have been postponed due to a lack of resources.

It is also important to highlight that the majority of the Engineering Groups completed their hiring process, filling (in some cases) long-standing vacant positions or difficult ones because of their specific area of expertise. The groups that have benefited the most from this process are Software, Optical Systems, and Systems groups.

On the technical side, in 2008 we committed to execute and finish 26 engineering projects (as they are listed in Gemini Planning Tool). Of these, a key one is the Operations & Maintenance (O&M) Project. In reality this is more than a project; it is a complex and long list of interrelated activities including a number of small- and medium-sized sub-projects. It covers all of the everyday O&M tasks ranging from O&M related upgrades, routine instrument configuration changes, and regular preventive and corrective maintenance shutdowns that keep both telescopes and instruments operating reliably throughout the year. The dedication and expertise of Gemini engineers and technicians make the O&M activities exceedingly effective at guaranteeing smooth operations that allow us to devote part of our time to development projects.

Although the completion rate for development projects is much better than in 2007, we can anticipate that it is not yet at a level where we can consider the observatory's planning process an integral and driving-force for overall engineering activities.

However, if we examine the development-connected projects list in more detail, there are several important milestones that have been achieved. A few that deserve mentioning include:

- Successful Gemini North primary mirror (M1) silver coating. This is an extremely complex activity that requires a lot of planning and several months of preparations.

Safety measures implemented in the process forced us to introduce several major hardware changes that demanded additional efforts on design, construction and installation;

- The Gemini North laser system is reaching an excellent level of stability and allowing for the scheduling of longer laser runs (10 nights per run) at higher rate (once per month) throughout the year. Still pending is the work on software and control modifications that will make the whole system more user-friendly and more reliable;
- Another important software improvement that was recently introduced to the Laser Guide Start Facility (LGSF) is the repair of a communication issue between Altair and other telescope subsystems. This fix allows operating the LGSF without glitches that, in the past, would have cost the observatory a couple of hours of down time per-night per-run;
- The MCAO project at Gemini South is progressing at a good pace. While we are reaching the telescope integration phase in many of the major subsystems, CANOPUS, the Adaptive Optics bench, appears as our main technical challenge. We have encountered numerous details that have been solved in the laboratory while conducting performance and characterization tests;
- On the other hand, our main concern at the moment is the Gemini South laser fabrication progress status, especially since Lockheed Martin Coherent Technologies (LMCT) communicated to us that the delivery date has been postponed until July 2009;
- The Data Flow project Conceptual Design Review (CoDR) took place in December 2007, at the time of this report we are preparing for a Preliminary Design Review (PDR) in February 2009. We have assigned one full-time software architect to work on this project to ensure that we reach PDR with an accurate and comprehensible plan regarding how to design pipeline architecture to meet the requirements defined and elaborated by the scientists;
- The repair of the Gemini Near-Infrared Spectrograph (GNIRS) is currently (as of the writing of this report) at a point where we are starting to receive the optics and begin the main subsystems reassembly. The GNIRS dewar and mechanical parts have been cleaned and repaired. Computers and software are running and some of the electronic subsystems have been checked and tested. Staff at the National Optical Astronomy Observatory (NOAO) is getting ready to test the new detector from Raytheon;
- The GPS-based Water Vapor Monitor for Gemini South is now 99% done and getting ready for commissioning. The implementation of this monitor was possible thanks to the invaluable contribution of Dr. Mark Falvey, a geophysicist that works for the Geophysics Department at Universidad de Chile;
- The LINUX migration project is, at this point, 70% done. This project has been tricky to execute since we are attempting to migrate all of our operational machines and servers to LINUX with the goal of minimizing the impact on telescope operations. This goal requires that planning, preparations and testing are done prior to reaching the final deployment phase. On Phase I, we are deploying System Support Associate's (SSA's) and astronomer's workstations; later on, we will deploy LINUX DHS and key servers;

- On the instrument development front, we have successfully accomplished Flamingos II software related commitments. We assigned engineers from all disciplines to participate in the Factory Acceptance Test (FAT) in August 2008;
- We have supported the Gemini Planet Imager (GPI) activities by sending engineers to the CDR and by keeping in touch with GPI team members and clarifying questions that they might have with respect to our telescope at Gemini South;
- High level software development continues to be one of our main activities. During this review period several new releases have taken place for Observing Tool and Queue Planning Tool;
- For the Aspen instruments programs, we have developed the Gemini Instruments Application Programming Interface (GIAPI). This uses a lightweight and flexible software design developed to interface any instrument code with Gemini software architecture. It uses an agile software engineering solution aimed to allowing end-to-end testing of software features early in the development process;
- The All-Sky CAMera (ASCAM) design and implementation was finished and, after concluding validation at Cerro Pachón, the system will be packed and shipped to Hawai'i to be installed on Mauna Kea for further testing. After a period on Mauna Kea, ASCAM could be sent to Palomar for final validation with multiple aircraft detections, once that is done it will return to Mauna Kea for definitive installation and deployment;
- We are currently selecting the Engineering Documentation Management Tool (DMT), which will follow a similar concept to the one adopted with the Gemini Planning Tool. We expect to deploy DMT in early 2009;
- During 2008, the Gemini Planning Tool was successfully deployed and supported by the Systems Group. Thanks to this work we were even capable of including customization features that were used during the October 2008 planning retreat in Waikoloa, Hawai'i.
- Finally, I would like to mention that safety has been another important area of improvement for engineering. We have designed and deployed several devices and structures that drastically improved our safety while executing normal O&M and shutdown tasks.

Table E.4.1.1. Engineering 2008 Band 1 tasks completed as of December 31, 2009.

TASK TITLE	TASK DESCRIPTION	% COMPLETE
GN LGS facility improvement	The purpose of this project is to finish undone tasks related to LGS system. Most of the tasks are geared towards improving night time efficiency and fixing faults.	40%
Eng Safety Projects	Projects include 1) All safety projects for GS M1 coating. 2) IPL upgrades. 3) Shutter drive access platform. 4) Dome Ice Shield. 5) Dome access ladder.	8%
NICI Commissioning /Operations	NICI commissioning/operations	91%
ENG managers duties	Engineering managers duties	80%

Eng Staff Hiring process	Engineering staff hiring process	78%
MK UPS upgrade	MK Site emergency electrical power upgrade (ENG05)	58%
GNIRS Repair	GNIRS repair and enhancement (2008 phase)	51%
ASCAM	This project is developed to build 2 modular All Sky Cameras to detect early aircraft trajectories flying over the observatories airspace. The ASCAM modules will be networked (URL) and connected via TCP/IP with the LTCS and TCS (Observatory Systems). The idea is to build the first ASCAM to install on MK, after some test on Palomar, then to build the second one.	77%
FLAMINGOS 2 AT and Eng Commissioning	FLAMINGOS 2 (AT and on-sky AT support). This project is a candidate to roll over to 2009 considering that Aug 2008 AT failed to pass. An AT-2 is considered to be performed on Oct/Nov 2008. F2 AT and Eng commissioning means to have F2 ready for F/16 (No MCAO) on-sky commissioning as Facility Instrument. F2 Science commissioning is a SCI project for 2009.	45%
Eng Tools Corp Approach	Engineering Tools Corporate Approach project includes two main sub-projects: The Gemini Management Planning Tool and the Engineering Documentation Management Tool (DMT). The appropriate DMT is being searched to implement and deploy during 2008. At the end of 2008 the Planning Tool (PI) will be at the 98% level of completion and the DMT will be at the level of 80% level. Most of the rollover task to 2009 are related to store OLD Gemini documentation in the DMT.	65%
Water Vapor Mon upgrade	Water vapor monitor upgrade	92%
MCAO (phase 1 and 2)	MCAO (phase 1 and 2)	52%
GN Coating preps A	GN coating preps A	100%
Tel Earthquake readiness	Telescope earthquake readiness	81%
OM program (A tasks)	OM program (A tasks)	76%
GS Instrument Maintenance	GS instruments maintenance	100%
GN Mirror Coating	GN mirror coating	100%
A&G Prev Maintenance	A&G prev maintenance	100%
GN Instrument Maintenance	GN instrument maintenance	100%
Spares procurement	Spares procurement	48%
Linux Migration	Linux migration	72%
Dataflow (Phase 1 & 2)	Dataflow Project Plan. Since Dec 2008 contains data flow phase 2.	31%

Obs Software maintenance	Observation software maintenance	95%
Chopping improvements	Chopping improvements	77%

E.4.2 Operational Support

Keeping the observatory systems maintained and up-to-date is a core function of the Engineering Team. To achieve this, we implemented a new functional position to lead these efforts at both sites. This position is called *Telescope and Instrument Operations Manager (TIO-M)*. The function of this manager is to develop a system and implement actions that will ensure that the telescopes and instruments perform at their best with little down time and with appropriate support to tackle problems that arise during the day or night. This position oversees both sites and is currently performed by the Electronics and Instrumentation Group Manager. In the future this management structure may change.

One of the first improvements that we made with this new scheme was to take an aggressive approach toward the planning and execution of preventive maintenance for all telescope and instrument systems. This approach has proven to be very successful and its immediate effect has been the reduction of telescope and instrument downtime, especially at Gemini South during semesters 2008A & B. We plan to continue to review and improve these plans at both sites. This improvement is a change in culture as we are now more proactive, anticipate problems and fix them at the root. As a result we are spending high-quality engineering time on solving the root problems rather than being reactive and working on faults only when they show up or applying fixes simply to get us going.

During this review period, we focused a dedicated team of engineers and technicians on finding solutions to some long-standing problems with the telescopes and instruments. Examples of these problems include: the GMOS on-instrument wave front sensor assembly at Gemini South which very often lost its index (and hence produced downtime constantly); poor secondary mirror (M2) chopping and guiding performance at Gemini North (the solution will be implemented at Gemini South in 2009); and various Altair software bugs.

For operations support during off working hours (and specifically at night), the engineering team has continued with the *Telescope Technical Manager (TTM)* role as this has proven to be very successful in the past. This role is shared on a weekly basis by various experienced engineers at each site. During this review period, a new generation of TTMs has been added to the team. The TTMs report directly to the TIO-M. Currently we have four experienced engineers from different disciplines at each site performing this role. The main responsibilities of the TTM are to:

- Serve as the first point of contact for the science staff for any telescope or instrument problem that arises at night or during off working hours;

- Coordinate engineering's summit support during off working hours, weekends, and holidays using input provided in advance by each group leader on manpower resources;
- Work closely with the Queue Coordinator on any issue that affects the night use of telescope and instruments;
- Prepare a weekly plan of all tasks that affect telescope and instruments systems based on the input provided by other engineering members or from the science team. The TTM has the responsibility to schedule these tasks to make the best use of the telescope at day and night;
- Update the plan for the week on a daily basis;
- Provide daily coordination of tasks that affect the telescope or instruments systems based on the plan for the week;
- Keep accurate track of progress on all tasks that are in the plan for the week;
- Chair the daily coordination meeting with the summit day crew that happens from Monday to Friday at 9:00 am at both sites;
- Chair the daily operation meeting that happens from Monday to Friday at 9:30 am at both sites;
- Report for the engineering team in the daily 4:00 pm coordination meeting at both sites.

Currently, Gemini does not have engineering personnel on site to tackle problems at night and during weekend and holidays. As explained earlier, off-hours support is achieved mainly by the TTM and personnel made available to provide this support over the phone or video conference and sometimes with an emergency trip to the summit. We have started discussions within the engineering group about how to improve this system with the goal of reducing down time, being cost effective, and making it sustainable for the personnel in the long term.

E.4.3 Maintenance of Telescope and Enclosure Systems

In order to assure reliable operations, the engineering group devotes considerable resources to the preventive and corrective maintenance of telescope and instrument systems. The following section describes the most significant accomplishments for this period:

Telescope Shutdowns: Both telescopes had a few scheduled shutdowns as part of our maintenance plans. It is important to emphasize that we take advantage of these periods to perform preventive/corrective maintenance to other telescope and or instruments systems that are not part of the main purpose of the shutdown;

Coating at GN: In July - August 2008, we successful coated the Gemini North mirror with silver. This was a major shutdown that involved participation of engineers and technicians from both sites;

Gemini South Shutter Cable Carrier and Cable Replacement: Both Gemini North and South have, over the past few years, experienced a number of serious failures on the upper and lower shutter cable carrier and cables of the enclosure. In October 2007 the replacement procedure, implemented first at Gemini North, was successfully executed at Gemini South;

A&G Maintenances: The Acquisition and Guiding Systems (A&G) are the subject of scheduled maintenance every six months. This is to assure their availability and reliability as they are one of the most complex systems used on the telescope during regular observing nights. It is necessary to schedule a telescope shutdown in order to perform this task. As a result of this preventive/corrective maintenance work we have been able to considerably reduce down time due to failures on both units. We have been doing this for several years, one sub-assembly of each system at a time. The A&G systems at both sites had their maintenance done during the shutdown of November 2007 and July 2008 at Gemini North, and October 2007 and April 2008 at Gemini South.

With regards to instrumentation at Gemini South we had several instrument shutdowns:

- **Phoenix:**
  - In March 2008, as part of the yearly maintenance period, we replaced the instrument cold head and executed preventive maintenance on all mechanisms;
- **GMOS-South:**
  - During April 2008, as part of the yearly maintenance period, we fixed a long-standing problem with the on instrument wave front sensor (OIWFS) assembly and did a general routine preventive maintenance to all mechanisms;
  - On an earlier instrument shutdown we replaced the cold head displacer;
- **T-ReCS**:
  - This instrument went into an unscheduled shutdown in May 2008 to modify and fix the slit mechanism since it had failed many times in past. This is also part of our "in house" upgrades strategy intended to increase overall systems reliability;
  - The yearly maintenance was done in October 2008.

With regards to instrumentation at Gemini North we performed scheduled and non-scheduled shutdowns as part of our current maintenance plans. A list of the most relevant work done includes:

- **MICHELLE:**
  - Routine cold head replacement;
  - Joule-Thompson (JT) compressor replacement due to failure;
  - Cold finger engineering period rework due to degraded thermal performance;
  - Edict board upgrades to reduce thermal induced faults;
  - Replacement of fans on Edict pre-amp boards;
  - Filter installation and move as per science group request.
- **GMOS-North**:
  - barcode replacement to improve durability;
  - Mask frame modifications to improve sensor activation;
  - Sine/Cosine encoders replacement in the on-instrument wave-front sensor (OIWFS) assembly;
  - Replacement and test of new OMS motor control boards.

- **NIRI**:
  - Routine replacement of cold heads;
  - CoAdder board repair;
  - Analog to Digital Converter (ADC) board repair;
  - Gemini NOAO Aladdin Array Controller (GNAAC) noise reduction modifications;
  - Power supply replacement.
- **NIFS**:
  - Routine replacement of cold head;
  - Power supply repair.
- **Altair**: Altair has gone through our regular preventive maintenance period that includes repair work as well as a large software debugging effort to remove long-standing problems. We have also, in conjunction with other observatories, begun working on the procurement of a spare quad cell module, a unique key device of Altair.

It is important to note that instrument shutdowns do not interrupt regular night observations since, during this time, scientists use other instruments by making adjustments to the queue.

Two corrective campaigns aimed to improve overall performance:

Besides shutdowns and routine preventive and corrective maintenance tasks it is necessary to invest time in projects that contribute to improving performance on several fronts. This is done in response to scientific needs once they become official requests from our science team.

Chopping/Guiding Improvement at Gemini North: Engineers at Gemini North and South started a campaign to understand and fix a long-standing difficulty with chopping and guiding with MICHELLE and T-ReCS, our mid-infrared instruments. This campaign was successful and we were able to eliminate this problem at Gemini North by introducing software and hardware modifications. Our plan is to retrofit these modifications to Gemini South in March 2009.

Image Quality Improvement: We continued with the campaign to correct image quality (IQ) problems that have been identified with some of our instruments. The campaign has been very successful since it leads us to better understand some of the causes that affect our IQ and introduce improvement. We also have plans to start collecting data in a systematic way that would allow us to be even more effective in attacking this issue.

E.4.4 New Instruments

FLAMINGOS-2

We have been supporting FLAMINGOS-2 (F-2) development through direct interactions with the University of Florida (UF) team by visiting them a couple of times during the year and also providing a considerable amount of on-site software engineering support to interface F-2 software to the Gemini environment.

During the second quarter of 2008 the UF team reported that Flamingos 2 was ready to perform the pre-shipment Acceptance Test (AT).

However, on August 3rd we were notified that the F-2 science camera cooling system had failed and therefore it would not be available for AT. After discussing the impact of this problem and concluding that about 40-50 % of the tests could still be performed, it was decided to carry on with the AT as scheduled.

The AT was conducted in Gainesville, Florida during Aug 4th – 8th. We followed the Acceptance Test Plan document, complemented by the Functional and Performance Requirements Document (FPRD), Operational Conceptual Definition Document (OCDD), Interface Control Documents (ICDs) and the Statement of Work (SoW). Even though the F-2 AT process was affected by the lack of the science camera, it was productive and positive. Gemini and the UF teams had the opportunity to exchange opinions and potential solutions on those issues that require some level of improvement with the aim of having a more robust Gemini facility instrument. A second AT (AT-2) will be conducted in mid-December 2008.

Gemini Planet Imager (GPI)

The Engineering Team supported GPI development by interacting on a weekly-basis with the GPI systems engineer. GPI Critical Design Review (CDR) took place on May 28-30, 2008 at Caltech. Prior to this we received detailed documentation that allowed us to submit questions to the GPI team before meeting for the review. A rather large number (for this type of meeting) of Gemini engineering staff were present throughout the review and made very valuable technical contributions. After the CDR, Gemini's technical support for GPI has increased considerably. This is one of the recommendations the CDR committee made with the goal of making improvements in technical and management areas.

Wide-Field Multi-Object Spectrograph (WFMOS)

We continue to provide systems engineering support to WFMOS development though the Gemini Instrument Program Manager. It has been concentrated mainly on providing guidelines for the formulation of a testable set of requirements, standards, and Interface Control Documents (ICDs).

Near-Infrared Coronagraphic Imager (NICI)

We have also supported telescope NICI commissioning, covering a wide range of specialties.

Software work was done to fully integrate the instrument with Gemini's current infrastructure:

- Observing Tool (OT) component of NICI was released;
- Sequence Executor (Seq Exec) logic was implemented to support all observation modes;
- Data Handling System (DHS) was modified to collect pixel images and header information;
- Instrument Status Display (ISD) was designed to provide optimized instrument components and instrument configuration visualization;

- Telescope Control Console (TCC) was extended to support guiding configuration with NICI/Adaptive Optics system;
- Internally, NICI's software was further developed to make it more robust and add new features to the instrument controller and instrument sequencer.

In Electronics, all the limits and home hall-effect sensors have been checked and calibrated; the detector fibers were changed.

Mechanically, the thermal enclosure cooling capabilities were completely re-worked to be able to reach appropriate and safe electronic components operating temperatures inside of the enclosure without dissipating more than 50 watts to the ambient environment.

Optically, the calibration source (infrared fiber-fed) was re-aligned to improve throughput. All the optics were checked, aligned and cleaned.

NICI commissioning work has been completed, the instrument is ready to be used for the science campaign.

Gemini South Adaptive Optics Imager (GSAOI)

GSAOI laboratory commissioning phase 2 will take place during November-December 2008. A detailed plan for this work has been developed between Gemini and Australian National University (ANU) personnel.

On the technical side, new GSAOI software will be tested to improve the On Detector Guiding Window capabilities and enhance data handling. The laboratory commissioning phase-2 is aimed at having GSAOI fully operational and ready to perform GSAOI-Canopus integration after operation verification and the software acceptance test.

Gemini Multi-conjugate adaptive optics System (GeMS)

Our GeMS project is structured in five major sub-systems: Canopus (the adaptive optics (AO) bench), the Beam Transfer Optics (BTO), the infrastructure for the laser, the laser itself, and the Operational High-Level Software (OHLS). The last category was added this year to synchronize the effort with a regular Observing Tool release every semester.

In general, resources have been quite intermittent until the last quarter when the shutdown activities at Gemini North were completed. At that point, a reassessment of resources provided more clarity for the future, although we continued to have peaks and valleys in staff resources due to telescope operational issues at Gemini South which pulls out key resources from the project for small periods. For these reasons, our goal to complete phase 1 (laboratory integration and testing) and phase 2 (telescope installation) by the end of 2008 was not accomplished.

Major areas of progress on Canopus include: high-level control and calibration software (Myst) development has reached enough maturity to release version 1.0; science-path image quality

characterization and non-common path corrections have allowed to reach a Strehl of 99% at any given point of the field and tomography reconstruction is on-going to determine the average performance over the whole field; flexure testing is in progress and allows us to identify the required compensators; various moving mechanisms have been debugged and are now operational. The major milestones ahead of us are: complete thermal upgrades of electronic enclosures, complete commissioning of all moving mechanisms and sensors, complete characterization of both LGS and natural guide star (NGS) wavefront sensors and verification of all the requirements in our compliance matrix. Once these milestones are met the AO bench will be moved in mid-2009 to Cerro Pachón to perform 2-axis flexure testing (using the flexure rig) and commissioning with GSAOI in the laboratory.

The beam transfer optics (BTO) was simplified early in the year and the splitting of the 50W beam will be done on the top end ring. We have performed end-to-end control testing of most transfer opto-mechanical assemblies and are currently designing the fast Laser Bench Beam Stabilization system to compensate for jitter between the laser bench and the telescope. We aim at performing integration and static alignment on the telescope in the second quarter of 2009.

Laser infrastructure work has finally made significant progress in the following areas: completion of the Laser Service Enclosure (LSE) construction performed at Cerro Pachón; completion of the fabrication drawings for the support structures of the LSE and the laser bench and initiating the bidding of these work packages at local workshops in Chile. We anticipate the LSE control tests will be done by the end of the year and the support structures erected on the telescope in the second quarter of 2009.

Laser development at Lockheed Martin Coherent Technologies (LMCT) has suffered dramatic delays this year due to difficulties in meeting requirements of stability for the laser's wavelength, beam quality, and power at 50 watts. The factory acceptance was successively postponed from July to October 2008 and finally to May of 2009 (as of October 2008), putting this system back on our project critical path. LMCT is aggressively attacking the problems and has included two new senior laser physicists in the core team. Some design changes (like oscillator Nd:YAG rod temperature set-point and control (affecting power), optical configuration to optimally pump the waveguide amplifiers (affecting beam quality), and new etalons to stabilize frequencies in oscillators (affecting wavelength) are on-going and will be implemented on the Keck laser prior to upgrading the Gemini optical bench.

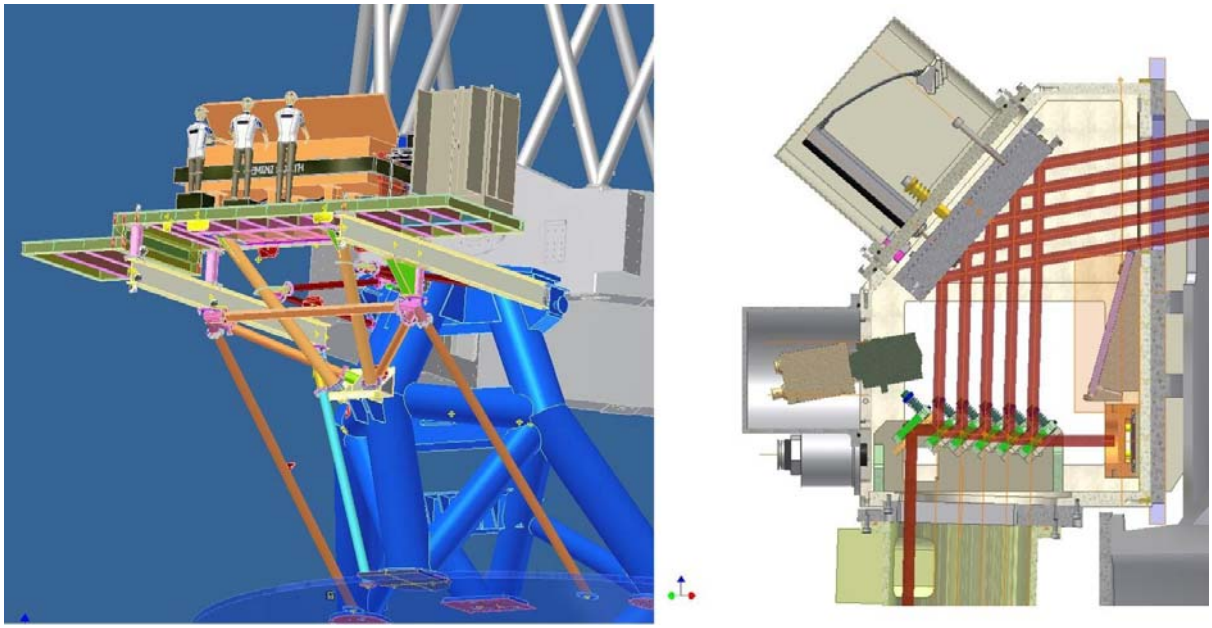


Figure C.3.1.1. Left: laser bench and the laser service enclosure (no wall nor roof) support structure; Right: 5-beamsplitting scheme in beam transfer optics at top end ring.

Finally, work began for high-level software for operations and is planned to provide the basic functionalities and tools to perform the technical commissioning in semester 2009B.

E.4.5 Software

In respect of software we have dedicated our efforts to the following projects:

Pipeline Reduction System

The Software Group, along with the Science Data Reduction Group, organized a Conceptual

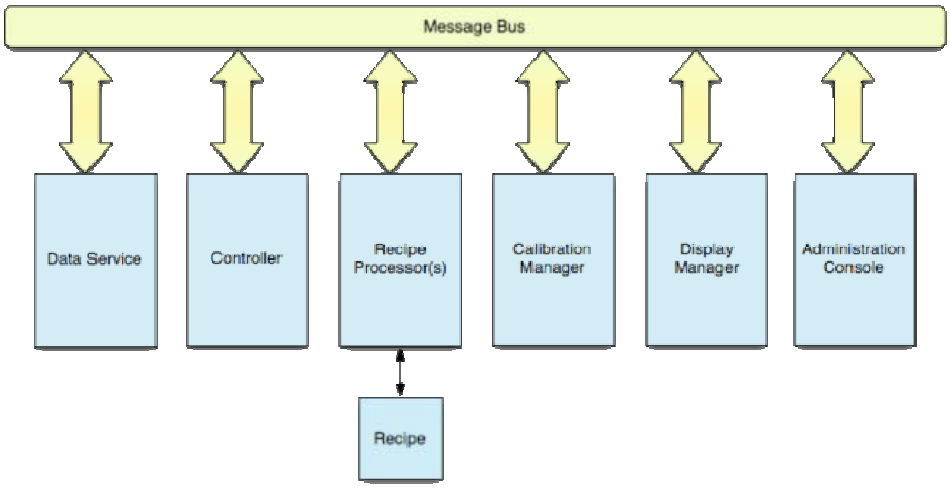


Figure E.4.5.1. Dataflow Pipeline Architecture.

Design review for the Software Infrastructure of Dataflow Systems, as shown in Figure E.4.5.1. A committee of external reviewers reviewed the design concept and made recommendations. A response to the committee was sent in early 2008. As a result of this review, Gemini is slated to have the Preliminary Design Review (PDR) of the project during the last week of February 2009.

Gemini Instrument Application Programming Interface (GIAPI)

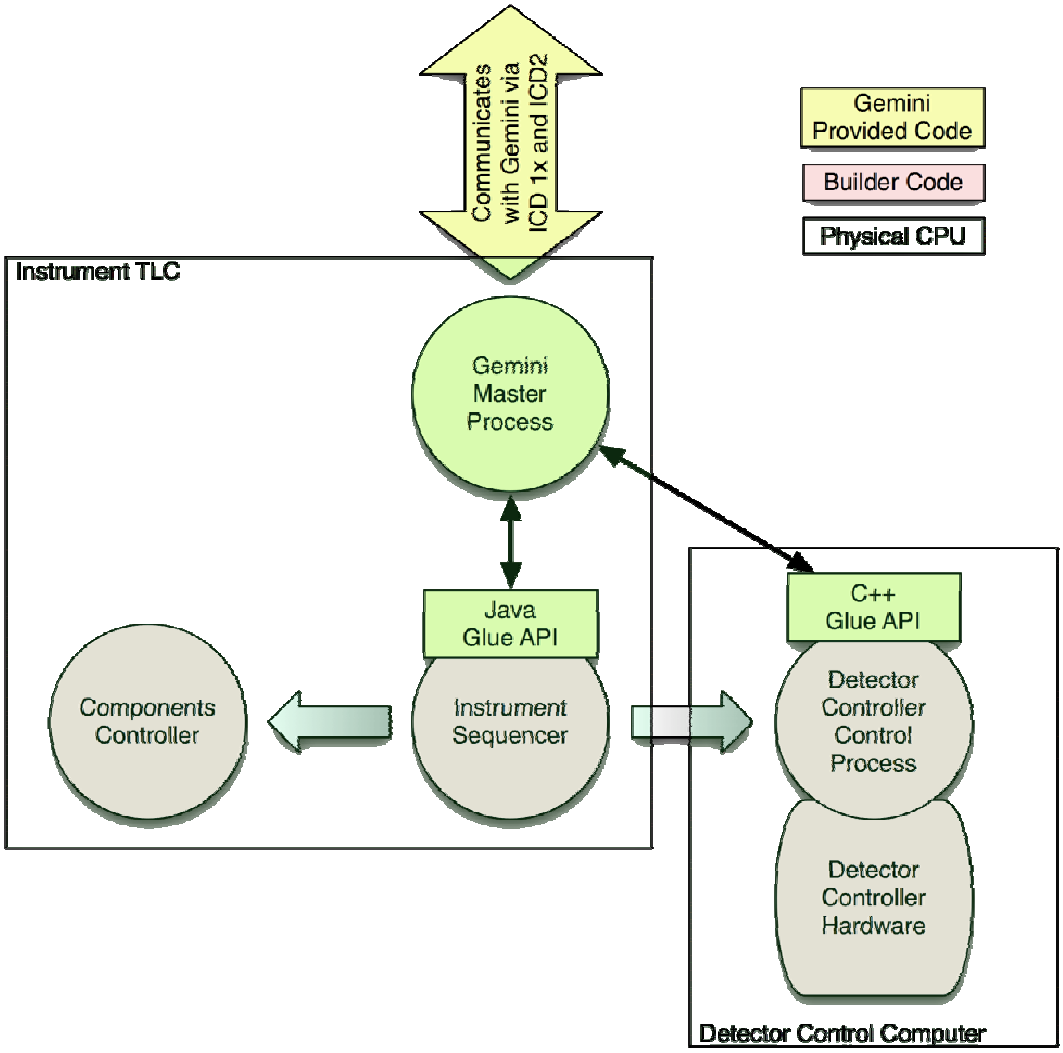


Figure E.4.5.2. Schematic Representation of the GIAPI flow.

For the Aspen instruments programs we have developed the Gemini Instruments Application Programming Interface (GIAPI). This is a lightweight and flexible software design (see Figure E.4.5.2) developed to interface with any instrument code using Gemini software architecture. The development started in January 2008, following an agile software engineering approach. The design of GIAPI allows the builder to progress on their design and development with as little dependency on Gemini as possible.

This approach simplifies the integration effort, allows builders more freedom to use their own software, clarifies software responsibilities, increases the overall quality and rigor of instrument code, and provides timely and appropriate levels of support to instrument builders.

GPI is the first instrument using this interface and approach. So far, we have produced four versions of the GIAPI and we have demonstrated the benefits of the agile software approach. In October 2008, we will test integration of GIAPI with GPI code. During these tests, we could verify the effectiveness of the approach, allowing us to discover and resolve issues that at this stage of development are easy to correct.

Water Vapor Monitor

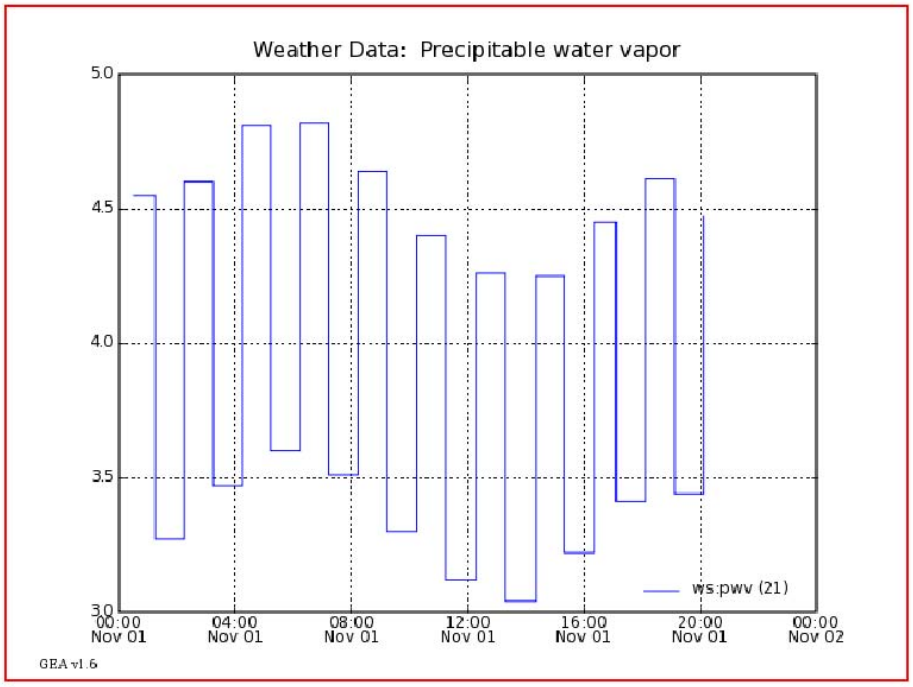


Figure E.4.5.3. Plot showing the Water Vapor Values for a week.

The Software Group, along with the support from EIG and Dr. Mark Falvey from University of Santiago, developed the pipeline for calculating the Water Vapor Precipitation at Cerro Pachón, using a global positioning system (GPS). The pipeline uses several GPS stations to come up with the best possible estimation of the Water Vapor Estimation. A snapshot of the values over a period of one-week is depicted by the graph shown above. At the core, the pipeline uses GAMIT (http://www-gpsg.mit.edu/~simon/gtgk/index.htm), developed by MIT, for calculating the water vapor estimation. As a future addition, more data from additional GPS stations will be utilized by the pipeline for better water vapor estimation.

All-Sky Camera (ASCAM)

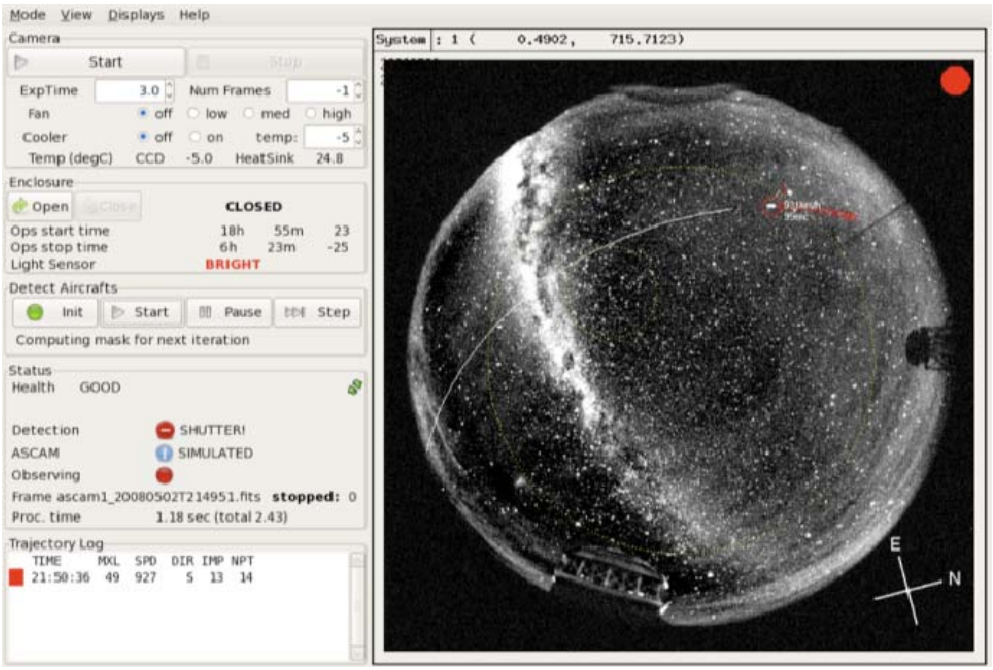


Figure E.4.5.4. User Interface showing the flying objects on the sky.

During the first part of 2008, the Software Group, along with the Science Team, developed software to control the new cameras for ASCAM, the automation of the dome, and the implementation of the logic for the interlocks used in the ASCAM system. Gemini is using an Alta-U camera for ASCAM, which is a different type of application for the cameras. Since the vendor provided an open-source driver for its cameras, the effort needed to adapt for ASCAM turned out to be minimal. The modifications were mainly confined to adding support for two cameras working in parallel. The multi-threaded nature of the original application helped in arranging synchronous overlap of open shutter time.

Developing the software components needed to interface with the enclosure and light sensor was also minimal. The device we selected (DGH) uses a simple ASCII protocol over a serial port for communication. A similar driver had already been developed for a different monitoring project.

The data stream coming from the camera was conserved. A high-level mathematical language called Yorick was selected to perform the complex and intensive computations necessary for the detection and data collection. It provides C-like performance and a convenient mechanism to create extensions (plug-ins). This feature allowed us to use the shared-memory interface provided by the original design, a fast and efficient way to pass data between processes. Control of the camera is accomplished using EPICS, the standard control framework used at Gemini. The User Interface was developed using Glade, a generic GUI builder, and Python. The interface among control, reduction, and detection tasks is accomplished using a simple and effective pipe.

Software for NICI Instrument Commissioning

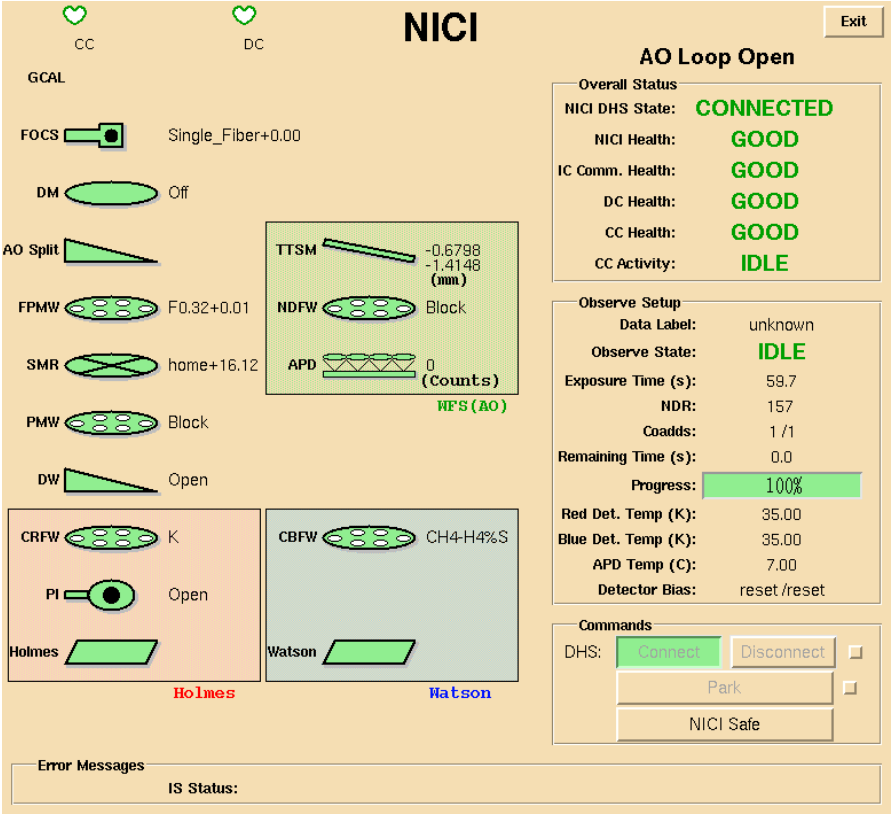


Figure E.4.5.5. NICI Instrument Status Display.

Most of the time was spent on the integration of NICI to the Gemini South telescope. This included:

- Integration of NICI AO control in the Telescope Control Console;
- Integration of Instrument Control and certain special AO control requirements in the Sequence Executor;
- Instrument Status Display.

Software for Flamingos-2 Acceptance Testing

Several Gemini pending tasks were executed, as part of Acceptance Testing of Flamingos-2 during 2008, which included:

- On Instrument Wave Front Sensor:
  - Provided by Herzberg Institute of Astrophysics;
  - Works in simulation mode;
  - Connected via simulated Telescope Control System and AgSeq;
  - Implemented using standard Gemini Records (CAD, CAR, APPLY);
- Interface to the Observatory Control System:

- Using standard Gemini Records (CAD, CAR, APPLY) in a Channel Access Server (CAS);

➢ Build System Retrofit:

- Switched to EPICS build system.

Software Enhancements

While developing new tools to facilitate efficient observations, the software group also developed certain new features for all of the software components. The following sections provide these highlights:

Observing Tool (OT) Administration

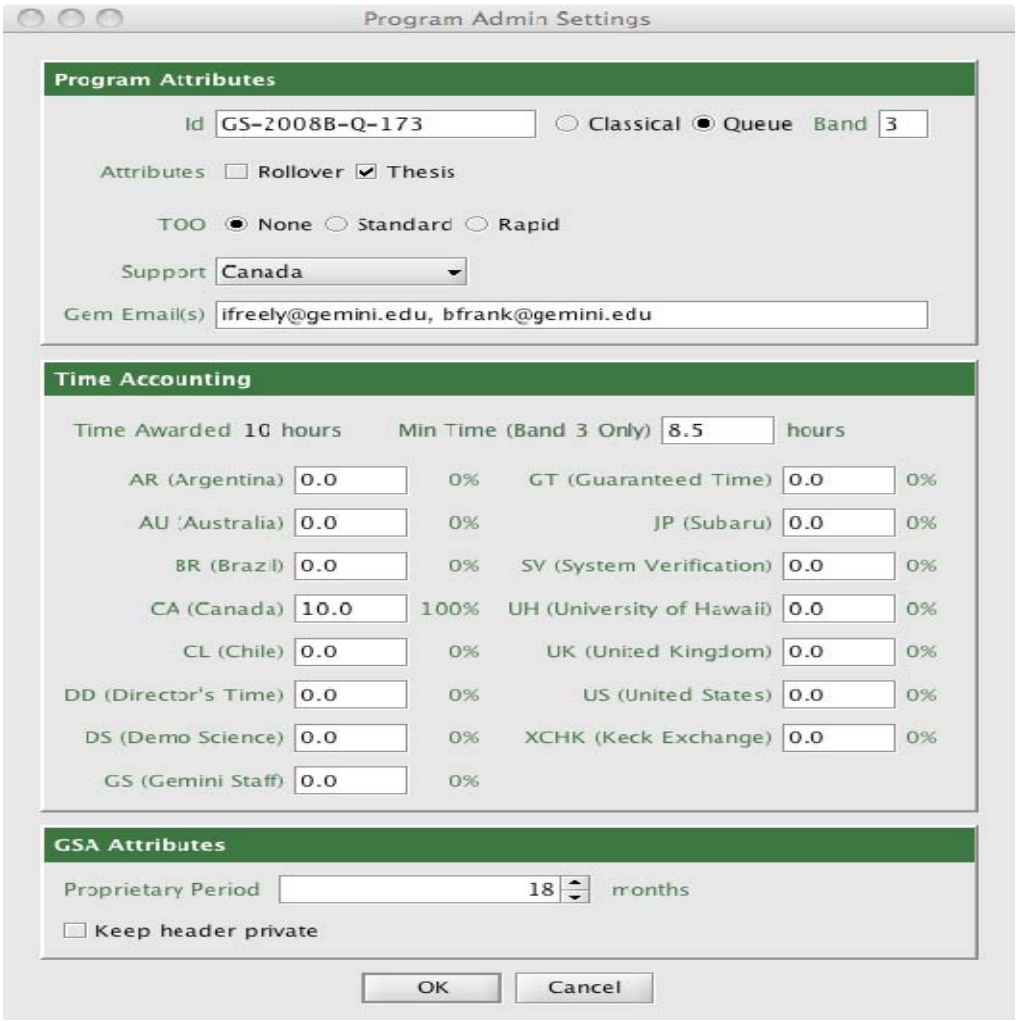


Figure E.4.5.6. Observing Tool Admin View.

- Simplified importing of Phase 1 proposals; prior to this, information was edited by hand in the XML;
- Ability to set time allocations (and other features) from the OT;
- Removes administration fields from the main OT.

Gemini Data Manager

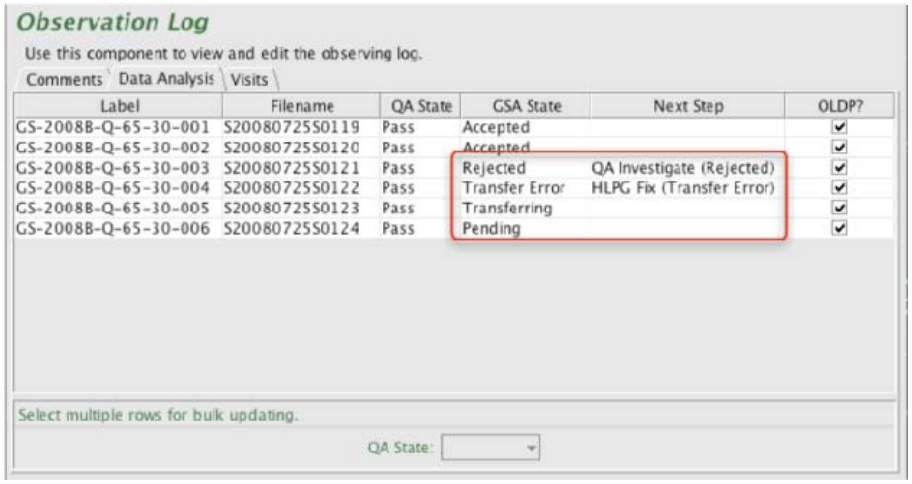


Figure E.4.5.7. Information about Data being transferred to GSA.

- Eliminated ambiguous "Limbo" status;
- Added more information about progress of the datasets through the system;
- Updated to avoid a Gemini Science Archive (GSA) bug triggered by having multiple datasets in the transfer queue;
- Enables faster ingestion.

Phase-I Tool Submission Facility

- User-interface reworked and simplified;
- Continuous proposal checking without user intervention.

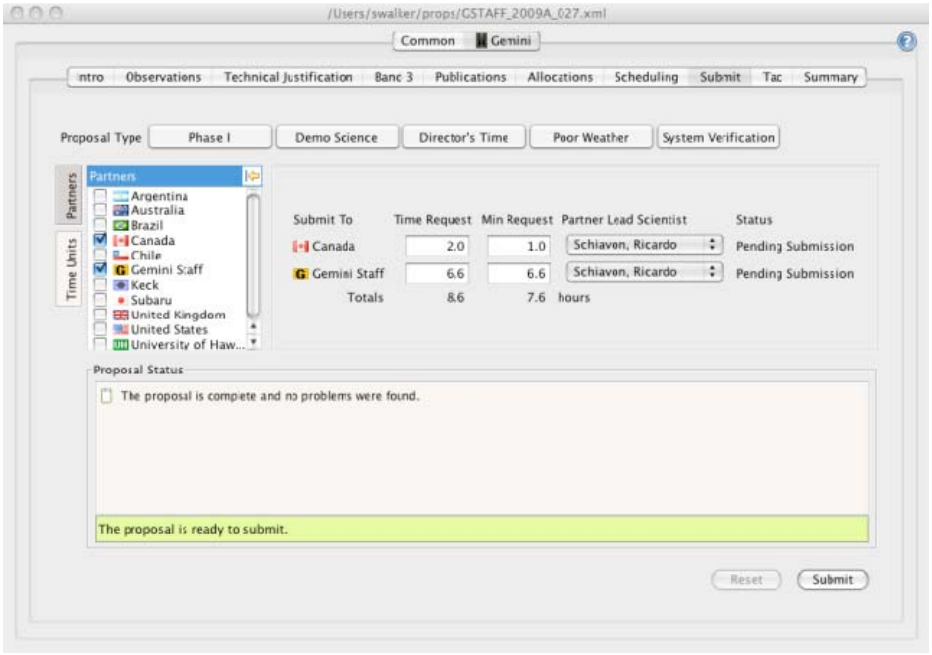


Figure E.4.5.8. User Interface to submit Phase-1 Proposals.

Phase-1 Proposal Notification

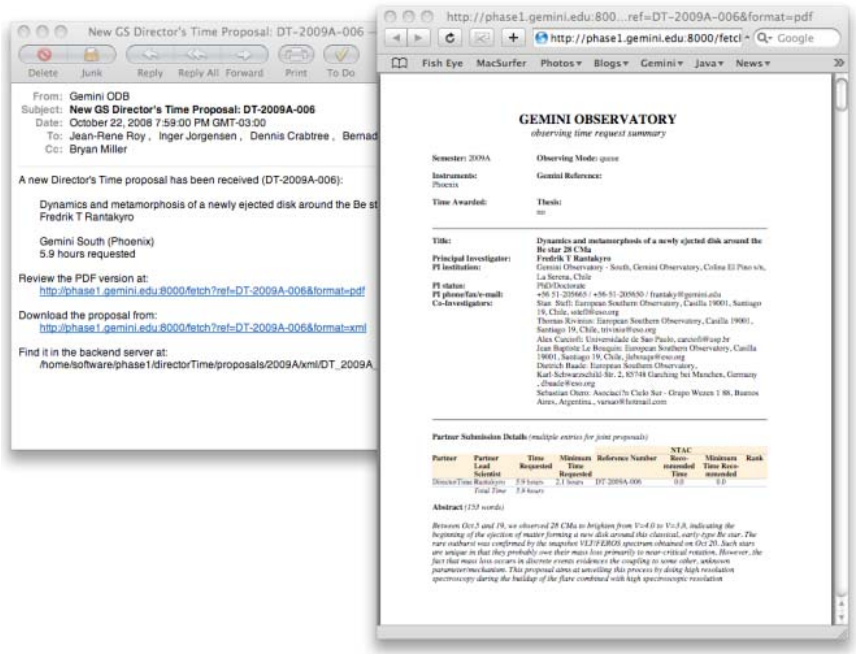


Figure E.4.5.9. Notification of Phase-1 submission

- Improved notification emails which now include:
  - Proposal title, PI, site, instrument, hours requested;

- Link to PDF;
- Link to XML;

➢ PDFs and XML now available with a single click.

Queue Planning Tool (QPT)

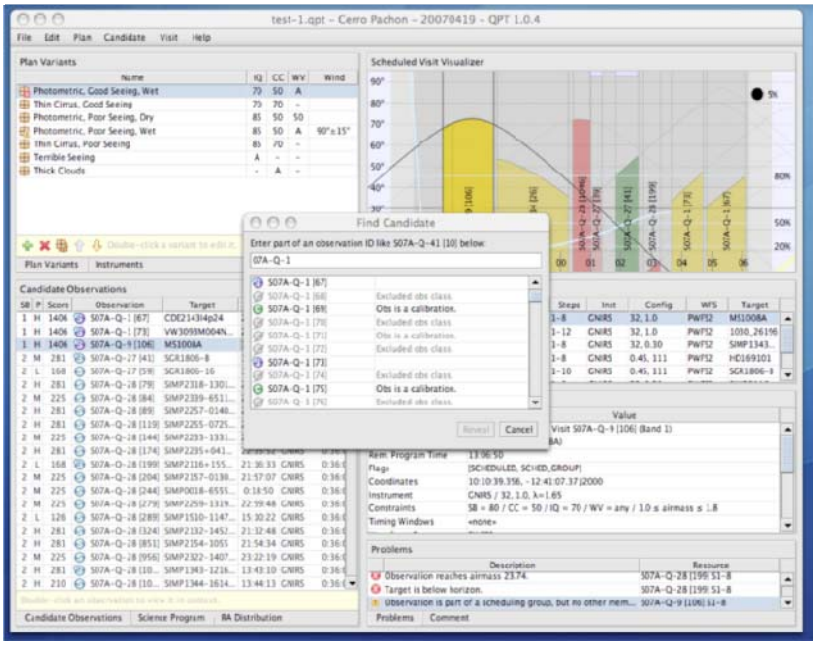


Figure E.4.5.10. A view of the Queue Planning Tool.

➢ User interface improvements, including cut and paste and new diagnostic screens;
➢ Algorithms to find candidate observations were augmented and greatly improved (including wind constraints, dark time requirements, etc.).

EPICS Gateway for Altair Controls

As part of increasing the efficiency of the Gemini North Laser Guide Star facility, the Software Group implemented an EPICS gateway for communicating with the Control System Software of the instrument. This gateway is responsible for maintaining a constant number of communication channels with the Control System Software, without limiting the number clients allowed to communicate with the system, thus rendering the system stable and hence improving the efficiency of the observations to be executed by the instrument.

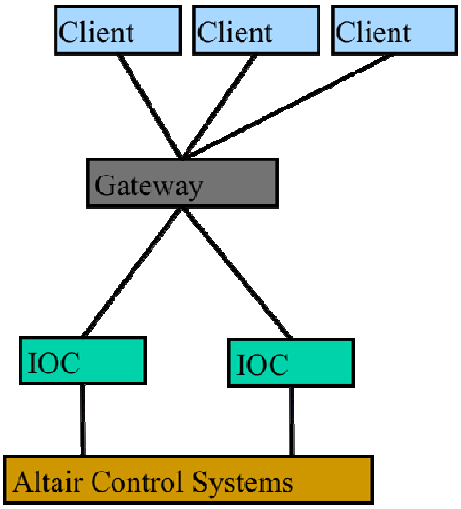


Figure E.4.5.11. Schematic Representation of EPICS Gateway.

Chopping Improvements

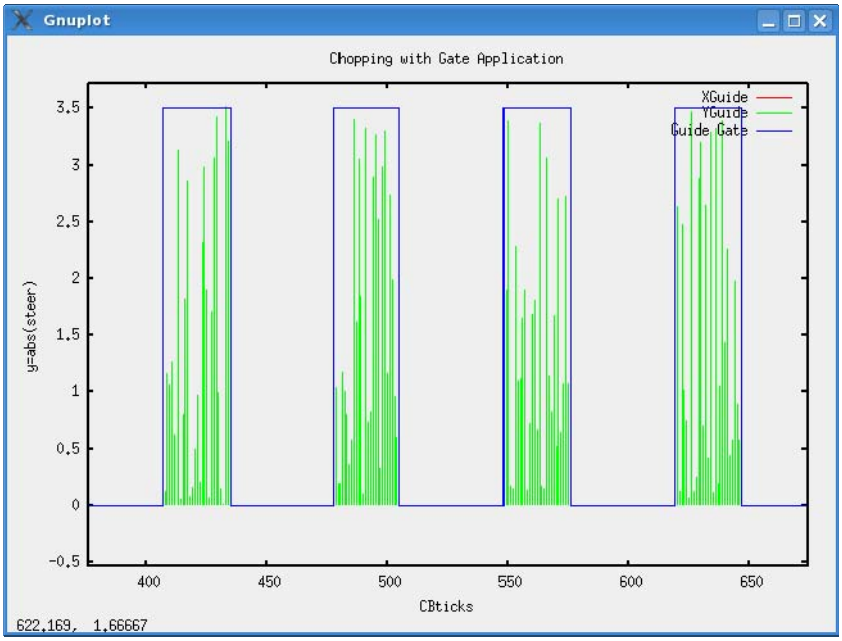


Figure E.4.5.12. Graph showing the Chopping and Guiding values.

Chopping improvements were created on the observatory priority list to address the severe problem of image elongation seen with the Gemini North infrared instrument MICHELLE. These improvements have focused on one probable source of image elongation, the chopping and guiding synchronization. Previous versions of the Control Electronics Module (CEM), of the Secondary Mirror Assembly, did not communicate with the Secondary Control System (SCS) and give it the appropriate time to apply guiding corrections during chopping. This can lead to steer corrections being applied the instant the Wave Front Sensor sees the guide star and before the CEM is fully in position.

Considerable Software effort was spent in 2008 to fix this communication problem and to improve the diagnostic tools for determining how well the chopping and guiding are synchronized.

E.5 Science Program

E.5.1 Gemini Science Staff Mission

Gemini's science staffing goal is to employ and maintain a high-caliber science staff that provides high-quality science data and support to our users, is dedicated to the success of the observatory, and with our Ph.D. astronomers actively engaged in forefront astronomical research.

Toward this end, the Gemini science staff has undergone some re-structuring over the last two years. We have a talented, dedicated and diverse science staff, both Ph.D. astronomers and scientists, and non-Ph.D. technical science staff. However, this staff has historically been significantly overloaded, in part by a much higher demand for queue observing than originally envisioned (original plan assumed 50% queue/50% classical observing whereas the actual demand from the community is >90% queue). In addition, the geographical separation of the two telescopes creates a natural tendency for the two science groups, managed separately, to diverge. The restructuring has addressed these issues by increasing our staff ~50% from 2004 levels, and creating a lead position overseeing all science operations at the associate director level.

The current science staff consists of approximately 60 people, led by Dr. Dennis Crabtree, Associate Director of Science Operations. They are organized into five functional groups: Gemini North and Gemini South Science Operations; Adaptive Optics; Science Software; and Data Processing Development. The two site-specific Science Operations groups, led by Dr. Inger Jørgensen at Gemini North and Dr. Bernadette Rodgers at Gemini South, include the majority of the staff and handle daily science operations. This includes support astronomers, scientists and science fellows, system support associates, and data analyst specialists. The Adaptive Optics Group is focused on Gemini's growing AO capabilities, including the Gemini Multi-Conjugate Adaptive Optics (MCAO) system, nicknamed GeMS. Science Software is a small group focused on defining requirements and priorities for the diverse collection of software required to support our mission, from the Phase I Tool, to real-time control software, to data distribution. Finally, the Data Processing Development group is a mix of scientists and programmers developing and supporting the Gemini data reduction software. Roughly two-thirds of the Gemini science staff are Ph.D. astronomers.

Gemini is very proud of the multi-cultural nature of our science staff, and their accomplishments. Fourteen nationalities are represented among our staff, with a large fraction being bilingual or multilingual. Approximately 30% of the staff is female, including two of the four tenured staff, 11 of the 40 Ph.D. staff, and 75% of the leadership positions. The observatory has

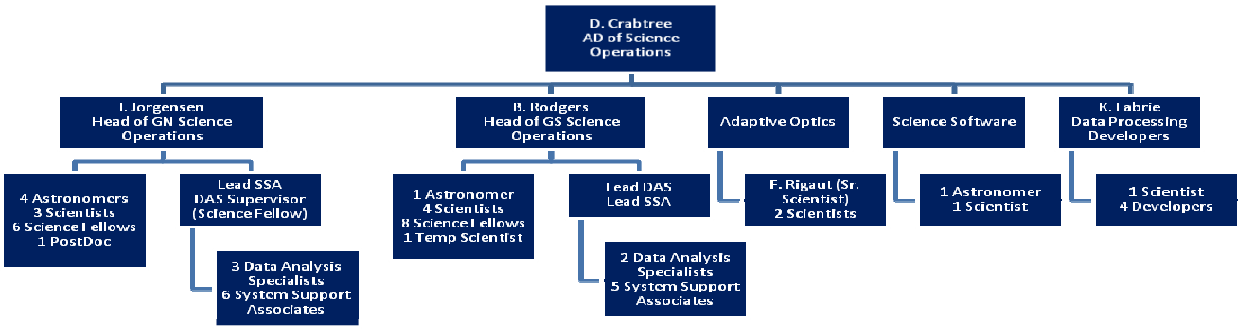


Figure E.5.1.1. Organizational diagram for the Gemini Science Staff in 2008.

been actively growing our permanent Ph.D. staff and in many cases moving Science Fellows into permanent scientist or tenure-track astronomer positions. Tenure was awarded to two individuals in 2007 and 2008, doubling the number of tenured positions.

Our technical staff is extremely talented and dedicated as well. The System Support Associates guide our two telescopes every night (and day) of the year and also participate in a range of support activities from commissioning of new instruments to assisting in the complicated international time allocation process. The Data Analyst Specialists ensure that all Gemini data are checked and verified to meet the Principal Investigators' requirements and are available to the community via the Gemini Science Archive, as well as providing their data analysis expertise to assist instrument scientists and engineers.

While supporting the community's use of the Gemini telescopes is the science staff's primary mission, our Ph.D. staff is also passionate about astronomical research. This is evident by our staff's on-going publications–477 refereed publications from current staff between 2005 and 2008, roughly 25% of these having 1st or 2nd author status for our staff. Naturally, a large fraction of the staff's research is based on observations from the Gemini telescopes and many collaborate with astronomers in our community. There are 35 staff first author publications to date based on Gemini data, while nearly 1/3 of all Gemini-based publications have staff co-authors. Our science staff is active in the astronomy community outside Gemini as well, serving on time allocation and national grant committees, and teaching workshops, for example. It is true that the demands of the observatory make it challenging for the research staff to achieve the full research fractions they should expect, so we continue to look for ways to improve this situation. Significant efforts in 2008 include increased staffing at Gemini South, continuing to improve our detailed planning, and improved visibility and accountability through the annual performance evaluation process.

Our science staff is constantly working to improve and reinvent itself, in order to meet the never-ending challenges of maximizing the potential of the Gemini Observatory. The mission we defined for ourselves in 2007 still holds true: "The Gemini Science Staff is committed to participating in and enabling a better understanding of the Universe. We declare that we are

daring visionaries. We are committed to being humble and compassionate with ourselves, our team and others. We are committed to being a unified team operating with integrity and accountability."

E.5.2 Science Operations

The priorities for science operations during the current year are set through the observatory planning process, which was initiated in 2007 and significantly improved in this year. The table below lists the high-priority projects resulting from the planning process for which the Science Division is responsible. This list only includes project work and does not include operations tasks, or staff research, which take up approximately 90% of the science staff effort. Note that many of the projects originally defined by Science ended up being the responsibility of the Engineering Division.

Table E.5.2.1. Science Group Band-1 tasks for 2008 as of December 31, 2008.

PROJECT TITLE	PROJECT DESCRIPTION	% COMPLETE
Improve Performance Evaluation	Improve feedback to science staff, job satisfaction. Staff load is minimal as this is a management task.	100%
Internal Web Pages	Moving, sorting, and reorganizing the contents of Science Operations internal web pages. Implementing new structure and philosophy using the Drupal content management system.	24%
Full transfer of operations to the PyRAF environment	Allow development of the next generation toolkit while maintaining continued support and usage of the full user package.	73%
External web pages	Improve user and staff access to information necessary to plan, perform and publish Gemini observations/data.	79%
Data reduction support for NICI	Provide the PIs with the essential data reduction tools for NICI.	50%
Development of next generation data reduction toolkit	Facilitate new and improved modular data reduction tools that can be driven from both the pipeline and the interactive data reduction package.	45%
Instrument Performance Monitoring	Regularly measure the total throughputs of all instruments to monitor system health.	5%
Science Staff Recruiting	Recruiting to fill open science staff positions	96%
NICI Campaign and Operations	Work leading to NICI being operational and collecting science data for the NICI campaign.	100%

E.5.3 Dataflow

This year saw a significant change in the personnel associated with the dataflow project. The chief software architect for the project left Gemini in early 2008 for a position at the Space Telescope Science Institute. A very qualified replacement was hired in September 2008 and the project Preliminary Design Review (PDR) is now expected in February, 2009. The panel from the Conceptual Design Review (held in December 2007) will perform the PDR.

In addition, two additional Data Process Developers were hired for Gemini South during 2008. This ensures that our data reduction development effort is balanced equally between our two operations centers and that the new instruments arriving at Gemini South will have local software development expertise.

On the interactive data reduction side, major milestones have been achieved in our migration from traditional IRAF to the PyRAF environment. All the Gemini data reduction tasks now run properly under PyRAF, as well as IRAF, and PyRAF is now used at the base facility at Gemini North for routine daytime operations. As well, an initial test of the PyRAF environment during nighttime operation on Mauna Kea was very successful and only minor problems were identified.

This transition is a vital part of our data processing strategy. Future data reduction code are being developed in Python rather than IRAF/cl, and PyRAF allows us to present a user interface that our community will find familiar and that allows them to run both our current cl data reduction tools and also future Python tools. In addition, it will provide several user interface enhancements which users and observers will appreciate.

E.6 Directorate Program Status Report

Listed in the accompanying table (Table E.6.1) are the projects the Directorate undertook to complete in 2008 along with the percent complete at the time of this report. Some of these projects will exhibit significant progress by the end of the year but others will have to be rolled over into the 2009 list. In several cases our resources were severely impacted by the unexpected Gemini Visiting Committee/Mid-Term Review (GVC/MTR), which was nominally expected to occur in 2009 when the 2008 plan was adopted, but we learned in February 2008 that the GVC/MTR would be pulled forward into 2008. Some specific comments about the Directorate projects include:

WFMOS Negotiations: A burst of activity finally occurred in recent weeks when our Japanese negotiation counterparts became defined and flew to Hilo to start negotiations. Prior to that event progress was weak at best. While we have a timeline to complete these negotiations before the required May 2009 deadline, we will not complete these negotiations before the end of the year (2008).

Create Call-out Policy and On-Call Policy: We will not have time to address these this year and they are on the list of roll-over tasks for 2009. Both the NSF Cost Review and the MTR/GVC

reviews took much more time than anticipated, impacting our ability to make meaningful progress on these important new policies.

Create Cell Phone Policy: By using our existing home internet policy as a framework, we anticipate that we will complete the first draft of this policy by the end of 2008.

Cyber-security Issues: Good progress was made on this project and we expect to complete it by the end of this year. We engaged a consultant who has been working closely with the head of the Information Systems Group (ISG) to develop a detailed cyber-security plan. This effort has included making an inventory of all of our data and determining who should have read/write privileges. The Associate Director (AD) of Administration and the ISG Manager attended the NSF Cyber-Security Conference in Washington, DC. In addition, three key IS staff attended another cyber-security conference in October that was focused on detailed technical aspects of the issue.

Possible Issues Related to the NSF Cost Review and/or Full Business Systems Review (BSR): The AD of Administration led the Administrative Team in the preparation for two site visits by LMI, (the cost review consultancy hired by NSF), to conduct the on-site review of administrative services and facility costs. The LMI team visited both Hilo and La Serena. This was far more time consuming than we expected but it was also an interesting process that no doubt benefited the observatory. In addition the AD of Administration has begun meeting with the NSF Business Systems Review team to plan the on-site visit in early March 2009. Two individuals will visit Gemini in early December 2008 for a "get-acquainted" visit. In early November, the NSF BSR team leader will provide us with a list of documents and the date by which they want them. Prior to the end of 2008, we will have set up the web-site shell and posted the agreed-upon documents, at which point this project will be deemed complete.

Gemini Science Archive: Excellent progress was made in 2008 on this important project, most notably the formulation and approval of a new contract with the Canadian Astronomy Data Centre (CADC) to continue archiving services to the Gemini Observatory.

Gemini South Summit New Work Schedule Definition: Considerable progress was made on this project though, at the time of this report, we have not been able to reach closure on a new schedule due in large part to complications with our counterparts at CTIO and SOAR who have expressed concerns (primarily cost) about our plans.

Improved Planning Process: Considerable progress has been made to date in this area, primarily reflected in the observatory-wide adoption of Project Insight in 2008 to support our planning systems. This involved considerable effort, particularly in the Systems Engineering group, who trained many members of the staff in the use of Project Insight, as well as making modifications to the program to permit custom project definition and resource management. Additional enhancements will occur with our planning systems through the end of 2008 and into 2009.

Table E.6.1 Directorate Band-1 tasks for 2008 showing % complete as of the end of December 2008.

PROJECT	% COMPLETE
Cell Phone Policy	0%
Cyber-Security Issues	100%
Possible issues related to the NSF Cost Review and/or Business Systems Review	100%
Gemini Science Archive	80%
Define Joint WFMOS Management Plan with Subaru	53%
Improve Planning Process	0%
GVC+NSF Funding Proposal	100%
GS Summit Crew New Work Schedule Definition	0%
TIO Manager and TTMs positions	0%
Improved queue planning tools and execution	0%
Improved data reduction tools and pipeline processing	51%
Research time for science staff – streamlining science operations	0%
Create Call Out Policy	0%
Create On-Call Policy	0%

E.7 Public Information and Outreach (PIO) Program

As this year's report is being written, the formalization of the new Gemini Observatory Statement of Purpose (SoP) is nearing completion. This milestone involved considerable effort by the Directorate and PIO departments as well as engagement by staff and the public in our local communities. In the end, the phrase "Exploring the Universe, Sharing its Wonders" emerged as one that captures the essence of Gemini and why we do what we do. Mentioning this is *a propos* since the phrase captures the essence of the PIO effort at Gemini and will undoubtedly guide the PIO effort, (and the entire observatory), as we move toward the future.

Figure E.7.1. Many Gemini PIO activities in 2007-8 were in preparation for the IYA in 2009.

Throughout the period of this report, the Gemini PIO department has realized the spirit of the observatory's Statement of Purpose and succeeded broadly on many fronts. From preparations for the International Year of Astronomy (IYA) to our ongoing efforts to improve communications both internally and externally, the PIO department has remained a leader in all aspects of PIO programming and has evolved significantly over the past 12 months.

Highlights from the past twelve months of PIO activities at Gemini are summarized below: beginning with an overview of ongoing/ annual programming; followed by a listing and description of all PIO Band 1 initiatives and their completion status; and then a commentary on any significant variations or issues with the

completion of Band 1 tasks.

Ongoing PIO Programs: Gemini's core PIO programming during the period of this report consisted of elements that addressed our four primary audiences/activities: local outreach (host communities), media relations, publications/communications and partner-ship, staff/user support.

Local Outreach: Among the most significant activities in this area included planning for the IYA (PIO Manager Chaired the Hawai'i IYA funding committee resulting in $24,000 for local Hawaii IYA programming and Gemini South PIO staff played a major role in national IYA planning in Chile), the Journey through the Universe program, AstroDay Chile, StarLab portable planetarium programs, FamilyAstro and partner-ships with the 'Imiloa Astronomy Education Center in Hilo and the CADIAS center outside of La Serena in Chile. Collectively these programs impacted over 50,000 students, teachers and the public. In addition to these programs, the Gemini Virtual Tour saw almost 110,000 users in kiosks in Hawai'i and Chile and facility tours, various classroom and public presentations reached an additional 6,000 individuals.

Media Relations: Media communications continues to expand as a core PIO function and has resulted in a total of nine press releases during the period of this report and over half-a-million web hits generated by these releases on the Gemini website. A new staff responsibility has also been established to coordinate all international media communications and logistics. To augment these efforts several new Gemini Legacy images were produced, (see Figure E.7.2).

Figure E.7.2. Gemini Legacy image of the interacting Galaxy pair that includes NCG 5427.

Publications/Communications: Major functions in the area of publications (the twice-annual *GeminiFocus* and this Annual Report) as well as a growing involvement in web content (and graphics and design) dominated this aspect of the PIO functions during the period of this report. *GeminiFocus* has continued to expand (see Figure E.7.3) and has evolved considerably both editorially (growth in science content) and aesthetically (new design elements). Another project worth noting is a new cultural astronomy publication called *Cuadernillo Astronómico*, created for Chile by the Gemini South PIO team. This publication is for children age 7-14 and provides connections between astronomy and Chilean culture.

Partnership and Staff/User Support: The Gemini Public Information and Outreach office participated in two meetings of the American Astronomical Society and assisted with the upcoming Gemini/Subaru Science Meeting in Japan. Several joint press releases were produced in conjunction with partner offices as well as staff scientists. In addition, several "Live from Gemini" videocasts were held for U.S. and several other Gemini partner audiences (including Australia, the US and Brazil) Other operational support functions included web content and design development, library operations, overall graphic support for diverse staff functions, facility tour coordination and execution, photography and documentation, and directorate-level community engagement facilitation.

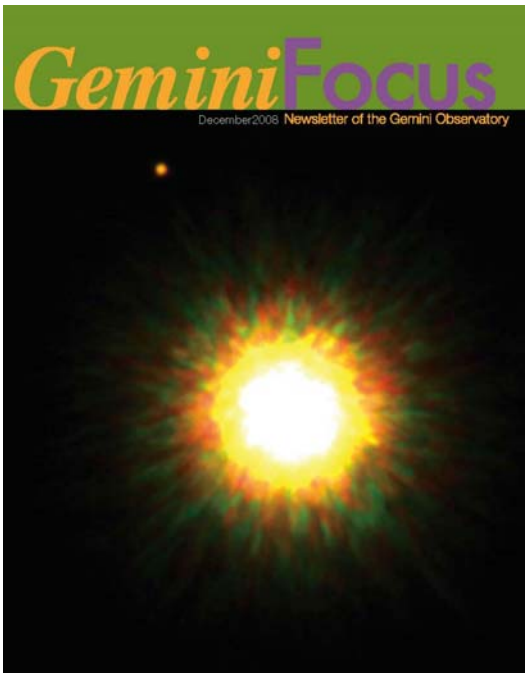


Figure E.7.3. Cover of the December 2008 issue of *GeminiFocus*, the largest (non-single topic) issue to date at 84 pages.

Current-year (Band-one) PIO Initiatives: In addition to the core PIO categories described above (and in sections C.2), the following new initiatives were executed during the period of this report. The Table E.7.1 lists these initiatives and the percentage of completion as of the end of December, 2008.

Table E.7.1. PIO Group Band-1 tasks for 2008 showing % complete as of the end of December 2008.

TASK TITLE	TASK DESCRIPTION	% COMPLETE
Base Operations	Staff Support, Outreach Programs, Publications, Media Relations, Project Management, Library Operations, Images, Travel, etc.	100%
IYA Working Group Chair	Chairmanship (PM) of IYA Working Group for Observatory Visitor's Centers and Informal Astronomy Education. Planning 2008 for 2009 Implementation. Will include all Gemini partners to address needs of Gemini Partnership.	90%
Media Relations "Upgrade"	Improve process and implementation of Gemini's media relations to increase innovativeness, timeliness and relevance.	100%
Public Mission Statement Development	Implement plan to converge on public mission statement and execute dissemination of said mission statement. Includes development of graphical elements and HBF sign	95%
GoogleSky Legacy Image Integration	Develop process for "ingesting" Gemini Legacy Images into GoogleSky and World-Wide Telescope Network.	75%

Annual Report - "Public" version	Produce full-color "glossy" version of Gemini Annual Report (note printing expenses to come from Directorate account).	100%
‘Imiloa Mauna Kea Programming	Serve as "consultant" in the development of Imiloa "Mauna Kea updates" program feature current science from MK observatories.	100%
3D All-Dome Video production/distribution	Initiate promotion and distribution of LGS All-Dome movies of Gemini N (2 & 3-D) and begin shooting of GS LGS with possible "dolly" move in 3-D.	100%
IYA Programmatic Planning (for 2009)	Complete planning of 3rd astronomy newspaper tabloid for publication for IYA in 2009 and 2009 StarTeachers program.	100%
CADIAS Gemini Classroom Completion	Complete Gemini Classroom at CADIAS to include posters, text signs and exhibits to complement the console and Virtual Tour exhibits.	100%
Integration of new PIO Assistant Position at GS	Hire and train new expanded PIO Assistant position to assist in expanded outreach and media relations at GS.	100%

Issues: The greatest area of concern for completion of the PIO band-one projects for 2008 is related to international participation in the International Year of Astronomy (IYA) for 2009. While we have been very successful in securing resources for our local programming and moving forward on initiatives that will support IYA activities in the Gemini partnership and locally in Hawaii and Chile, key funding (primarily in the US) has fallen short and some programs have been scaled back or are delayed pending funding. These include the GalileoScope initiative, advertising and the international (generic) content for a newspaper supplement based on the ones Gemini has produced in the past. While we will continue to develop our own newspaper supplement and provide IYA resources both locally and for the partnership, several key programmatic elements originally in the plan are unlikely to happen due to external funding limitations.

E.8 Environmental, Health & Safety (EH&S) Program

In the second year of the Gemini Safety and Health Management System implementation process, major progress has been made in improving many weak areas of the program, developing new elements and reinforcing other safety initiatives. The program has matured to a stage where EH&S is becoming integrated into the day-to-day activities of the observatory with line management and employees taking ownership of safety and health.

Safety Leadership Team (SLT): The SLT under the chairmanship of the Gemini Director has met every month since its inception and has made a major impact on the safety program by supporting numerous EH&S projects. Not only does the SLT direct and approve Gemini safety policy but they have supported and encouraged a number of the initiatives listed below.

Safety Forums: During the period under review Safety Forums were initiated at both sites. These Safety Forums are held every 3 months and are open to all employees to attend. The Forums are chaired by a member of the SLT on a rotational basis.

Lock out project: Based on a risk assessment, a major project was launched to upgrade the energy control program at both sites. A specialist was contracted to supply complete lock-out devices, write specific lock-out procedures for all equipment at the observatories, and base facilities, and to conduct the training of employees who are affected by lock-out procedures.

Ergonomics: Ergonomists were contracted to conduct ergonomic risk assessments at numerous offices, workstations, control rooms and within the observatories. Individual workstation assessments were discussed with the users and an open training session on office ergonomics was conducted on both sites.

MSDS: The Material Safety Data Sheets (MSDS's) were updated after a physical inventory of substances kept and used on site and the posting of these sheets on a common, easily accessible website is in process.

Evacuation drills: Incident Commanders and Fire Wardens were appointed and trained at each base facility and emergency evacuations were successfully conducted. To adapt to the Hilo Base Facility Extension, more Fire Wardens were appointed and trained and a new assembly area was identified and posted.

Mirror Stripping: In preparation for the North mirror stripping and coating shut down in August 2008 the Safety Department in conjunction with the Engineering and Optics Teams prepared site specific chemical handling, electrical lock out, medical monitoring, decontamination, rescue, and chemical handling and spill procedures. A 24-hour hazardous chemical training course, which included respirator fit testing and chemical protective equipment usage, was presented to team members at both sites so that the stripping and coating teams were all aware of the correct procedures during the process.

Figure E.8.1. Summit crew performing M2 Stripping procedure.

Hazardous Materials Transportation: Eight employees attended an 8-hour training course on the transportation of hazardous materials.

Scaffolding Competent Person: Six employees attended an 8-hour training course and received certification as competent persons in relation to scaffolding.

Employee safety orientation: An employee safety orientation presentation was completed and approved by the SLT. New Gemini employees attend this safety orientation which is presented monthly. During the orientation the *Gemini Employees Safety Manual* is issued for employees to use as a safety reference guide and an ongoing reminder of their safety responsibilities. Acknowledgement of receipt of this book is incorporated in the orientation process.

Safety System Standards: Progress on the writing and approval of the Gemini safety system Standards has been ongoing during the period and some 16 new Standards were written, approved by the SLT. A major project completed in this process was the compilation of the *Gemini Disaster Plan* which is under final review. All Standards and other safety policies and documents are translated into Spanish before being posted on the new safety website which has been developed during the last 2 years.

Gemini Representation: Gemini's safety program was represented when the Safety Manager presented papers on safety at the American Society of Safety Engineer's conferences in Honolulu and Las Vegas as well as at the NSF Large Facilities conference in Boulder Colorado. Gemini was also asked to conduct a safety baseline inspection at the UH 88 observatory on Mauna Kea and to participate in the ALMA safety review in October 2008.

Injuries: Four injury-producing accidents, all resulting in time away from work, occurred. An employee stubbed her toe on an uneven sidewalk and cracked the bone; an employee sustained a back injury when a scaffolding, in the process of being moved, partially collapsed; an employee suffered a foot injury when he climbed out of his vehicle and stood on a rock in the parking area; and an employee sustained an internal ear injury at 13,000 feet en route to the Mauna Kea summit.

Driver training: The driver safety training initiative launched in 2007 continues with ongoing new hire and refresher training. All Gemini vehicle drivers are required to attend this 8-hour behind-the-wheel driving course.

Safety Representatives: A major safety initiative undertaken during the period was the selection and nomination of certain employees as Gemini Safety Representatives. These employees have the specific duty of conducting a checklist-inspection of their work areas and reporting any unsafe situations to their immediate supervision. They also play a role in the general promotion of health and safety in the workplace. Final selection and training is currently in progress.

Table E.8.1. Safety program band-1 tasks for 2008 with % complete as of December 31, 2008.

TASK TITLE	TASK DESCRIPTION	% COMPLETE
Safety System Standards	Write second 20 Safety System Standards, circulate for comment and table at SLT for approval. Have approved Standards posted on safety web page. Achieve 48% (Of total program implementation).	70%
Applied laser training	Arrange Laser training for Gemini South	100%
Critical Task	Arrange and conduct 2 critical task identification and analysis/JSP	0%

training	compiling courses.	
Safety Representatives Training	Start the training of Safety Reps. and include potential candidates in the training on hand. Appoint and train if appropriate to the system at that time.	0%
Risk Assessments	Present 1 Risk assessment course at each site and train 10 employees in the technique.	0%
Ergonomic training	Arrange office ergonomic training for both observatories	100%
Action Plans	Compile and circulate action plans for the implementation of the new standards and update master control sheet monthly.	50%
Employee handbook	Write the employee safety handbook, obtain approval and manage circulation and translation thereof.	85%
Team development plan	Draft the safety team self development program and implement it	10%
HK Inspection	Facilitate the 6 monthly housekeeping inspections and competitions. Arrange presentation function and delivery of trophies.	100%
Safety Seminar	Arrange the "Gemini Observatory" 1-day safety seminar and invite local industry to participate. Arrange exhibitions etc.	0%
Annual systems audit	Plan and arrange the annual external safety audits at both sites. Arrange presentation of findings and circulate reports. Table at SLT. Draft action plans.	5%
Briefing sessions	Hold briefing session on the contents and implementation of safety system Standards that have been approved.	0%
Visit to other plants	As part of staff development, arrange visits to other observatories and industries.	10%
Gemini Emergency Plan	Draft the Gemini Emergency Plan	25%

SECTION F

2009

PROGRAM PLANS

F. 2009 Program Plans

F.1 Administrative Program

The 2009 Administrative Program plan includes projects of four basic kinds. First, the five Administrative Groups will be continuing work on the Administrative Team projects identified in 2008. These were designed to be multi-year projects. These relate to improving our customer interface and the efficiency of our operations. Second, there will be some carry-out projects that we had hoped, but were unable, to complete in 2008. Third, there are new projects related to continuous improvement, preventive maintenance or routine updating/replacement that will be initiated and completed in 2009. Fourth, there are projects that are beginning steps toward the Administrative Group's vision for the year 2020 (see Section G.1).

The list below is the "to-do" list that came out of the October 2008 planning retreat, but it is not yet the official project list for 2009. Prior to the end of 2008, the projects on this list were planned in more detail and the labor and non-labor resources required were further refined. The official project list may indeed be a little shorter than the ambitious list below.

Table F.1. 1. Administration program plans for 2009.

TASK TITLE	TASK DESCRIPTION
DIR09-003 : Energy Initiatives	The purpose of this initiative is to make some advances in the area of energy improvement, building on the initial staff input received in the blog which was established with this objective, in the same time period that the longer term plan is developed. The outcome of this initiative will be the realization of several specific energy improvement initiatives during the first 6 months of 2009.
DIR09-004 : Energy Planning Oversight & Control	The purpose of this initiative is to assess Gemini's current energy performance and to develop a long term energy plan for Gemini. The outcome of this initiative will be the presentation to the Director by June 30th, 2008 of a formal Gemini Energy Plan. The project involves the development of Gemini energy consumption base data, with clear key performance indicators, against which the impact of future initiatives will be assessed.
DIR09-009 : Create Call Out Policy	Research and create a call out policy for nighttime and weekend support of telescope operations.
DIR09-010 : Create On-Call Policy	Research and create an on-call policy for nighttime and weekend support of telescope operations.
DIR09-011 : AURA Compensation Study Follow-up Work	Earmark directorate and HR time in anticipation of an AURA Corporate initiative that could take a great deal of Directorate and HR Manager time.
DIR09-012 : NSF Business Systems Review Preparation & Site Visit	Directorate and Admin Group time associated with coordination and preparation of materials for the NSF Business Systems Review in 2009.

AFG09-004 : Establish long term Base Facility security measures (access/cameras) at both sites	Keyless entry and security cameras at base facilities at both sites.
AFG09-005 : HBF Redecoration (including lobby) AFG08-A2	This will cover a few small items remaining from the 2008 project.
AFG09-006 : SBF-X Planning AFG08-A3	Review options for bringing Chile based staff back under one roof if possible. This includes changing use of space at the SBF.
AFG09-007 : AFG Web Page Development	Internal web site improvements that will improve customer interface with the AFG group and improve efficiency.
AFG09-008 : Review of Processes and Forms	Continuous improvement project addressing specific processes and forms.
AFG09-009 : Planning Process for 2010	Improve AFG planning process
AFG09-010 : Warehousing Review	Work with engineering to identify items stored in the Hilo warehouse that should be disposed of or stored elsewhere. Organize a spares storage system.
CTR09-001: New Payroll Software Setup	The setting up and implementation of a new payroll and HR software.
CTR09-002 : Electronic Travel Expense Report	The selection of and implementation of an electronic travel expense report software to replace our current paper system in the North. We will look at the feasibility of using it in the South as well.
CTR09-003 : Update Web Presence	We will be updating our web presence regarding forms, policies, contact info, etc. to make it easier for employees of Gemini to get the answers or help they need.
CTR09-005 : Financial Month End Closing	Investigate ways to determine if there is a more feasible way to close financial month ends in order to get financial data into the hands of the managers quicker. Bear in mind the other systems we need information from in order to do this - NOAO and AOSS.
HR09-002 : AURA Awards and Suggestion Program	Promote Aura Policy XXXII regarding to Awards and Develop a Suggestion Program that associated rewards with implemented suggestions.
HR09-003 : Create Retention Program for all Employees	Retention programs
HR09-004 : Upgrade Relocation Services	Revise relocation policies to reflect best practices; research other relocation polices; survey newly relocated staff upon arrival at Gemini.
HR09-005 : Create of Employee Newsletter	In order to increase awareness and improve communication, develop a monthly staff newsletter highlighting new hires, changes in benefits, additions to benefits, Gemini events and parties. Will initially create a paper version and once the self service HRIS is implemented will place online.

HR09-006 : Develop standard procedure for follow-up on Employee Survey Results	Develop a formal standard for all departments to incorporate for follow-up on the Employee Survey.
HR09-007 : Continuation of creation of internal webpage for ADM-HR side	Continue with the creation of the web pages of forms and services for the internal webpage.
HR09-008 : Implement online performance evaluation	Implement online performance evaluation
HR09-009 : New Software for HR & Payroll	Plan and implement program for use by HR & payroll
HR09-013 : Planning Process for 2010	Plan priorities for 2010
ISG08-IN107 : Deploy Single-Sign-On Solution - NSF	SSO provides centralized management and authentication of staff credentials.
ISG08-IN321: Network Redundancy	Purchase, install & configure network hardware to reduce/eliminate single points of failure.
ISG09-003 : Transition to MS Exchange 2007	Upgrade will provide new features for mobile device support, improve OWA interface and better support for Mac OSX.
ISG09-004 : Upgrade Backup infrastructure	Upgrade will provide more online and off-line storage capacity for both GN/GS summit and base facilities.
ISG09-005 : SQL Database Consolidation	Migrate all single instances of SQL to a redundant SQL cluster (GN).
ISG09-006 : VM Cluster Deployment	Consolidation of services/servers, both Windows and UNIX to Virtual Machine cluster.
ISG09-007 : Gemini Cyber Security Program	Establish IT controls, policies and procedures to comply with NSF article 51.
ISG09-008 : Web Services Optimization	Establish reliable mirrors. Convert dynamic content to static HTML. Use or create a Content Distribution Network (CDN).
ISG09-009 : WAN speed optimization	Investigate and deploy a solution to drastically improve file sharing, remote collaboration, etc.
ISG09-010 : Improve ISG web presence	ISG guidelines, procedures, policies, etc.
ISG09-013 : Enhancements to ISG Monitoring Systems	Upgrades to Zenoss, Solarwinds and provision 'out-of-band' access/alerts.
ISG09-014 : IS Critical Spares/Support Procurement	Identify, purchase essential support contracts and spares for 2009.
ISG09-015 : ISG Operations and Maintenance	Server maintenance, clean fibers, reboot network switches, etc.
ISG09-018 : Plan Enterprise Linux OS upgrades	Ensure that all production Linux boxes comply with Gemini standard. Evaluate new releases of RH Enterprise Linux
ISG09-051: (SCI09-032) Remove GN dependencies from GS web site mirrors	Make GS mirrors more useful, simplify off-site access (SCI08-121).

PRO09-003 : Update Procurement Procedures	Update procurement procedures to be consistent with current cooperative agreement, make procedures match actual practices, and streamline procedures. Bring Gemini into compliance with current cooperative agreement and streamline procedures for increased efficiency.
PRO09-004 : Update property tracking procedures	Update property tracking procedures to be consistent with current cooperative agreement, to improve efficiency, and to better meet the needs of Gemini staff. Bring Gemini into compliance with current cooperative agreement and streamline procedures for increased efficiency.
PRO09-005 : Property and inventory tracking web application	Develop web application that performs all functions currently done by FATS database. Add online forms for property transactions, tools to enable staff to query property data and to track inventory, automated input of data from USL, and other features. Reduce manpower needed to operate existing property tracking system and provide new tracking capabilities to staff to reduce duplicative purchasing and delays due to inventory depletion.
PRO09-007 : Searchable web-based contracts database	Web application that allows searching and sorting of contracts database information and documents to reduce time spent retrieving information.
PRO09-009 : Identify ways to get better prices on purchases	Research techniques used by other large organizations to get the best possible price on purchases and come up with follow-on projects to implement the best techniques.
PRO09-010 : PO Browser continued development	Enhance capabilities of PO Browser to reduce labor spent on information retrieval.
PRO09-011 : Reqless continued development	Enhance capabilities of Reqless to reduce labor spent on entering and processing requisitions.
PRO09-012 : Update property disposal procedures	Revise procedures to bring them into compliance with current cooperative agreement, streamline property disposal tasks, and increase revenue from property disposal.

F.2 Instrument and Facilities Development

The table below details the Instrument Development tasks planned for 2009. Note that many of the tasks associated with new instrumentation, such as the NICI campaign, MCAO testing, and FLAMINGOS-II commissioning, are included in the engineering or science group plans. Please refer to the tables in those sections for more details.

Table F.2.1. Instrumentation and Development Tasks for 2009.

TASK TITLE	TASK DESCRIPTION
GMOS-N CCD replacement	Procure new CCDs and provide support for construction of a new focal plane. Supervise detector testing and characterization, installation in GMOS-N, and re-commissioning.
GPI support	Support GPI development
WFMOS Conceptual Design Study support	Support competitive conceptual design study completion and conduct design review.
WFMOS Construction	Negotiate construction contracts for WFMOS and begin the next design phase (subject to Board approval and new funding).
GPI science team selection	Issue call for proposals for the GPI science campaign, obtain letters of interest, assist with team formation, review and assess proposals, and report to the Gemini Board (subject to Board approval).
Development group long range planning process	Develop the long range instrument development plan and budget proposal. Work with the GSC to develop instrumentation strategy, instrument deployment plan, and instrument decommissioning plan. Organize the next community instrumentation meeting (the next "Aspen" meeting).
GMOS-N filter procurement	Procure, install, and commission new red-blocking and various narrow-band filters for GMOS-N.
F2T2 support	Support for the F2T2 tunable narrow band filter integration, testing, and use on FLAMINGOS-2.
NIRI/GNIRS array controller replacement	Procure new detector controllers for GNIRS and NIRI (subject to availability of funding).
IR wavefront sensor detector procurement	Work with vendors and other institutions to develop a high-speed IR WFS (subject to availability of funding).

The tasks in Table F.2.1 can be completed with the human resources currently available within the observatory. Funding for WFMOS construction has not yet been approved; the Board is expected to make a decision regarding WFMOS at the May 2009 meeting. We have sufficient funding for GMOS-N CCD replacement. We are likely to have enough funding to replace the NIRI and GNIRS array controllers, but bids are needed before we can be certain. Given the current uncertainties in the budget for 2009, one or more of these tasks may be cut. Note that most of the work in instrument development is contracted to other institutions.

F.3 Engineering

The 2009 planning process has resulted in a set of projects that the Engineering Group intends to complete in 2009. These projects are listed in table F.3.1. Some highlights of the 2009 plan include the following:

Telescope Operation and Maintenance (O&M): In order to manage O&M more efficiently, five separate O&M projects were created. These projects are: Management; Routing Operational Tasks; Preventative Maintenance Tasks; Corrective Maintenance Tasks, and Projects Tasks.

Telescope Earthquake Readiness: We'll complete the installation, integration and testing of the earthquake sensor systems at both Gemini North and Gemini South. These sensors will provide a direct indication of the severity of the ground motion at the telescope sites for moderate to severe earthquakes and allow us to better plan recovery efforts after these events. In addition, modifications to structural and non-structural systems as a result of the earthquake readiness audits will continue through to completion.

Safety Projects: Safety projects occurring in 2008 were geared toward all aspects of the Gemini North primary mirror (M1) coating activities including mirror and equipment handling, personnel access to various locations, and ventilation of the mirror stripping area. Procedures were reviewed and revised. Formal training was provided where appropriate and critical steps were practiced. In 2009, facilities upgrades intended to improve safety include the installation of M1 cell guardrails, the development of a safe work platform to access the shutter drives, improved access to the dome and improved work area on the instrument platform lift.

GN Air-cooled Glycol System: This project is intended to add redundancy to instrument helium compressor cooling systems and the computer room cooling system. During a HELCO power outage, having an air-cooled glycol system is the only positive method to provide sufficient cooling to the helium compressors/computer room.

GNIRS Repair and Engineering Commissioning: GNIRS repair and lab testing are continuing on schedule with on-sky commissioning set for mid-2009.

MCAO at Gemini South: The Multi-Conjugate Adaptive Optics (MCAO) system development continues at Gemini South with integration and testing of the AO bench (Canopus), installation, integration and testing of the Beam Transfer Optics (BTO) and Laser system infrastructure. On-telescope integration and testing is scheduled to begin mid-2009 with the delivery of the Gemini South laser and installation of Canopus on the telescope.

Software Engineering: In addition to supporting general operation and maintenance, the Software Group will complete the following specific projects:

- Data Flow (Phase II);
- Observing software enhancements;
- Planning Tool upgrades;
- Gemini Application Platform;
- Time Allocation Committee (TAC) Software upgrades.

Flamingos-II Factory Acceptance Test and On-sky Commissioning: The second Acceptance Test is scheduled for late 2008 followed by activities related to on-site f/16 (no MCAO) science commissioning.

Table F.3.1. Engineering Projects for 2009.

TASK TITLE	TASK DESCRIPTION
ENG09-163 : OM Management Tasks	This project describes all the activities that are OM management tasks. Among these activities we have executing the TIO-M and TTM role, including training for new TTMs.
ENG09-164 : OM Routine Operational Tasks	Tasks that are routinely performed on the telescope and/or instruments.
ENG09-166 : OM Preventive Maintenance Tasks	Preventive maintenance to facility, telescope, and instrument systems.
ENG09-167 : OM Project Tasks (Upgrades or New Developments)	Modifications to current systems driven by telescope/ instruments operation or maintenance purposes, small in manpower and cost in general .
ENG09-162 : Procedures writing process	Create a database that contains all the procedures for the tasks that are performed on a regular basis at both sites. This project is driven by technical requirements and also by safety requirements imposed by Chilean law.
ENG09-174 : Engineering managers duties	This project summarizes all the management tasks to be performed by the engineering mangers throughout the year.
ENG09-009 : Data Flow Project Phase II	Continue developing data flow concept to achieve on-line reduction capabilities for QA Pipeline for GMOS imaging mode.
ENG08-031: MCAO (phase 1 and 2)	Laboratory I&T, BTO and Infrastructure completion
ENG09-006 : MCAO (Phase 3 and 4)	I&T on Telescope and Telescope commissioning
ENG08-012: GN LGS facility improvements	The purpose of this project is to finish undone tasks related to LGS system. Most of the tasks are geared towards improving night time efficiency and fixing faults.
ENG08-026: New M2 Control H/S	Rollover of 08 Band 1. Replace the obsolete HW for M2 CEM and upgrade SW. Re-scoped to go from start of PD phase to pass of CDR.
ENG09-143 : Implement air-cooled glycol system for GN	Add redundancy to instrument helium compressor cooling systems and Computer Room cooling system. During a HELCO power outage, having an air-cooled glycol system is the only positive method to provide sufficient cooling to the helium compressors/computer room. It was discovered on 30 Sept. 2008 during the HELCO power loss test that the heat load from Chiller No. 2's circuit transferred to Chiller No. 1's circuit through the supply/return cross-overs significantly warmed up the Chiller No. 1 gylcol, which in turn significantly warmed up the telescope thermal enclosures. This project also provides excellent MK summit electrical power savings, since Chiller 2 will be in standby mode almost continuously.
ENG09-170 : Observing Software Enhancements	This project manages the regular updates to the Gemini operations software including the Gemini public software releases (OT and PIT), Phase I process support, the remaining elements of the OCS (QPT, seqexec, TCC/TCS, WDBA, ODB, e-obslogs), ISDs, public ODB database pages, instrument dm and other control screens, mask tracking database, and other tools

	used by the observers or SSAs and maintained by the software group. The releases of all components are tied to the public releases of PIT and OT, which occur four times a year.
ENG08-057: Engineering Safety Projects	Projects include 1) all safety projects for GS M1 coating; 2) IPL upgrades; 3) shutter drive access platform; 4) dome ice shield; 5) dome access ladder.
ENG09-023 : Engineering Training Program	Safety and technical training
ENG09-030 : Spares procurement	Develop a long-term equipment renewal plan, spares inventory based upon risk, use of CMMS for inventory management, spares storage and spares purchasing.
ENG09-011 : GNIRS Engineering Commissioning	Install GNIRS on the GN telescope and perform instrument re-commissioning from Engineering point of view.
ENG09-032 : GNIRS Repair completion	This project involves the completion of the GNIRS repair work that is currently performed at HBF.
ENG08-033A: FLAMINGOS 2 AT and Eng Commissioning	FLAMINGOS 2 (AT and on-sky AT support). This project is a candidate to roll over 2009 considering that Aug 2008 AT failed to pass. An AT-2 is considered to be performed on Oct/Nov 2008. F2 AT and Eng commissioning meant to have F2 ready for F/16 (No MCAO) on-sky commissioning as Facility Instrument. F2 Science commissioning is a SCI project for 2009.
ENG09-165 : OM Corrective Maintenance Tasks	Describe all faults that are pending in all telescope and instrument systems as per FRS. The listing of all pending fault that we need to work in 2009 will be issued in December 2008.
ENG08-041: Eng Tools Corp Approach	Engineering Tools Corporate Approach project includes two main sub-projects: the Gemini Management Planning Tool and the Engineering Documentation Management Tool (DMT). The appropriate DMT is being searched to be implemented and deployed during 2008. At the end of 2008 the Planning Tool (PI) will be at the 98% level of completion and the DMT will be at the 80% level. Most of the roll-over task to 2009 is related to store OLD Gemini documentation in the DMT.
ENG09-154: Facilities Upgrades - MK A	Build a spares warehouse at the summit approximately a 15' x 15' secure storage space.
ENG09-082 : Planning Tool Upgrades	Customizations and support for the Gemini Planning Tool Operations weekly planning improvements as well as Science and Telescope planning integration. As first component, the planning involves long range projects and daily routines. The goal is to integrate all useful information into a "big plan" system.
ENG09-085 : Gemini Application Platform	A common application framework that will unite all the disparate user interfaces and applications used in observing today behind a common platform architecture. It will provide a consistent and efficient user experience by accessing all parts of observing configuration and status information in a uniform way. This is a 4-phase project, where the first phase will be mostly planning and having a Design Review for most part of

	2009, and actual construction not taking place until 2011 in three-phases: foundation/framework, transition of the existing tools to this new framework, and dashboard-integration of all the high-level tools into one single Dashboard/UI instance.
ENG09-175 : TAC Software Requirements	Science goals: The Time Allocation Committee (TAC) process is an important link in the chain of Gemini Observatory operations. It is the means by which a submitted proposal is given an allocation of time for observation and assigned a ranking band. The process begins with the submission of staff proposals to the Gemini Staff server and delivery of submitted proposals from the partner countries. It ends with the notification of accepted proposals and creation of Phase II skeletons. Because the current software used for the TAC process was written without much thought to ease of use, process optimization, or error checking, the users have to do many time consuming, manual tasks that are highly error prone, resulting wasted time and effort for everyone involved. It is also important to note that the new version of Microsoft Excel no longer supports the visual basic macros that are critical to the queue creation process. We hope to replace the current system before it causes large problems in creating and distributing the merges to the TAC members. The requirements set forth in this document intend to address many of the issues found in the current system and will provide a roadmap for moving more efficiently from the initial proposal to program observation. DESCRIPTION: 1). Functional Requirements: The new system should provide a distributed interface that allows multiple users of varying access levels to submit and modify proposals. It should contain integrated and expandable error checking. The sections describe the requirements of the system we would like to implement. Statement of General Functionality – Multiple platforms: The system will be run by multiple users and will need to be compatible with the variety of operating systems. Multiple access points: The proposed system should be accessible from multiple parties across globe. Multiple access roles: The users of the system must have varying degrees of access that also varies over time. Note: Multiple access roles required for the system are described in. Multiple access windows: There will be predefined windows that can be enabled by the Technical Secretary, ITAC Chair, and Admin. These will define which users can edit what information. Multiple windows can be opened at the same time, allowing more than one type of access at once. The windows include editing NTAC comments, ITAC comments, Contact Scientists, NGO contact emails, and general editing of programs. They will also include viewing summaries of other countries programs and NGO feedback emails.

ENG09-010 : SALSA (ENG03)	ASCAM & BOCAD integration, FAA approval of camera systems, SOP for laser use
ENG09-122 : ISS Vibration mitigation	Reduce the vibration level at the ISS. This task includes the following: 1) program planning phase, 2) ISS vibration measurement and data analysis campaign, 3) cryo pump vibration mitigation engineering, 4) instrument vibration characteristics measurement and analysis, 5) Altair vibration investigation.
ENG09-173 : GS Laser cutting project	GS Laser cutter system installation, commissioning and startup operations. This project includes not only the laser mask cutting machine, the GS mask tracking database, but also the realities of the Gemini South/CTIO operations staff related to the cutting and shipping, budget, and environment.
ENG09-018 : SOAR M1 Coating	Coat SOAR M1
ENG09-077 : Image Quality Monitoring & Characterization with ENG data	The systems group should support efforts of IQ optimization while keeping night time efficiency at the forefront of our minds. This included implementing tools that allow us to analyze current IQ and develop/optimize models all from archived engineering data. Data will be pulled out the seeing monitors, GEA, the WFS, the mirror tuning (but not the science instruments, see SCI09-35).
ENG09-040 : GEA Re-code and Functionality Improvements (ENG13)	This project is to re-code GEA and improve its functionality considering dynamic channels addition and as part of functionality and improvement provide IQ pages upgrades, Instrument/AO calibration upgrade, MCAO integration, etc.
ENG09-055 : Guiding Improvements	Correct deficiencies in guiding performance in current system: astigmatism convergence, non-chopped image elongation, dynamic skyframe, actuators out of range, and centroiding algorithms. The first phase considers acquiring a good understanding of the guiding process currently implemented.
ENG09-091 : Laser Upgrade B - Improved diode reliability and lifetime.	The 12W 589nm laser system at GN is pumped by 12 high powered laser diodes @808nm. The diodes are assembled in a fiber array packages FAPs and are purchased directly from the manufacturer-Coherent Laser, Santa Clara, CA. At GN, we are experiencing an operational MTBF of the FAPs of approx 1000 hrs whereas a more typical industry standard is ~ 20,000 hrs. The premature failure reduces the availability and uptime of the LGS and also impacts the quality and stability of LGS performance. Reducing the MTBF of the FAPs will increase reliability and availability of LGS system and will reduce operational costs of consumption of these expensive components. These reliability improvements could be applied to the GSK systems and future LGS systems. Project Objective Statement (POS): Utilizing existing resources found at GN and GS we will investigate and then implement new 808nm pump laser diodes controllers and operating procedures with

	improved MTBF on the GN 12W laser. Make available the results to our worldwide partners that use the DPSS LGS as best practices.
ENG09-090 : Laser Upgrade A - Modify GN to take advantage of improvements during design of GSK systems	Modify GN to take advantage of improvements during design of GSK system. Following the 50W Gemini South and 20W Keck laser program there are a suite of new designs and design enhancements that can be applied to the existing 12W 589nm GN laser. Laser Upgrades: angle tuned etalon for frequency control, updated Wavelength Locker design, added encoder to HR mirror, all photodiode detector are powered from DC supplies, inclusion of diagnostics via I/O panel to maintain EMI integrity, tighter tolerances specified on key mirror coatings HR mirror, SFG optics Use of Ion Beam Sputtering (IBS) coatings for durability and hydroscopic issues Use of Invar optical bench to reduce thermal effects. Better, more stable optical mounts. These laser upgrades will increase the availability and uptime of the GN LGS and also improve the quality and stability of LGS performance. Additionally, convergence of design will reduce complexity of PM and the risk of component damage. An additional benefit will be standardization of spares for GN, GS & Keck.

F.4 Science

The three core activities of the Science Group in 2009 will continue to be the planning and execution of the Gemini user programs on the two telescopes, the development of data reduction software and data pipelines, and the astronomical research carried out by the Ph.D. science staff members.

The key tasks for the science division in 2009 were developed as part of the observatory planning process. This was the third year of this process at Gemini, and the addition of the Project Insight tool, as well as better understanding of the process, allowed the science division to develop a more detailed and fleshed-out program than in 2008. The FTE effort required to support various aspects of science operations were explicitly unrolled in this year's plan and the numbers tuned to more closely represent the actual effort required as tracked in timecard records for 2008.

The majority of the effort from the science staff in 2009 is required for the support of nightly science operations. This effort is approximately the same as last year. One of the projects defined by the science division is to enhance the tools that are used for filling the queue during the ITAC process. This would allow the queue to be filled with a mix of programs that better match the expected observing conditions and better fill the RA distribution of available time. This project is under the engineering division as they are responsible for the Software Group, which has the responsibility for these tools.

The tasks listed in Table F.4.1 represent a subset of the effort from the science division. Science effort is required to support many of the tasks that are the responsibility of the engineering division. Good communications with the engineering division is essential for the tasks that have requirements defined by science and the delivery done by engineering.

We are putting a strong emphasis on the continuing development of data reduction software packages for both Gemini users and the automated pipeline. While IRAF-based reduction software exists for all operational instruments, there is a need to provide a real-time quality assessment pipeline running at each summit. This would allow for an immediate assessment of most of the data acquired by Gemini instruments. To fulfill this demand, the observatory completed the migration to a PyRAF data reduction environment in 2008. This environment allows one to execute both classical IRAF tasks as well as reduction tasks developed in other languages within the Python environment. This environment will be a core element of the Dataflow Project that will provide automated data reduction for data quality assessment.

We will continue to support instrument commissioning and integration of new instruments or capabilities into the multi-instrument queue. The priorities for the coming year are restoring the Gemini Near-Infrared Spectrograph (GNIRS) to operation on Gemini North, improving Laser Guide Star (LGS) operations, and continuing the planet-search campaign with the Near-Infrared Coronagraphic Imager (NICI) on Gemini South, which started in December 2008. Science effort will also be directed towards the commissioning of the FLAMINGOS-2 near-infrared Multi-Object Spectrograph and Canopus, Gemini South's multi-conjugate adaptive optics (MCAO) system. Smaller effort will be directed towards improving the monitoring of the status and performance of the instruments.

Finally, Gemini Ph. D. science staff plans to carry out forefront research in 2009 in areas that exploit the best of our observatory's capabilities. Most of these programs will be conducted in collaboration with members of the Gemini communities. Some of the most active areas of investigations for the coming year will be:

- Searching for young large Jovian planets with the near infrared coronagraphic imager NICI;
- Probing a new substellar regime with the UIKIDSS large area survey;
- Mapping gaseous inflows in the center of active galaxy nuclei;
- Old white dwarfs and the age of the galaxy;
- How do small galaxies become big;
- Determining the low-mass end of the local $M_{\text{Black Hole}}$ – velocity dispersion;
- Primordial solar system ices;
- Qualifying the dusty surroundings of unobscured AGN with mid-infrared observations;
- Gamma ray bursts: from progenitors to probes;
- Kinematics and stellar populations of the most massive galaxies;
- Carbon-Nitrogen-Oxygen abundances in globular clusters from near infrared spectroscopy.

Table F.4.1. Science division priorities 2009.

TASK TITLE	TASK DESCRIPTION
Research Productivity	Science goal: produce science (SCI08-127). Description: much of the science staff has a research component in their contracts and this should be tasked and tracked like any other work. Measure time spent through timecard charging, and productivity relative to research-related performance goals.
Phase II Support	Produce error-free observations ready for execution, all CS duties (SCI08-117).
Queue planning and daily preparation	Efficient queue execution: QC, daytime SSA, masks etc. (SCI08-114)
Nightime Summit Support	Active collection of science data (SCI08-113)
Data quality assessment and distribution	High quality and timely science product (SCI08116)
GNIRS science support	Science goal: provide user support for GNIRS. Description: this project contains all effort on GNIRS science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these. This project does not start until commissioning is complete.
NIFS science support	Science goal: provide user support for NIFS. Description: this project contains all effort on NIFS science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these.
NIRI science support	Science goal: provide user support for NIRI. Description: this project contains all effort on NIRI science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these.
Altair science support	Science goal: provide user support for Altair. Description: this project contains all effort on Altair science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these.
Michelle science support	Science goal: provide user support for Michelle. Description: this project contains all effort on Michelle science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these.
T-ReCS science support	Science goal: provide user support for T-ReCS. Description: this project contains all effort on T-ReCS science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these. Improve

	user support for T-ReCS (place holder task, need description) (SCI08-132).
GMOS science support	Science goal: provide user support for GMOS-N and GMOS-S. Description: this project contains all effort on GMOS-N and GMOS-S science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these.
NICI science support	Science goal: provide user support for NICI. Description: this project contains all effort on NICI science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these.
Science Operations Statistics	Science goal: to track science operations efficiency and identify areas for improvement. Description: this project includes top-level time accounting for both sites, and science operations statistics: acquisition times, open shutter efficiency, coordinate distributions, instrument mode demand etc. This is an ongoing operations project. The effort for 2009 includes ongoing training of a DAS.
Science staff training	Better trained observers, SSAs and DAS for improved efficiency at night and better scientific product (SCI08-120). Includes QC training. Development of training documentation.
GNIRS science commissioning	Science goal: to make GNIRS available for science use. Description: this project contains the science effort involved in bringing GNIRS back to operations on GN. Detailed description and planning will be provided by the GNIRS science team. The team will use this project for planning and tracking the science effort for the commissioning.
Maintenance of the data reduction package for operations and PI support	Science goals: support daytime and nighttime operations, and support the PIs with their data reduction. Description: continue to provide the observatory with stable facility installation of IRAF, PyRAF and Python, and support the users of the Gemini Data Reduction Package. Specifically: maintain SBF, CP, HBF and MK IRAF, PyRAF, and Python installation in support of the daytime and nighttime operations, and in support of research activities by the science staff. Support external users (Helpdesk requests, critical bug fixes). Maintenance of test suite and framework. Release of a last IRAF CL-compatible user package: release new tools (if any), clean up, important fixes (e.g. re-work of nstransform → nsfitcoords+nstransform, better handling of VAR/DQ for GMOS, and many more fixes since last release). Release of first PyRAF-compatible user package: deploy some of the next generation toolkit to the user to facilitate and speed up the reduction of Gemini data. Maintain data reduction package.
Planning Process	Science goals: we need to track the effort needed for the science staff participation in the observatory planning process. Description: this project includes the science staff effort needed for general observatory planning including developing the planning process (e.g. Project Insight), SPT work that does not fit into other duties, and work associated with the 2010 planning retreat. Estimated cost: $15000 for travel expenses.

Science staff recruiting	Keep science staff positions filled (was SCI08-133). This project includes time spent on hiring committees to review applications and conduct interviews, as well as staff time to host visiting candidates, conduct summit tours, etc. For 2009, estimates assume 3 AST positions (openings as of Sept 2008), and 1 for each of the other groups (no current openings, but included as buffer against possible departures).
NICI Campaign	This project encompasses effort required to conduct the NICI campaign (was SCI08-042). It is expected that the campaign will start in 2008 and so most of the "start-up" work will be completed by 2009; however, the NICI campaign will likely continue to require support above "typical" operations support provided to other queue programs. The FTEs listed here are estimated, detailed resource analysis is not done yet.
Gemini Science Archive Operations	Science goal: ensure accessibility and usability of Gemini data to both our PIs and to the public user community. Description: Gemini's side of GSA operations. Cost is as per the GSA Operations Contract which we don't have the final version of to hand out. Additional costs include ~ 1 CADC visit / year by GSA scientist approx $4000, also there are some hardware costs for example the gsag(n,s) transfer machines at each site. Suggest budgeting $1000/yr on average for hardware.
LGS SciOps Improvements	Science goals: to obtain higher efficiency, especially during LGS runs. Description: this project includes improvements to LGS operations requiring mainly Science effort. This does not include the normal operations work which should be listed under the Altair support or engineering improvements which are in the engineering LGS project. FTE load is set assuming we will use the available AST FTEs in the Altair team for this project as well as part of the effort from the GN AO scientist.
Flamingos-2 Science Commissioning	This project includes on-sky commissioning work and all work required within science to prepare F-2 for operations. The bulk of the science effort will be included in this project, although some science FTEs will also be in the engineering F-2 commissioning project (and some engineering FTEs will be included here).
Phoenix science support	Science goal: provide user support for Phoenix. Description: this project contains all effort on Phoenix science support (on-sky checks, day-to-day support, web updates, semester changes, etc) as well as improvements done by the science team (AST, DAS, SSA). The instrument team will add detailed sub-projects and tasks and draft the priorities for these.
Update current GMMPS to support F2	Allow mask design creation for F-2 (SCI08-046)
Instrument Performance monitoring	Regularly measure the total throughputs of all instrument to monitor system health (SCI08-001). The 2009 effort is to implement the plan fully as developed in 2008 and to continue the ongoing monitoring effort.
Science Mentoring	Science goal: increased scientific productivity and job satisfaction (was SCI08-131). Description: time for senior astronomers to meet with junior astronomers for scientific guidance, particularly related to personal research work but can include support work and other aspects of career development. This project specifically covers astronomer mentoring only.

GNIRS Data Reduction Software	Science goals: support the re-commissioning of GNIRS. Help PI reduce GNIRS data. Description: re-factor the old IRAF software to support the new GNIRS. Improve support for cross-dispersed mode (code and documentation).
Data Reduction Recipes Development	Science goals: speed up data quality assessment and data reduction in general, define standard way to reduce Gemini data, and support pipeline. Description: each bullet is an independent subproject. Depending on the priorities for 2009, the selection of a subset of those will likely be required. Help from the instrument scientists or specialists in the reduction of a particular type of data will be required.
Observing Condition Review	A working group will review the way in which observing condition constraints are defined and utilized.
Image quality Performance Monitoring: Science images	Science goal: enable Gemini to take advantage of excellent seeing to produce exceptional images (SCI08-060). Description: when the natural seeing is very good, we often see all kinds of image quality problems with the Gemini N (and presumably Gemini S) instruments. This prevents us from really taking advantage of the best conditions. We need to document and quantify these problems, thoroughly investigate and understand their cause(s), and fix them. Further, we should implement regular and automated IQ monitoring to act as an early warning system in case problems recur, and to provide users with a realistic guide to what they can expect from Gemini instruments. This task would include the creation of infrastructure that allows scientists and engineers to individually characterize all of the systems involved in the guiding and active optics process, and give them the ability to better diagnose problems resulting from these systems. In the past, because of a lack of logging facility infrastructure, we have used trial and error to come up with the best parameters for our wavefront sensors, M1 and SCS. As a result we have many loops working together that are tuned "OK". This leads to the system as a whole not working to its fullest capability. We need a system that allows us to record data in real time for all the systems involved in guiding/active optics, and separately see the contributions made by those component parts. The infrastructure must be in use all the time so that we do not swap SCS configurations and waste time on the sky when we could be doing science. All of the proposed logging and monitoring will also be invaluable in diagnosing large problems like chopping/guiding problems (INST03/06) and small random problems like loss of guiding. This project includes only IQ from science images. ENG09-077 covers the engineering aspects of IQ monitoring.
Improvement of the internal sciops web pages	Improve staff access to information necessary to perform observatory support work (SCI08-122).
Improvement of the external sciops web pages	Improve staff access to information necessary to perform, plan and publish Gemini observations/data (SCI08-126).
Development of next generation data	Science goals: facilitate new and improved modular data reduction tools that can be driven from both the pipeline and the interactive data

reduction toolkit	reduction package (SCI08103). Description: the building blocks of Gemini's future DR needs. In 2009, we will be building onto a system developed in 2008. Realistically, this is a very long-term project, but based on the upcoming instrument support needs (NICI, F2, MCAO). Here are the proposed 2009 tasks: defining the required toolkits and set up a framework to accept the new routines as they come in Logging and history. A suite of generic imaging and spectroscopy tools to be added to the toolkits. The specifics of those will come from the design of the NICI, F2 and MCAO data reduction software. Reminder: the toolkits will not be complete. The goal for 2009 is to start populating them based on the immediate needs.
Data reduction support F-2	Science goals: provide the PIs with the essential data reduction tools for Flamingos-2. Description: include support for Imaging, Long slit, and MOS, in that order. This project covers requirements, design and development, testing, and documentation. The data reduction support for Flamingos-2 will make use of the toolkits described in item SCI09-074.
Datalow Project QA Pipeline	Science goals: Near-Real-Time automatic QA data assessment. Description: proceed with the dataflow project plan at least as far as deploying a QA pipeline at the summits. Include: infrastructure, non data reduction components design & development (covered elsewhere). E.g. Calibration Manager, Recipe Processor, etc. In this project we concentrate on the Science Staff contributions.
AstroData	Science goals: facilitate data reduction software development, automation, and robustness via a comprehensive data access infrastructure. Description: AstroData (formerly GeminiData) is at the center of the new Python data reduction software development. The specifics of each type of data is encapsulated and 'hidden' behind a generic interface. The first implementation is completed. It now needs to be cleaned up, documented, and a few additional features need to be added. Given outsiders interest in this software (AURA Software workshop, STScI, SciPy community), adopting an open source approach for this project from now on should be seriously considered.
Data reduction support for NICI	Science goals: provide the PIs with the essential data reduction tools for NICI (SCI08110A). Description: NICI has very special data reductions needs that are not currently covered by the current package. New tools are needed. In 2009, complete, if necessary, the 'point-source' support. Then add to the suite support for the reduction of observations of extended source. The NICI campaign has its own software pipeline tools. Gemini will require development of similar tools to support queue observers.
Gemini Acquisition (gacq) as a standalone task	Science goal: improve observing efficiency, reliability and ease maintainability. Description: the 'gacq' tool has proven to be a great boost to efficiency at night. Taking the project a step further and converting gacq into a Python tool will increase reliability and ease maintainability. Also, being a Python tool, it can act as either a standalone tool or through PyRAF depending on preferences and needs. A prototype is in the works at STScI.

GSAOI Science Commissioning	This project includes on-sky commissioning work and all work required within science to prepare GSAOI for operations. The majority of this work will come after the basic MCAO commissioning defined in the engineering projects.
Procedure and requirements for data reduction software provided by Aspen instrument teams	Science goal: enable implementation and integration of reduction software for the Aspen instruments, essential for the science productivity of these instruments (SCI08-111). Description: ensure that the data reduction software that is to be provided by the Aspen instrument teams addresses the broad scientific needs of the Gemini community, and that its integration into the next generation toolkit is straight forward. For the Aspen instrument, the data reduction software will be part of the contract. It is imperative that procedures and requirements be set by Gemini to ensure that our needs and the needs of our users are addressed. Proper documentation needs to be written and passed along to the instrument teams.
Upgrade FITS Data Storage Infrastructure	Science goals: improve observing reliability, reduce routine maintenance load on staff, and prevent loss of valuable FITS data. Description: Improve the hardware, software and procedures we use to store and manage our FITS data internally. This will prevent loss of time due to full disks etc in a way that requires less staff load than the current system. Also provide a long term off-line "disaster recovery" archive which we can use to recover data that would otherwise be lost. The current DAT tape archive has proven not to be reliable for that. Some of the new hardware (upgraded netapps) has already been provided by IS as they serve other purposes too, but I would estimate US$25k +/- 5K for the servers and tape drives for this project.
Data reduction support for MCAO/GSAOI	Science goals: provide the PIs with the essential data reduction tools for MCAO/GSAOI (SCI08-110B). Description: MCAO/GSAOI: Obtain scientific and technical requirements from the MCAO team. GSAOI is a near-IR imager, therefore it is likely that we will be able to build upon the existing software to provide data reduction support for this instrument.

F.5 Environmental, Health and Safety

The Gemini 2009 Environmental, Health and Safety (EH&S) plan consists of several goals that contribute synergistically to the mission of attaining world class EH&S performance in the next 3 years. The Gemini Safety and Health Management System provides the strategic framework for achieving world class safety performance and continues to play a prominent role in 2009. To build on the existing foundation, new safety and health standards are scheduled for promulgation, approval, and implementation by the Safety Leadership Team (SLT) on a monthly basis.

In addition, the EH&S Department intends to examine the current status of the Gemini safety culture and build an optimized plan of EH&S program implementation and integration. There is going to be a targeted focus designed both to engage the entire Gemini workforce in the safety

process and to implement safety programs that gain sustained traction in the field while permeating all strata of the organization on a consistent basis.

In summary, the Gemini 2009 EH&S plan aims to drive company-wide safety and health engagement, leadership, accountability, and ownership while delivering maximum value in terms of risk mitigation and ensuring the protection of people, property, and the environment.

Table F.5.1. EH&S priorities for 2009.

TASK TITLE	TASK DESCRIPTION
Gemini Disaster Preparedness & Recovery Plans	Finalize and implement comprehensive documents that comprise training, procedures, and guidelines required for the proper preparation, response, and recovery to a serious emergency incident, including for example fire, earthquake, tsunami, hurricane, or act of terrorism.
Gemini Safety and Health Committees	Implement results oriented safety and health committees, consisting of Safety Representatives from all levels of the organization, chartered to perform monthly inspections, drive corrective action closure and safety process ownership, implement rewards and incentives program, and facilitate positive safety culture change in the organization.
Gemini Safety Culture Integration Initiative	An endeavor to role model engaged safety and health leadership, optimize EH&S program implementation, and build safety momentum, the Safety Culture Integration Initiative is designed to provide a detailed roadmap and highlight the specific steps necessary for the organization to achieve world class safety performance.
Comprehensive fall hazard survey	Conduct detailed fall hazard surveys in the observatories in order to recognize, evaluate, and control serious risk profile.
Comprehensive fire and life safety assessment	Conduct detailed fire safety and life safety surveys in the observatories in order to recognize, evaluate, and control serious risk profile.
Comprehensive office ergonomics program	Implement on-line ergonomics training and assessment tool to identify high risk desk dweller population and implement timely corrective actions as required.
Gemini on-line MSDS management system	Fulfill hazard communication and right to know requirements through implementation of a state of the art Material Safety Data Sheet (MSDS) on-line management system accessible through Gemini EH&S internal website.
Gemini EH&S training program	Implement comprehensive role-based EH&S training program qualifications for all Gemini employees and track completion rates.

F.6 Public Information and Outreach (PIO)

The following priorities represent the ongoing evolution of the PIO department's scope of work and programmatic elements for 2009. Previous experience has shown that baseline PIO-core

functions expend about 80% of the existing PIO staff and budgetary resources. The tasks beyond the PIO Base Operations come from the remaining 20%.

In addition to the considerable number of ongoing (baseline) operational programs and functions, 2009 will see the additional of several new elements that will improve our media relations, internal and external web communications and collaborations with other organizations throughout the Gemini partnership. As with all 2009 Band-one plans, these are all pending budgetary constrains and several of these will likely be moved into Band-two priorities based on budget availability.

Table F.6.1. PIO priorities for 2009.

TASK TITLE	TASK DESCRIPTION
PIO Base Operations	Ongoing PIO programming and services, including local outreach programming, publications, press releases, Legacy Imaging, Web content updates, Community Engagement funding logistics, partner country conference support (IAU, AAS, Gemini/Subaru Science Conf), etc.
GS Mirror Coating Documentation	Create timelapse of GS coating/shutdown for safety, media and documentation purposes [NOTE: this activity has been delayed due to cancellation of coating at Gemini South in 2009]
Identity Program Integration	Complete integration of "Statement of Purpose" for all printed and electronic delivery. Include guidelines for use in communications etc. for staff and partner offices, etc.
Plan/Implement Press/Publications Office/Resources	Develop a plan to establish a world-class press office at Gemini that will also support publications functions across the observatory
Evaluate/Address Web Presence/Planning/Management	Hire independent consultant to evaluate our web pages and develop a plan to address issues related to content development, management and overall site design
Local IYA Programming	Implementation of IYA Programming in Hawaii and Chile - limited to host community events and activities
Web Redesign Implementation	Implement consultant recommendations as endorsed by directorate
StarTeachers 2010 Development	Announce and select teachers for 2010 StarTeachers Program
From Earth To The Universe Exhibit Development	Development of "From Earth to the Universe" exhibit to travel to all partner countries
Gemini Overview Video Clip	Produce Gemini Video Overview for IYA Observatory Tour and for overall web background content. Approximately 5-minutes long.
New Media Development	Expand dissemination of PR materials into new media (e.g. Twitter, Second Life) and develop new materials for WWTN, Google Sky and podcasts.

F.7 Directorate 2009 Projects

The Directorate loaded the observatory planning database with a number of strategically important projects that the Directorate, as a leadership team within the observatory, will work on in 2009. These projects are listed in the accompanying table (F.7.1.) in approximate order of importance.

First on the list is the National Science Foundation's Business Systems Review (BSR) which represents a contractual obligation the observatory has to fulfill. In general any such contractual obligations were defined as high priority (or "mission critical") projects in our planning system. Next on the list is to successfully complete the Wide-Field Multi-Object Spectrometer (WFMOS) agreement with National Astronomical Observatory of Japan (NAOJ). Completing this agreement in parallel with the WFMOS studies by May 2009 has enormous importance to the long-term vitality of Gemini and, if successful, represents one of the largest inter-observatory ventures in modern history. For a variety of reasons we anticipate energy conservation to be a major theme in future years. With skyrocketing fuel costs worldwide, Gemini's budget is being impacted in terms of electricity and travel costs. In fact, these two cost categories rank second and third only to labor in Gemini's overall O&M budget. The first step in this process will be to devise an energy policy since, in practice, we anticipate implementation to involve not only new technologies but new behaviors by the staff (e.g. turning off lights, Polycoms, computers, etc. at the end of the day, and making double sided hard copies, etc.).

Next in the list is the hiring and training of a new Deputy Director. The Deputy Director handles myriad responsibilities on behalf of the Directorate in Chile and manages, on a daily basis, the observatory's discretionary time program and Head of Science functions. For obvious reasons filling this position is critical to Gemini's mission and therefore warrants the necessary resource allocation in the 2009 plan.

Following that project a pair of crucial international meetings are listed, namely the Gemini user's meeting and science conference in Kyoto Japan. We already know that these meetings will prove to be extremely popular with our respective communities as they represent a unique opportunity to blend what have historically been two distinct astronomy communities (Subaru and Gemini). The Kyoto science conference is being organized primarily to foster future scientific collaborations between our communities, consistent with the objective of the WFMOS collaboration. For these reasons, and more, it is important that we factor the resources needed to support these meetings into next year's plans. Working down the list, next is the AURA compensation follow-up project. In 2008 AURA initiated a study through an external firm to examine the various forms of compensation offered to AURA's staff worldwide in an effort to identify and remedy unfairly or unevenly distributed forms of compensation. We anticipate that once the results of this study are understood, implementing changes in response to this study will draw upon considerable resources at Gemini, principally from our administrative group. This initiative has broad interest in Gemini's staff, which experiences a range of compensation packages based primarily upon location, not necessarily need. Finally, projects are listed that will focus on improving telescope support both during regular hours and after-hours through

new policies aimed at compensating staff for unplanned activity, e.g. nighttime software or network support.

Together these projects reflect a number of internal and external strategic initiatives that will have a lasting impact on Gemini. In the previous annual planning process there wasn't a Directorate group of projects proposed, as we focused instead on the primary groups, but this has now changed as the Directorate functions more and more as a team instead of a set of parallel division leaders.

Table F.7.1. Directorate priorities for 2009.

TASK TITLE	TASK DESCRIPTION
NSF Business Systems Review Preparation & Site Visit	Directorate and Admin Group time associated with coordination and preparation of materials for the NSF Business Systems Review in 2009
WFMOS Agreement	Negotiate agreement for joint development and operation of WFMOS with Japanese community
Energy Planning Oversight & Control	The purpose of this initiative is to assess Gemini's current energy performance and to develop a long term energy plan for Gemini, building on the initial staff input received in the blog which was established with this objective. The outcome of this initiative will be the presentation to the Director by June 30th, 2008 of a formal Gemini Energy Plan. The project involves the development of Gemini energy consumption base data, with clear key performance indicators, against which the impact of future initiatives will be assessed.
Energy Initiatives	The purpose of this initiative is to make some advances in the area of energy improvement, building on the initial staff input received in the blog which was established with this objective, in the same time period that the longer term plan is developed. The outcome of this initiative will be the realization of several specific energy improvement initiatives during the first 6 months of 2009. The initiatives include: developing ways to ensure a reduction in energy consumption during off peak hours, when fewer staff are working, but many PC's and electrical appliances remain in use; making energy savings from ensuring staff computer and printer settings are set up properly for optimum energy saving, plus printer consolidation; the elimination of disposable cups and glasses; improved recycling and a travel carbon footprint awareness initiative.
Hiring and training new Deputy Director	Participate in the hiring and lead the initiation and training of a new Deputy Director, stationed at Gemini-S, when Jean-Rene Roy retires in mid 2009
2009 Gemini Users' Meeting	Organize the User's meeting, in conjunction with the GSC, immediately after the Kyoto science conference
2009 Joint Subaru/Gemini Science Conference	Organize the Kyoto science conference, in conjunction with Subaru
AURA Compensation Study Follow-up Work	Earmark directorate and HR time in anticipation of an AURA Corporate initiative that could take a great deal of Directorate and HR Manager time

TIO Manager and TTMs positions creation project	This project studies the possibility of creating new positions that would allow us to avoid current double booking of several engineers, plus introduce improvements to the engineering operations support scheme that we have at the moment.
Implementation plan of the new GS summit crew work schedule	Elaborate a plan to implement this new schedule
Observatory wide standardization procedure	To write a procedure that would allow us to have a mechanism to deal with the approval, upgrade and modifications of observatory wide standards
Create Call Out Policy	Research and create a call out policy for nighttime and weekend support of telescope operations
Create On-Call Policy	Research and create an on-call policy for nighttime and weekend support of telescope operations
IAU Commission 55 Duties	Crabtree will be President of C55 after the Rio GA. He is currently involved with C55 and IYA activities. This project accounts for staff time associated with C55 and IYA.

SECTION G

LONG RANGE PROGRAM PLANS

G. Long Range Program Plans

G.1 Administrative Program

The Administration Program's long range plan reflects both a mid-range vision of the future and a longer range vision that we have begun to refer to as the "2020 Vision."

In mid-2008 the Administrative Group, at the urging of Gemini's Director, engaged in a planning exercise where we envisioned what we believed the observatory should look like in the year 2020 from an Administrative point of view. As we developed and refined our 2020 vision, we realized that there were elements of that vision that it made very good sense to begin work on in 2009. We also have multi-year initiatives that we began in 2008 that will continue into 2009 and 2010. Some of those multi-year initiatives relate to the Administrative Group's goal of improving our customer communication and overall efficiency, others relate to innovations that we simply do not have the resources to address in a single year. Our challenge for the future will be to balance our approach so that we devote the optimal amount of resources to on-going improvements, cyclical maintenance and upgrade, and laying the groundwork for the future.

In studying trends and innovations that we felt were relevant to developing our 2020 vision, we found that these trends fell into three areas: workforce trends, energy and "greening" issues, and technology advances.

The workforce trends observed are: the world's need for knowledge workers will surpass the availability in the very near future (as soon as 2012); worker expectations for the workplace are changing dramatically in real time; and, technologies will continue to transform when, how and where work will be done. These trends indicate a need for Gemini to consciously position ourselves so that we can attract the knowledge workers we need in this highly competitive global environment. We need to take steps now, and will begin by reviewing our benefits package to increase the likelihood that it will always be relevant to all of our workers, increasing our understanding of what it takes to make sure that Gemini continues to be an interesting and pleasant place to work, and understanding the effect of technology on our workplace and our workers in order to create policies that will prepare us in advance for the radical world changes that we see coming down the road.

The trends in energy and "greening" issues are driven by the convergence of world concerns about energy security (availability and cost) and climate change. Market and political pressures for innovation and conservation will create new technologies for energy efficiency and Gemini will certainly take advantage of those as they are developed. In the meantime, Gemini can begin to improve our energy behavior immediately. In 2009 we can develop the energy policy that will guide our future and create our long-range energy and greening plan.

Technology trends that we anticipate are great increases in internet bandwidth and speed, more and better wireless with very high speeds, there will be a migration to "cloud computing" (with software and hardware as a service), an increased use of portable computer and communication technologies, improved telepresence and virtual presence technologies and

advances in “smart” appliances and facility monitoring and control devices. While the technological aspect of these trends is breathtaking in the sense that keeping up will require impressive resources and detailed planning, the knock-on human effects are even more staggering. We are beginning to assess how these technological advances will affect the human aspect, particularly the “how, when and where work will be done” as mentioned above, and we will be ready to implement changes as they make sense.

G.2 Instrument and Facilities Development

Table G.2.1 contains a number of development tasks that are anticipated for 2010. Some of these are carry-over tasks from previous years, and some are proposed new tasks for 2010.

Table G.2.1. Instrument Development tasks for 2010 and beyond.

TASK TITLE	TASK DESCRIPTION
BAND 2: Anticipated tasks for 2010	
GPI support	Management oversight of GPI contracts, provide engineering support for software and design development, provide data on Gemini performance.
WFMOS support	Management oversight of WFMOS construction contracts, continued work with Japanese collaborators.
GLAO concept design study support	Issue RfP, assess proposals, select team, and negotiate contracts, if not done in 2009; provide support to design study teams.
GMOS-S CCD replacement	Procure new red-sensitive CCDs, provide support for construction of a new focal plane, detector testing and characterization, installation in GMOS-S, and re-commissioning.
Long Range Plan development; hold next community instrumentation prioritization meeting	The Aspen process was designed to cover instrument development through 2010. Some Aspen projects may "roll over" into the next phase. Some new projects may be proposed. We are planning to hold the next community meeting in early 2010 to chart a course for instrument development during the next decade. The Gemini partnership renegotiation in 2011 and 2012 and budget planning process will require input from this meeting.
IR WFS procurement	This task represents an on-going attempt to work with vendors and other institutions to develop a high-speed IR WFS for the new A&G and possibly GPI.
MICHELLE detector upgrade	Procure new detector controllers for MICHELLE. Include issuing a public RFP, selecting a vendor, negotiating contracts, overseeing development, providing technical feedback, and overseeing installation and testing.
Mid-IR filters	Procure new mid-IR filters for MICHELLE and T-ReCS
BAND 3: 2011 and beyond	
GPI support	Management oversight of GPI contracts, provide engineering support for software and design development, provide data on Gemini performance.
WFMOS support	Management oversight of WFMOS construction contracts, continued work with Japanese collaborators.

GLAO design study support	Management oversight of GLAO design study contracts

G.3 Science – Long Range Plan

This section is focused on the long range planning for the science operations of Gemini. While previous annual reports have listed specific detailed projects within the science group for the years to come, the science group has taken the approach this year of looking at long-range goals for the science operations in the time frame of 5-10 years. These ideas will then be used to guide the detailed planning for the coming years.

Top-level goals for the Gemini science operations and the motivation for these

Goal #1: *Gemini will deliver all requested data for all scheduled queue programs.* Through this goal Gemini distinguishes itself from classically scheduled observatories. When a program is scheduled on Gemini, the principal investigator is guaranteed data, rather than being awarded a set amount of telescope time, some of which may be lost to weather or technical problems.

Goal #2: *Gemini will deliver signal-to-noise (or maximum exposure time) on all science targets.* Through this goal Gemini will optimize the use of telescope time. Many programs can be done in less time in very good conditions, or in poorer conditions using more telescope time. Thus, the very best conditions can be used for programs that cannot be done in poorer conditions, e.g. requires the very best seeing, low water vapor etc. Once those programs have been executed, the very best conditions can be used for faster completion of programs that are also doable in poorer conditions.

Goal #3: *Gemini will deliver science quality reduced data for all facility instruments and modes.* Through this goal Gemini will aid our users in timely publication of all science results. The science-quality reduced data will be available to the users through the Gemini Science Archive. The users can concentrate on the scientific analysis of the data, rather than spending their time on fairly routine data reductions.

The three top-level goals described here are designed to address a number of key issues in the current Gemini science operations.

Currently the Gemini queue is overfilled to ensure that we have sufficient observations available for all observing conditions. This leads to substantial wasted effort from the users in preparing observations, and from the staff checking these observations that are never executed. To put this in perspective, in semesters 2007B and 2008A roughly 25% of all science observations fully prepared for execution never got executed. The wasted effort in turn leads to unhappy users as their expectations are not met and their effort does not lead to data.

Currently observations are defined to require a certain set of observing conditions. In reality many users want a certain signal-to-noise and care less about whether that is reached quickly in very good conditions, or using more time in poorer conditions. However, the limited amount of

observing time leads users to apply for the good conditions, since this makes it possible to reach their science goals using less observing time. The side effects of this are that the poorer conditions are often not used in an optimal way and the good conditions are not reserved for the science programs that can only be done in those conditions.

Gemini currently makes reduction software available to the users as the Gemini IRAF package. However, the users have to run the software on their data, a process that requires a fair amount of manual work. Thus, the users will spend a significant amount of time on basic data reduction. This may lead to delayed publication of the data and results, or no publication at all.

A path to reaching the goals: Reaching the three top-level goals outlined here requires a concerted effort by the science staff, as well as an inclusive discussion within the Gemini staff and the NGOs, with our users and the relevant Gemini committees. So far the discussion has involved the staff and the NGOs and draft versions of the plan have been presented to some committees through the latter half of 2008. The current understanding of how we may reach these goals is summarized briefly in the remainder of this section.

To reach goal #1 – how to fill the queue: Based on the long-term statistics of charged telescope time when operating a multi-instrument queue (2005A-2008A) we can derive information about how large a fraction of the scheduled science nights are actually charged, i.e. used for science, and how that time is distributed on different observing conditions. Using this information we can then determine how the queue should be filled, on average, to ensure completion. By overfilling only slightly and carrying over all unexecuted programs, we can then ensure that we always have observations available, and that all programs will get completed in a timely fashion. The statistics show that a feasible solution is to fill the queue at six month intervals to 70% of the calendar available time, taking into account the unexecuted observations still in the queue, as well as the observing condition and sky position distributions. At each call-for-proposals Gemini would advertise the predicted time available by observing condition bin based on the up-to-date status of the queue.

To reach goal #2 – how to deliver signal-to-noise: It is well understood how to “trade” observing conditions for exposure time. Software like the Integration Time Calculator can be used to quantify the requirements. It is also expected that it is straight forward to identify the programs that can trade observing conditions for exposure time and those that cannot, e.g. a program attempting to spatially resolve close binaries can obviously not be done in poor seeing. However, a program aimed at reaching a certain signal-to-noise in spectroscopic observations of un-crowded point sources can do so either with relatively short exposure time in very good seeing and photometric conditions, or with a longer exposure time in poor seeing and/or cirrus. The implementation of these trades in practice will have to address both how scheduling is done and how telescope time is charged according to the observing conditions. An integral part of the implementation will also be the ability to know the signal-to-noise that has been reached. This in turn requires an advanced data quality assessment pipeline to be in place.

To reach goal #3 – how to develop a pipeline for science quality data reductions: Data reduction to science quality for all facility instruments and modes is well understood by the

Gemini science staff. The current dataflow project has as its ultimate goal to deliver a pipeline capable of reducing all science data from the facility instruments to science quality. The pipeline will be implemented in stages, starting with the recipes for the reductions. Some of these are already made available to our users through the Gemini IRAF package, while others are being developed. Second we will put in place the data quality assessment pipeline, which is also needed in order to reach goal #2. Then building on the data quality assessment pipeline, we will implement the science quality pipeline. In order to deliver science quality data reductions, the pipeline reductions will be rerun at the completion of a given science program such that the reductions can be optimized using all available calibration data.

G.4 Engineering

Table G.4.1. Instrumentation and Development tasks for 2010 and beyond.

TASK TITLE	TASK DESCRIPTION
ENG09-093 : Replace BTO Mirror train with fiber delivery system	Simpler, more reliable and more transmissive BTO
ENG09-037 : aO Improvements	Crosstalk between both astigmatism, field astigmatism model (Zernike model in TCS), P2 astigmatism model with de-center of M1 from optical axis, TCS LUT synchronization/restore, statistics Z8 when parking/unparking.
ENG09-034 : M2 hardware and software upgrades phase III	All tasks from CDR pass to deployment and commissioning
ENG09-176 : Advanced Queue Planning Tool	The next generation of queue planning tool needs to be able to automatically generate usable plans in a few minutes. This project will first identify the requirements for AQPT, compare the options of in-house development versus a commercial S/W approach and begin development.
ENG09-116 : M1 Temperature Control - commission the M1 surface heating system	Surface heating system never commissioned. Need to: 1) commission magnetron 4, 2) complete systems engineering review of this entire system, 3) complete the electronics design, I&T and commissioning, 4) re-package and relocate the electronics cabinet, 5) complete the systems I&T and commissioning.
ENG09-169 : Chopping Improvements/Upgrades	On this new project we include installation of the final hardware at GN, make new verifications if necessary, and transport it to GS too. At GS we need to install the hardware and software and verify performance on the sky.
ENG09-014 : Real-Time System Software Consolidation	In which we would like to consolidate our real-time systems software that includes: 1) moving away from GEM versions; 2) eliminating dependency on Capfast, moving to VDCT; 3) having a cross-compiler on Linux for all our VxWorks images; 4) having the same build framework for both high-level software and real-time software; 5) eventually moving towards to single version of VxWorks/RTEMS/ RTLinux and EPICS.

ENG09-076 : Improve Acquisition camera	Put new CCD with smaller pixels in AcqCam to improve sampling and use it as a good telescope IQ sampler or to diagnose instrument IQ problems. We first assume we can 'simply' put a new CCD in with minor changes to the same existing controller.
ENG09-052 : Automated vent gate control	M1 thermal control - automate vent gates to optimize M1 flushing. We could systematically reduce the mirror (and somehow the dome) seeing instead of depending on manual action by the SSA. Improvement of IQ.
ENG09-058 : Upgrade Coating Plant to Professional/ Commercial standards	Make the coating plants a professional/commercial environment: we can improve the quality of our coatings and eventually safely provide coating services to the community for protected AG-coating (SOAR, UKIRT, PanStar, etc.): sealing of coating area into semi-clean room type, improvement project (vessel closing speed, permanent vessel positive pressurizing, etc.).
ENG09-065 : Upgrade HRWFS software	Upgrade HRWFS software and /or to commercial SHWFS like Imagine Optics device.
ENG09-161 : GS M1 coating 10-year durability	Upgrade the coating process and maintenance plan to set a new milestone of 10y-durability for astronomical coatings using protected silver.
ENG09-035 : New A&G Project Phase 2 - detailed design	Implement design approved in 2009
ENG09-036 : EMS Implementation	Sensor installation, subsystem performance monitoring, data logging enhancements.
ENG09-208 : GMOS focus LUT	implement focus LUT based on guide star use
ENG09-075 : Telescope Monitoring BUSY/IDLE	Full implementation of BUSY/IDLE. If one of our engineering goals is to have an efficient telescope system, we need to look at our partially working IN POSITION and BUSY/IDLE software implementation. We need to complete undeveloped software, remove all "fudge factors", and fix all bugs in our system to use it in the way it was initially designed.
ENG09-086 : Work Log and Fault Reports	Fault Reports, Daily Work Log and Project Insight Tasks need to be integrated in such a way that tasks can be tracked in a single database. Currently it is not possible to account for the number of hours spent on Fault Reports in Project Insight and vice versa, due to separate applications.
ENG09-046 : Software Test Lab Facility	In which the Software Team would like to setup a full-fledged Software Test Laboratory. Currently most of the software is tested directly using the production machines, which has a high risk of interrupting operations. Using this test lab, the Software Team hopes to mitigate this risk and also letting us to produce high-quality software code, by following some basic software engineering principles.
ENG09-016 : GS Mirror Coating Preparations (A Tasks)	Coating preparation tasks that absolutely must be completed prior to coating.
ENG09-092 Laser Maintenance Upgrade: Implement a dedicated laser analytical maintenance bay	Implement a dedicated laser analytical maintenance bay at GN. Issue Statement: provide better environment for laser maintenance preparations, rebuild part of the laser if needed. Operating the 12W

at GN	589nm laser system at GN requires regular preventive maintenance, realignment of optical components and sub-assemblies and replacement of worn out and consumable components. i.e., FAPs. Currently, GN has no offline facility for laser testing of replacement and diagnostics of suspect components. This means that issues may only be discovered once the component has been fully integrated into the laser system after many hours of work. An offline facility will eliminate wasted setup and realignment, verify and confirm faults, and troubleshoot offline. Conduct experiments and characterize sub systems. Perfect and reduce setup of sub assemblies. Reduce turn-around time of replacement, laser downtime, and PMs. Project Objective Statement (POS): utilizing existing resources found at GN and GS to design and build a facility to provide a better environment for laser maintenance preparations, rebuild part of the laser if needed.
ENG09-017 : GS Mirror Coating	GS Mirror Coating
ENG09-083 : Monitoring for Tel Systems and Instruments (Phase A)	Design a master telescope systems, plant room support equipment and instruments Monitoring System. The Monitoring System must be designed in consideration of industry standard, platforms and tools. Fault safe and redundant network support is a goal for this project. Design the system (2009 phase A) and build (2010 phase B) a robust solution for consuming services from the various systems and engineering archives and many other heterogeneous systems. This solution will be reporting in real time on system failures or giving some hints to solutions. Generation of alarms and notifications are part of the requirements of the project.
ENG09-123 : M1 mirror cell cart improvements	Organize cables and hoses to avoid damage during maintenance or operation. This task may require purchasing new hoses to fit new routing. Develop and implement ways of bleeding air bubbles from all the hydraulic lines and cylinders. Air free in the hydraulic system is fundamental for a proper operation of the cart. Procure a good quality labeling on the cart control panel. Clearly indicate a correspondence between pads and pressure regulators. Engineer and procure a simple and reliable way for the operator to monitor from the control panel the individual height of the air pads. Procure air pad spares. This should include a full assembly (air pad already mounted to the aluminum yellow frame). Revise the procedure for replacing the air pads. Modify the legs of the cart to facilitate replacement in the event of a failure while the cart is loaded with the mirror cell. Ship all eight cylinders to the manufacturer in the US for a complete overhaul. The four cylinders corresponding to the second stage are already in Hilo. Procure a protective shroud for the cable wires of the linear encoders. These linear encoders are exposed and un-protected. In a couple of cases these wires have been accidentally caught by personnel working around, damaging the encoder winding mechanisms. Update and document the M1 Cell Cart Operation Procedures. Commission the first stage safety mechanical stops. A couple of them do not fit the locking slot. Procure adjustable hard

	stops bolted down temporarily to the mount base to define and repeat the location of the cart when positioned under the M1 cell.
ENG09-088 : Maintenance Management SW Upgrade (Maintscape replacement)	Tasks: 1. Assess the performance requirements for the CMMS System. Performance requirements may include: a. web based system, b. capable of interacting with planning SW (Insight),c. capable of interacting with fault management software systems (Remedy), d. capable of interacting with GEA and other monitoring SW, e. efficient database search capability, f. calendar management issues " shifts, holidays, vacations, major shutdowns, g. resource management issues " visiting personnel, contractor support, h. access to documentation system database, drawing files, and text documents (manuals, specifications, reports, etc.). 2. Assess the functional requirements for the CMMS System. Functional requirements may include: a. management of daily/weekly/monthly maintenance work, b. preparation of instructions for carrying out work, including safety and special instructions, c. recording actions and remedies for faults, d. recording work hours for preventive and corrective maintenance tasks, e. spares inventory management, individual part tracking, and consumables tracking, f. reporting capabilities, trending (failures, performance degradation), and backlog management (tasks not completed in the work period). 3. Additional features: preventative maintenance planning, weekly plan, monthly mid-term plan, yearly long term plan, corrective maintenance planning, fault reports generate corrective maintenance tasks, shutdown planning, planning and scheduling for major events.
ENG09-124 : M1 wash cart improvements	Engineer a solution to the problem of dust generated by the air pads in clean room. Installation of handrails. Implementing a remote console for translation drive to avoid working under suspended load. Modifications to the cart legs for facilitating the replacement of failed air pads. Modifications to the center drain pan to avoid overspills.
ENG09-127 : A and G Handling cart and lab test fixture	Procure Handling and Testing Carts to provide a safe way for: 1) moving each module from the observing floor to and around the Laboratory; 2). tipping and rotating each module for maintenance, repair and testing. It is envisioned to have one cart per module (four in total per A&G). Each cart will have a pivoted top platform that would allow tipping the modules from vertical to horizon. The top platform will be equipped with a rotary table. Tipping and rotary platforms would be motorized. Pivot axis would be located at each module center of gravity. A total of 8 carts would be fabricated (4 for GS and 4 for GN).
ENG09-059 : Magnetron Upgrade	Replace planar magnetrons for new rotary (or TBD) technology, providing increased target lifetime and reliability.
ENG09-096 : Altair LGS zoom upgrades	Modify LGS zoom corrector for lower elevation angle operation
ENG09-137 : GS Instrument	Gemini proposes to build a GS Instrument Docking Station (IDS) on

Docking Station	the observing floor similar to the existing GN IDS. The IDS shall provide all necessary mechanical and electrical services required to keep science instruments in a near operational state including glycol, helium, compressed air, network, power and time bus services. With the arrival of new instruments at GS, this capability is critically needed. The estimated resources to execute the project are: ME 100 hr, MT 200 hr, EE 100 hr & ET 200 hr. $40,000 to procure and fabricate parts and hardware The project requires no telescope down time.
ENG09- 200:(DEV19) Update ICDs	Update the ICDs, particularly those needed by external instrument teams. This is largely a systems engineering task, but the impetus is coming from the DEV group.
ENG09-094 : Laser upgrades-C	Procure new (50W) class laser - duplicate of GS laser or procure from SOR team, or by collaborations (Keck, University of Adelaide, ESO, or by MK APO center (Fugate group)), or built in-house.
ENG09-069 : PCS Calibration improvements	PCS calibration process and/or AO controlling hardware upgrade. More reliable PCS, less noise by actuators out of range. This is to anticipate an aging of the PCS requiring major upgrades (like done at VLT). The calibration process is described at item 9 and 10 of: http://sitescape.gemini.edu/gemini/dispatch.cgi/PCSoptimization.
ENG09-074 : GMOS ADC implementation	Commission a deployable (in/out) ADC for GMOS. Better GMOS IQ at low elevation.
ENG09-129 : Bogie alignment monitoring system development	Bogies become misaligned often and it is labor intensive to maintain proper alignment. Dome rotational speed is reduced as a result. This project consists of engineering and designing a system to monitor bogie load and alignment. Implementation is deferred to 2010.
ENG09-067 : Upgrade PWFS	Upgrade PWFS scheme to allow for fainter stars and low-order (up to Z14) close loop operation, see: http://sitescape.gemini.edu/gemini/dispatch.cgi/f.midiriqtrou/docProfile/100035/d20071204215638/No
ENG09-008 : Reduction of NIRI Pattern Noise	This task is to continue working in NIRI noise reduction. The task involves a re-grouping of the engineers working on the problem and explores new avenues to tackle this important problem. Effort tied to detector controller replacement task.
ENG09-172 : LLT focus and collimation screws motorization	Allow remote fast IQ fine-tuning, tighter LGS on-sky, less engineering time to improve LGS (both sites).
ENG09-072 : NIRI f/6 camera improvements	Put new optics in NIRI f/6 imager to provide round IQ across whole field. Estimated cost: 50k. A professional optical designer would be hired to redo the design, optimized for 1-2.5 microns.
ENG09-171 : Upgrade coating plant HV valves	Replace Pneumatic HV gate valve 3.1 with controllable mechanical valve like 3.2. In case of failure of control, have redundancy to control plasma pressure.
ENG09-201: (SCI09-036) T-ReCS array controller repair	Improve T-ReCS data quality by improving the noise (was SCI08-035). Description: Negotiate an external contract with U. Florida to have Frank Varosi and Kevin Hanna come to Gemini and implement all of the electronic and software changes they have made with CanariCam which uses the same electronics and detector, and they have been

	able to reduce the array noise significantly over what we have now. Frank Varosi could also solve all of our outstanding software glitches (including SCT 257) probably in a week or so. There are a range of possible improvements from relatively trivial to highly invasive (e.g., rewiring the dewar). The first step is to do the cost-benefit analysis for each step. Rolando is in contact with K. Hanna, and some of the trivial steps may be attempted during the 2008 October shutdown. Note that the UF resources mentioned are also involved in Flamingos-2, so they could be contracted while here for F-2 support, but impact to F-2 commissioning needs to be considered.
ENG09-041 : GN Dome Sealing	Engineer Dome Seal Solution. Research inflatable seal system and new system infrastructure requirements. Purchase seal systems for shutters, vent gates, and Bogie Skirt. Install infrastructure and inflatable seals.
ENG09-060 : Continue protected silver coating development	Continue protected Ag coating development, addition of 4th magnetron to deposit AI or other enhancing material. Continue study of recipe (coating software + small AI Magnetron) , purchase large AI Magnetron.
ENG09-042 : GN Dome Painting	Paint dome, contracted. Research costs to recently paint other enclosures on MK. Prepare Request for Proposal, and get quotes to prep and paint. Manage contract.
ENG09-095 : Laser upgrades-D	Procure fiber laser upgrade study - commercial source or collaborations with LLNL.
ENG09-066 : Modeling of Telescope Systems	Develop tools for modeling system performance and error budgets so that we can better anticipate when aging parts of the telescope are starting to fail. We have no centralized, easy to use, system that tells us how the telescope should be performing and how it has performed in the past.
ENG09-203: (SCI09-058) Investigate long-pass filter for PWFS2, PWFS1	Improve the guide performance, in particular the limiting magnitude, of the peripheral wavefront sensors (SCI08-080).
ENG09-097 : Altair WFS upgrades	Implement new low noise WFS for NGS and LGS modes. Increase sensitivity.
ENG09-204: (SCI09-118) NICI Modifications and Upgrades	Science goals: to optimize NICI operations and usage. Description: this project should include any additional improvements or activities for NICI that carry over in 2009. Some modifications are needed to complete commissioning such as putting NICI on the bottom port. Upgrades include desirable features such as M2 offloading and an AO MEF extension to the data. None of the tasks in this project are critical to starting the campaign or queue operations in 2009.
ENG09-070 : PCS control mode improvements	New PCS elastic mode based control. Less crosstalk between modes, more accurate aO.
ENG09-205: (SCI09-108) Automatic header keyword ingestion for the environmental conditions	Once all the raw weather values are available in EPICS and the instrument headers. The system should be able to set the raw conditions percentile keywords (RAWCC, RAWIQ, RAWBG, RAWWV). This can be done on the fly or as a post observation procedure automatically.

ENG09-099 : Altair AO upgrades	Increase Altair spatial correction scale. New DM with more actuators and new WFS.
ENG09-073 : Telescope System Performance Characterization	To support the modeling of telescope systems and to tell when parts of the telescope are degrading in performance. We need to understand every aspect of our current system. GEA was our first step in this process, but we should visualize this stored data in a way that describes the system's performance characteristics. Specific systems of interest are the mount, the primary and secondary, full system guiding, and the A&G. Proper documentation of every system should be a byproduct of this effort.
ENG09-206: (SCI09-116) Implement Sky-probes to measure transparency	We need to accurate measure sky transparency during observations. CFHT's Sky-probe does this very well and this project will implement Sky-probe on both telescopes.
ENG09-100 : Canopus AO upgrades	Increase Canopus spatial correction scale. New DM with more actuators and new WFS.
ENG09-078 : Predictive Instrument Performance Monitoring	The current system of performance monitoring of instrumentation is a reactive model. We take data daily, don't analyze them, and react when there is a problem. The systems group should support the development of a system that analyzes that archived data and looks for negative trends to help us catch problems earlier saving time in the long run.
ENG09-101 : Sodium Monitoring	Use Lidar for Sodium abundance and elevation
ENG09-117 : M1 Cell node box cooling system	Mechanical engineering analysis and design of the chilled water circuit to balance flow and temperature. Mechanical design of flow restriction devices, flow sensors and temperature sensors. Mechanical technician effort to install the elements of the modified design. Leak containment and detection system design. I&T plus commissioning of the entire system
ENG09-109 : NIRI Detector Upgrade	New detector for NIRI with on-chip guide star connections
ENG09-098 : GN Laser Cutter upgrades	Retrofit z axis stage for focus. Increase room area
ENG09-110 : OIWFS upgrades	Improve OIWFS systems in NIFS, GNIRS and NIRI
ENG09-112 : Cyrogenics improvements	Upgrades to cryogenic systems at both sites
ENG09-038 : Weather Tower Upgrade (ENG27C)	Keep basic weather information reliable, e.g. wind direction and humidity for GS.
ENG09-132 : Provide access to the shutter drive boxes from inside the dome	Improve maintenance access to the shutters during winter
ENG09-089 : Investigate small coating plant for small optics	Investigate feasibility of a small commercial sputtering chamber for optics up to 1m (like instrument optics, M2s, etc.).
ENG09-140 : Silver effluent management improvements	Tank room improvements
ENG09-128 : Cassegrain Wrap services upgrades	Design, integrate, test and commission wrap services upgrades. More chilled water to instruments with either more lines or secondary loops. Investigate use of booster pump(s). Helium hose

	improvements to extend service life.
ENG09-151 : A&G Replacement Phase 3 - Fabrication, Integration and Test	Commissioning and Replace A&G's
ENG09-015 : In-Situ Wash upgrades	Hardware upgrades at GN and GS: put hard pipes instead of flexible hoses wherever possible. This will speed up the process.
ENG09-153: Facilities Upgrade - CP B - Build a warehouse facility in the area of the containers	Build a warehouse facility in the area of the containers
ENG09-071 : M1 baffle replacement	New M1 carbon fiber baffle light-weighted and optimized for ventilation. Better IQ, easier to remove for in-situ wash and other processes.
ENG09-064 : Re-polish one M2 mirror	Upgrade the GS M2 for MCAO, 2% absolute Strehl increase, less effects for visible imaging, less effects for GPI-like instruments. Alternative is to wait until GLAO DM M2.
ENG09-062 : Coating chamber cryo-pump upgrade	Add Telemark-like cryo water vapor pump at each site
ENG09-087 : Simulation	Considering science/engineering data we would simulate telescope conditions, generate 3D visualizations/animations to validate telescope systems and instruments performance.
ENG09-061 : Telescope Efficiency Optimization	Develop tools that allow night time telescope efficiencies to be monitored, visualized and finally optimized. Efficiency must be the goal of any queue based observatory and these tools will allow us to identify areas where we waste time and change our procedures and software to reclaim that time.
ENG09-080 : Full Data pipeline for Engineering & Science	To support the item above, full performance characterization of every system on the telescope (noise, zero points, etc), we should deliver a data pipeline with engineering functionality too, so we can monitor and predict instrumentation performances.
ENG09-019 : New A&G Project Phase 1 - Conceptual design thru CDR	New A&G Conceptual design through CDR
ENG09-024 : Organize Engineering Documentation	Organize drawings, ICD's, documentation
ENG09-039 : Web Based System Monitoring Tools (ENG22)	Need web-based monitoring system for non-EPICS systems and GEA improvements.
ENG09-045 : Sky Photometry Monitor (ENG276d)	Properly implement our site monitoring system at both sites - split into separate monitors at each site to allow prioritization across monitors.
ENG09-053 : GN Mirror Coating Preparations (B Tasks)	Coating preparation tasks that improve subsystem performance, permanently and properly install components, and reduce risk, would save time during the coating process.
ENG09-054 : GS Mirror Coating Preparations (B Tasks)	Coating preparation tasks that improve subsystem performance, permanently and properly install components, and reduce risk, would save time during the coating process.
ENG09-056 : Change uEs at GS	Hardware procurement and engineering shutdown for uE change

ENG09-084 : Improve coating maintenance techniques and processes	Improve CO_2 cleaning process. Re-evaluate the laser radiation based in-situ cleaning system for M1. Study polymer peeling technique for large optics and/or cold environments. Gemini contracted STI Optronics in 1994.
ENG09-102 : MCS Upgrades	Improve unguided performance and improve wind disturbance rejection.
ENG09-103 : A&G WFS Upgrades	Replace WFS with IR guides
ENG09-105 : CRCS Upgrades	Change current implementation of tracking mode
ENG09-107 : Electronics Upgrades	Tackle obsolescence issues in electronics equipment
ENG09-115 : M1 temperature control - radiation plate cooling system commissioning	Radiation Plate cooling system never commissioned. M1 temperature not actively controlled. This project is to complete the integration, testing and commissioning of the radiation plate cooling system.
ENG09-119 : Enclosure thermal management- commission the enclosure active ventilation system	Active ventilation system commissioning. Improve local seeing in low wind conditions.
ENG09-120 : Enclosure thermal management-commission the enclosure passive ventilation system	Passive Ventilation system commissioning. Improve daytime enclosure temperature control. Reduces load on Enclosure AC System.
ENG09-121 : Electronics Enclosure heat management upgrades	Reduce heat dissipated to the environment. Improve operating temperature for electronics.
ENG09-126 : M2 Handling equipment upgrades	New handling cart, lab test fixture
ENG09-130 : Drive bogie improvements	Install idler wheels of the drive bogie chains to reduce chain whip and improve local control of the drive.
ENG09-131 : Implement shutter chain tension sensors	Slack shutter chains have caused the shutter drives to jump links in the past causing risky realignment work.
ENG09-133 : Improve access to all grease fittings in the shutter drives boxes	Some grease fittings are extremely hard to access
ENG09-134 : Implement active methods of snow removal from the dome vent access platforms	Resources necessary to remove snow from the vent access platforms are extensive and the work is risky.
ENG09-135: Increase data transfer across the enclosure slip rings A	Improve remote sensing on the enclosure
ENG09-138 : M1 safety restraint upgrade	The current M1 safety restraint system is thought to be inadequate. A new restraint system is needed.
ENG09-139 : M1 Cover Upgrades	Allow operation at elevation angles other than zenith. Allow more live loads capability on closure beams for M1 in-situ wash. Improve reliability. Seal covers for M1 daytime dust protection.
ENG09-141 : Implement secondary cooling loops for	Split M1 cell, radiation plate, ISS and Top end branches of the CP4 circuit into separate local loops fed by liquid-to-liquid heat exchanger

telescope services	on the telescope mount. Implement leak detection and management in these circuits.
ENG09-145 : Implement variable speed drives for plant room equipment	Drives for Chilled water pumps, chiller compressors and air compressors changed to variable speed type.
ENG09-152: Facilities Upgrade - CP A - Add fabrication shop to North side of enclosure base	Add fabrication shop to North side of enclosure base
ENG09-156C: Facilities Upgrades - MK C	Lab clean area upgrades

G.5 Public Information and Outreach

Looking at the future of Gemini's Public Information and Outreach (PIO) effort, the connections between the technologies that drive the observatory, such as the ever-growing dependence on information technologies, and the challenges of supplying a workforce to maintain these technologies, present both interesting challenges and profound opportunities.

As mentioned elsewhere in this report, the observatory as an organization will be grappling with many issues over the next 10 years and beyond. These range from energy sustainability, global environmental stewardship, to the transfer of almost unfathomable amounts of information at the speed of light and managing all of this with a workforce that is evolving almost as quickly as the technologies that our employees will interact with daily.

The Gemini PIO effort will play an important role in not only utilizing these advance information technologies to share our exploration of the universe with the world, but in supporting our organization by facilitating communications, inspiring our future workforce and creating a legacy of Gemini's results that the public can appreciate.

To accomplish this will require that we embrace the new technologies and mindsets that will shape our observatory through the next decade.

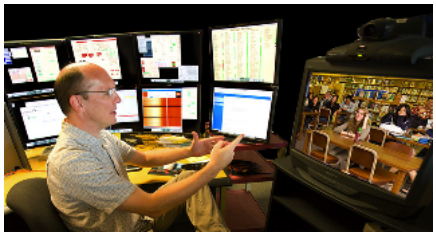


Figure G.5.1. Gemini Outreach Scientist Dr. Scott Fisher uses internet technology to reach out to students around the world as part of the "Live from Gemini" program that illustrates how Gemini will incorporate new technologies and partnerships to share our discoveries with the world.

Internet technologies will become ever-more interactive and immersive. Educational products will be accessible to everyone at all levels of interest and aptitude. Providing virtual experiences that engage students, educators and the public in a compelling and human way will be essential to our success. This means delivering our message in a manner that makes a human connection. It is easy to neglect the human connection when utilizing technology and we will need to be vigilant in avoiding this pitfall.

At the other extreme is the highly personal connection we make in our host communities. While we should not strive to simply maintain our existing level of interactions with our host

communities, we need to evolve to meet the needs of our local teachers, parents and students. Engaging families in learning experiences that allow partnerships with local businesses has proven to be an extremely effective way to leverage our resources while sharing the satisfaction of our success with other organizations that have the same goals and desire to share with humanity.

An additional benefit of local outreach is the impact it has on our future workforce and inspiring students (especially in our host communities) to aim higher than they might otherwise. Our staff represents some of the brightest and most inspirational thinkers and explorers anywhere. Our communities have much to gain from our staff and we need to be able to engage the public in our communities so that this generation has no misunderstandings about what we do at Gemini and the inspirational nature of our exploration.

Like initiatives in other Gemini groups, it will be important to maintain existing, and foster new partnerships within our existing networks of observatories (much like the Gemini/Subaru instrument partnership with WFMOS and the Journey through the Universe model we already have in place), with local businesses and formal and informal educational institutions. While this is already an important part of the PIO philosophy, growth in our partnerships will need to be a central part of our future if we are to expand our impact and sense of community in our programming.

Finally, our vision of the future of PIO at Gemini needs to have a strong global element that is focused on our partnership. This is an element that builds on the inspiration we foster in our local communities, utilizes the global information technologies to spread the awe we generate beyond geographical and political borders and allows anyone who wants to learn more about Gemini to go as deep as they choose with no obstacles. Engaging our partnership will be a critical element of this global effort and as we enter the second decade of the 21st century it is likely that the Gemini partnership will evolve. This evolution is part of the life of Gemini and will provide opportunities for growth, new resources and fresh perspectives.

Bringing these visions to reality in a manner that will align with the purpose of the Gemini Observatory, which is to “Explore the Universe and Share its Wonders,” will require the support and active participation of everyone involved in Gemini, from all staff to the Gemini Board. In the final assessment sharing our work with the world cannot be forced, it will be the quality of our staff, the inspiring nature of our results and the human spirit of exploration that will drive this effort and make it a success.

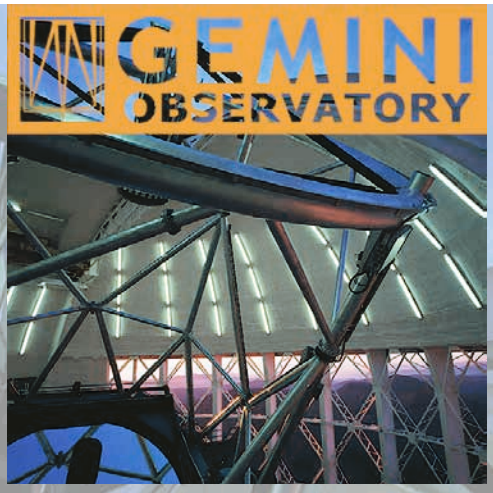
The following (Table G.5.1.) represents several of the initiatives that are envisioned for implementation in future years to fulfill the objectives discussed above.

Table G.5.1. PIO long-range plans/tasks for 2010 and beyond.

TASK TITLE	TASK DESCRIPTION
Library Image Catalogue	Establish on-line catalogue of key Gemini images. Utilize ongoing internship program to perform repetitive work functions.
Civic Organization Support	Increase participation in local, host community civic organizations
ProjectAstro - Chile	Begin limited pilot ProjectAstro site in La Serena Chile
StarTeachers	Develop variation of StarTeachers educational exchange that involves all partners who choose to participate.
Virtual Tour Web Delivery	Adapt the popular Gemini Virtual Tour for WWW delivery for broader access and increase language options.
Gemini Traveling Exhibit	Develop and exhibit of Gemini images and background information that travels throughout the Gemini partnership.
Live from Gemini Expansion	Expand the Live from Gemini program to allow more, regularly scheduled programming throughout the partnership.
Public Webpage Development	Improve Gemini's public webpage content, graphics and ADA accessibility.
Electronic Publications	Improve accessibility to Gemini's publications online
Informal Science Education Resources	Provide timely and effective resources on Gemini for the global planetarium community.

G.6 Environmental, Health and Safety (EH&S)

The Gemini long term EH&S goals focus on developing a fully engaged workforce in a continuous quality improvement environment where risk-based decision making has led to comprehensive proactive risk mitigation. The workforce consistently demonstrates 100% safe behaviors and has the knowledge, support, and necessary tools required to maintain a safe and healthy occupational environment in the midst of the Gemini high performance culture. The stated goal for Gemini achieving world class EH&S performance is December 2012. The means of measuring Gemini world class EH&S performance will be accomplished starting through an agreed upon standard of measurement from either OSHAS 18001, the OSHA Voluntary Protection Program (VPP), or the DNV International Safety Rating System (ISRS-7).



SECTION H

ADVISORY COMMITTEE REPORTS

H. Advisory Committee Reports

The Gemini Observatory and AURA have several oversight committees who give advice to the Director, the Gemini Board and the President of AURA on the observatory's scientific and management directions and strategies. Two of the most important, from a user's perspective, are the Gemini Science Committee (GSC) and the AURA Oversight Committee-Gemini (AOC-G).

The Gemini Science Committee advises the Director and the Gemini Board on scientific strategies, productivity and users' issues. The GSC held its regular annual meeting on October 6-7, 2008 in Hilo, Hawai'i. The GSC also held several teleconferences during the year. A special meeting of a sub-set of the GSC took place during the Marseilles SPIE meeting in June 2008. Finally, three GSC members were closely involved in the 2009 Observatory Planning Retreat.

The GSC has re-stated the instrument priorities for the near-term insisting on the deployment of red sensitive CCDs (Gemini North first and then Gemini South) and stating a preference for the Hamamatsu devices. Completing GNIRS repair and re-commissioning the instrument on the telescope confirmed the observatory priority of doing this in the most timely fashion. For Altair, the Gemini North adaptive optics optical bench, the GSC recommended exploring a larger field of view for the tip-tilt field lens, completing a full error budget for Altair/LGS performance and investigating LGS operation without tip-tilt. For Gemini South, the earliest start of the NICI planet finding campaign was emphasized, followed by the completion and commissioning of FLAMINGOS-2, and MCAO/GSAOI.

The GSC strongly urged the rapid pursuit of the remaining Aspen instruments and their associated contracts. The GSC discussed the format for the future Gemini Future Science Workshop, and supported an approach where substantial national feedback would be gathered through pre-meetings led by the various communities.

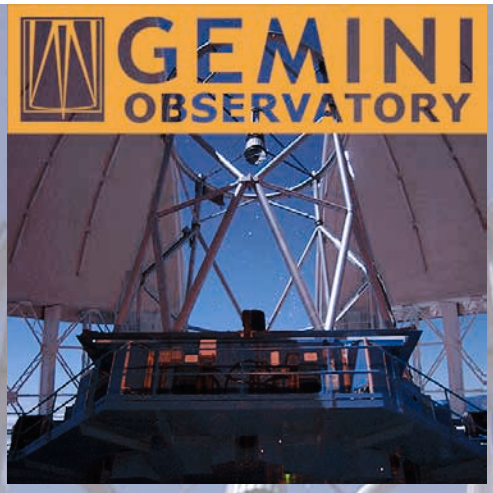
The GSC, who acts as the Gemini Users Committee, reviewed, commented and made recommendation on several users' issues including: telescope subscription rate of observing time, difficulties encountered by users with the Phase II skeleton, challenges of the Gemini data reduction packages, and the status of the Gemini science systems web pages.

The AURA Oversight Committee Gemini (AOC-G) provides oversight for the management of the Gemini Observatory. The AOC-G met twice during the period covered by this report, both times in Hawai'i on March 17-18, 2008 and again on September 9-10, 2008.

The AOC-G dealt with several management and personnel matters and provided the President of AURA and the observatory with strategic advice on several issues. Here is a summary of some items addressed:

- The AOC-G has recommended that the highest possible priority be given to the effort to repair the Gemini Near Infrared Spectrograph in order to return it to the Gemini community as soon as possible.
- The AOC-G expressed deep concern about the lack of progress on FLAMINGOS-2 and encouraged the observatory to explore all options for completion of the instrument.

- The observatory was urged to focus additional resources to increase the reliability of the Gemini North Laser Guide Star Adaptive Optics system. The committee stated that experience gained in improving the Gemini North laser may ultimately pay dividends in enhancing the productivity of MCAO at Gemini South.
- The AOC-G expressed concern for the scope, timescale and effort required for the completion of the Data Flow Project as currently envisioned and recommended a carefully planned approach with minimal steps at a time.
- The AOC-G congratulated the Gemini staff on the successful implementation of its safety plan, and especially for engendering a positive reception of the new safety culture among the Observatory personnel.
- The Observatory was commended for the successful and timely commissioning of the near infrared coronagraphic imager NICI.
- The Council commended the observatory on the excellent progress made in building closer ties to the Japanese community, thereby laying groundwork for collaboration on WFMOS.
- The Council congratulated the Director on his success in initiating and developing internal management planning tools and procedures through a tremendous amount of work and dedication.
- The Council endorsed the Observatory's proposed plan to no longer clear laser pointings with Space Command, and instead to post relevant and timely information on a website about current and planned laser pointings.



SECTION I

GEMINI'S FUTURE AND KEY STRATEGIC ISSUES

I. Gemini's Future & Key Strategic Issues

I.1 Recruitment Challenges

While improvements have been made in our recruitment efforts in 2008 (see "Recruiting" summary in Section E.2.2), we still face several recruiting challenges at Gemini. Most of our challenges arise from the reality that both Gemini telescopes are based in locations that are remote from large population centers. The small population and a lack of a sizable technology base make it less likely that some of skills Gemini operations require will be available at our local sites. Therefore we are often required to look outside of our communities and even outside of the countries we operate in to find the workers who possess the skills that we require.

We often face challenges in enticing workers to our remote sites from elsewhere. The Hawaiian islands are considered the most remote land mass in the world. This adds to the feeling of isolation for "imported" personnel who would find themselves many miles and several airplane flights from family and friends. This can also be a concern for individuals who are considering relocating to Chile. In both cases as well, new Gemini workers can find themselves in places where the people speak languages that are not familiar to them, a factor that can also intensify a feeling of isolation. Another similarity for individuals who are considering relocation to Hilo or La Serena is the fact that there may not be an opportunity for the worker's spouse to find employment, either because the spouse is barred from working due to visa restrictions or because the community is small and jobs are not available in the spouse's field. Add to these factors concerns about school quality and the availability of medical care, especially for Hilo recruits where there is currently a shortage of doctors, and the result is that recruiting can be difficult and it can take some extra time to find people who will thrive in their adopted home.

Recruiting challenges that are internal to Gemini relate to recruiting logistics, such as time zone coordination issues and delays for telephone interviews, scheduling complications when travel is required for short list candidates and even scheduling conflicts within the interview committee exacerbated by the brief "overlap" time between Chile and Hawai'i each work day.

Despite these recruiting challenges, we have been able to recruit 18 individuals so far this year from areas outside of Hilo or La Serena. At this writing, we have only eight open positions, less than 4% of our total staff.

I.2 The Aspen Program

The generation of new instruments currently under development for the Gemini Observatory was defined by the Gemini community of astronomers several years ago, culminating in a 2003 conference in Aspen. Far more than incremental improvements to existing instruments or technologies, the Aspen instruments are being designed and built to answer fundamental questions in astronomy. While Aspen originally aimed to define instrument development priorities for the 2006-2010 time-frame, it is clear that the impact of Aspen will extend well into the next decade. Gemini's long-range science goals and planning process remain pinned to the

current Aspen development program. The observatory is now entering the planning process for the next decade, and the results and lessons learned to-date in the Aspen program will factor into the planning for the generation of instruments that will follow Aspen.

The Aspen instruments require new technologies and operational paradigms that require broad community collaboration and large science programs. To make meaningful progress in answering fundamental questions facing astronomy, we must work together within the Gemini partnership and with new partners around the world to make the most of the limited funding that will be available for astronomy research in the coming years. Technical and programmatic elements of the Aspen program have been described earlier in this report. Here we mention some of the key challenges that remain ahead:

Technology: The Aspen instruments are at the cutting edge of technology. The Gemini Planet Imager (GPI) is pushing the limits of current adaptive optics technology. Test-bed experiments are being used to verify the viability of such technologies as micro-machined deformable mirrors, apodized (high-contrast graduated) masks, and infrared wavefront sensors. The Wide-Field Multi-Object Spectrograph (WFMOS) design study teams are developing new ways of packing thousands of individually-addressable fiber positioners in a limited space and weight environment. The Ground-Layer Adaptive Optics (GLAO) project will require an adaptive secondary mirror, laser guide stars, and new AO control algorithms.

Funding: Aspen is being financed in an extremely competitive environment across the partnership and our ability to complete the Aspen science mission is at risk. The Precision Radial Velocity Spectrometer (PRVS) instrument was canceled for financial reasons, even after we negotiated contracts with pre-defined “off-ramps” at multiple points to minimize Gemini’s financial risk. It is important to recognize that we depend upon instrument builders that are typically funded through “soft” money, so funding uncertainty at Gemini has significant knock-on effects in our entire development program and may drive instrument builders to find other projects. At the very least it makes it difficult to maintain the morale and motivation of the teams when funding to continue and finish the instrument is not guaranteed. Finding a way to more consistently fund new instrumentation in the next decade will be important to getting the best instruments built at the lowest risk and cost. Funding uncertainty leads to wasted money on studies and canceled projects, and discourages good teams from participating in the first place.

Inter-observatory Collaboration: Instruments of the size, cost, and complexity of WFMOS cannot realistically be pursued by a single observatory and are compelling Gemini to forge new strategic relationships with Subaru and the National Astronomical Observatory of Japan, who are in parallel developing the HyperSuprime Camera. HyperSuprime will share infrastructure and science goals with WFMOS. The new SPHERE instrument being constructed for VLT shares a science mission and technical approach with GPI. Working with ESO on a joint GPI/SPHERE science mission represents another possible inter-observatory collaboration that could pay large dividends. Aligning long range development programs across observatories is a key challenge in our future.

New Operations Paradigms: The amount of telescope time needed to complete the Aspen science campaigns will be measured in hundreds of nights over many years. This cost is likely too high for a single observatory or community to bear, and therefore motivates pursuing new types of scientific collaborations to spread the burden for such campaigns across multiple telescopes through time exchange programs. Again, Gemini is playing a leading role in this area through the Mauna Kea network of major observatories (Gemini, Keck, and Subaru)–a system we intend to expand to other observatories, possibly including VLT, in the future.

New Contracting and Risk Management Models: The institutions involved in building the Aspen instruments have not been willing to sign fixed-price contracts without sharing some of the risk of cost-overruns with Gemini. Aspen instruments are technologically challenging, of course, and it is often difficult to quantify the cost and schedule risks associated with new cutting-edge components. Exchange rate risks are also particularly difficult to quantify in the current financial environment. Aspen instrument teams have negotiated to limit their liability and exposure to risk areas that are outside their control. Gemini has had to migrate away from the previous "simple" fixed price contracts used in our early generation of instruments to contracts involving considerable (30%) contingency and shared risks in order to accommodate the needs of the builders of astronomical instruments. The current global financial uncertainties will only make the shared-risk contracting process more complex and more important.

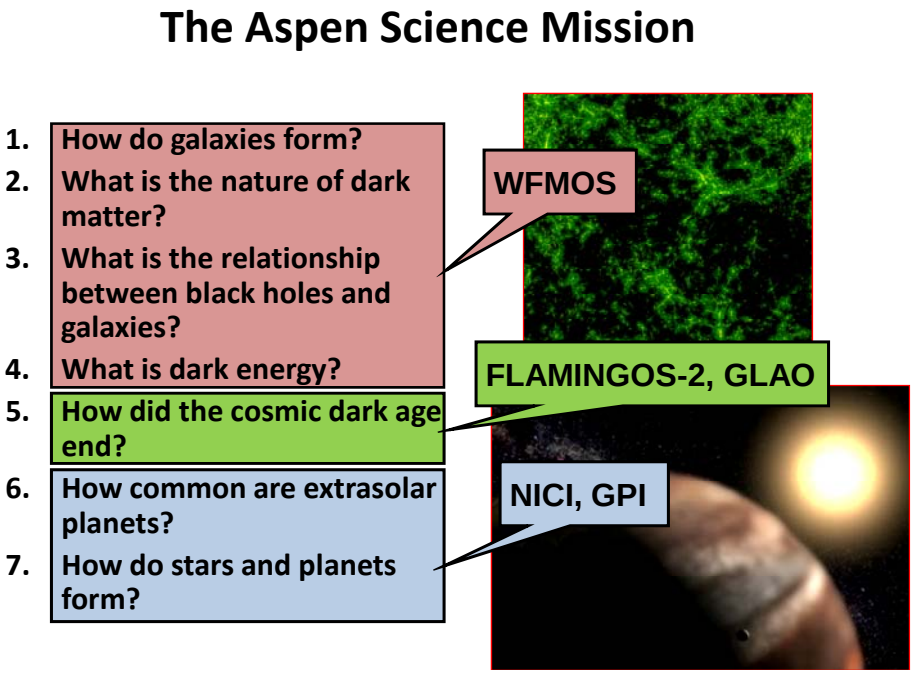


Figure I.2.1. The questions identified through the Aspen process have been mapped onto the instruments that together stand to make significant progress toward answering some of the most profound questions about nature before society. Note that the original Aspen instrument complement also included a High-Resolution Near-IR Spectrograph (HRNIRS) and PRVS, which have been cancelled. NICI and FLAMINGOS-2 are current–generation instruments that will contribute to meeting the Aspen science goals.

I.3 Science initiatives

Gemini Observatory is currently involved in a close consultation process led by the Gemini Science Committee and involving the national communities to develop a science vision for the 2010-2020 period. Coming events that will help to crystallize this vision are the Joint Subaru/Gemini Science Conference (Kyoto, Japan) in May 2009 and an Abingdon/Aspen-type meeting in 2010. While conducting this process, we are absorbing the inputs of the various Gemini partner planning exercises.

I.4 Base and Dorm Facilities

I.4.1 La Serena Base Facilities

The Gemini base operations in La Serena are housed in three facilities. There is the two-story, 17,665 square-foot Southern Base Facility (SBF) that houses the majority of the staff, the temporary building called Casa Verde that houses about sixteen staff, and a spacious rental home adjacent to the SBF called Casa Ocho that has been remodeled into offices and houses about ten staff.

We expect staffing levels in Chile to remain about the same in the foreseeable future, so we do not need to plan for more space than these three facilities provide us. However, we would like to consolidate our facilities to the extent possible, and also must bear in mind that Casa Verde has not been constructed for indefinite use. So, while the current approach is working for us now, we need to begin to explore possible future solutions.

Three approaches are under consideration, either separately or in conjunction. First, we have participated in discussions with the LSST team who is planning a base facility on the La Serena AURA campus. It is possible that we could share some space in a new LSST building. The timing of the construction is uncertain, but is likely to be several years down the road.

A second possibility is a fairly extensive expansion of the current SBF. The building was designed to bear a third story, if necessary. Or, similar to the extension in the North, a free-standing extension could be built. An effort like this has not been planned in the current 5-year budget, and we must conduct basic research on such an expansion before judging its viability.

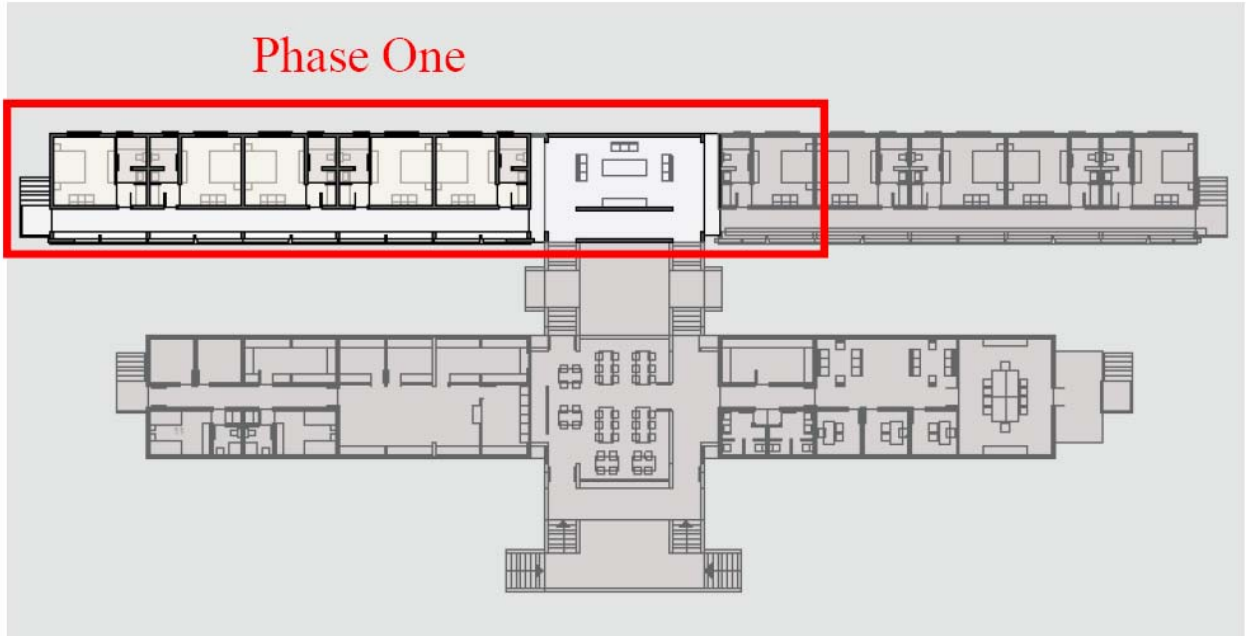
Our third approach is to reassess the space in the existing SBF to identify ways to utilize it more effectively. In 2008, we took action on this approach and converted former archive space in the SBF into office space, creating one permanent workspace and four visitor work stations in the remodeled room. Two windows were built into the room, one on the external wall and one on the internal wall, in order to create a well-lit and spacious environment.

In 2009, we will identify and explore other build-out possibilities in the existing SBF and undertake basic research on possibilities for future SBF expansion.

Figure I.4.1.1. Remodeled SBF offices

I.4.2 Cerro Pachón Dorms Expansion

In 2008, the AURA Corporate Office undertook the construction of the first phase of a Dormitory on Cerro Pachón next to the AURA 20-unit construction camp and about 3.5 kilometers from the Gemini South telescope. Phase I, completed this year, includes five dormitory rooms, a common room and a paramedic office. The facility will comprise, when finalized, 10-12 dormitory rooms, a dining facility, a common room, program offices, a conference room and a paramedic office.



The funds for Phase I were provided by the AURA Corporate Office and will be paid back over the course of several years through the nightly per use fee. Demand for the dormitory rooms has been high, and the overflow is being diverted to the adjacent, and outdated, 20-unit AURA facility. The observatory will be asking the Gemini Board to allow expenditure of Gemini partnership funds for Phase 2 in 2009. Phase 2 has not yet been specifically defined, but since there is a need for additional sleeping space, it is highly likely that Phase 2 will include additional dormitory rooms. The completed Phase I is pictured below after a winter snowfall.

Figure I.4.2.2. Phase I of Cerro Pachón dorms expansion.

I.5 Long Range Planning Process

Gemini has embarked upon a comprehensive long range planning process intended to define in broad terms the state of the observatory around 2020, when the "landscape" of astronomy will have changed significantly in an era of JWST and next-generation ELT and panoramic ground based telescopes. This is a crucial step in the aforementioned planning system which heretofore has been focused primarily on near-term/tactical objectives and ultimately needs to be pinned to a longer term vision for the observatory. This is more than a conventional "blue sky" assessment of what the observatory should look like in 2020. Instead, it is a multifaceted analysis of long range objectives from each branch of the observatory, recognizing that the viability of any long range plan (LRP) is linked to the viability of the technologies and resources available to support that plan.

The end product of this LRP process will be documented and incorporated into Gemini's next funding proposal, which ultimately sets the timeline for its development. In the figure below (Figure I.5.1) key milestones in the development of the science component of the LRP are identified including review points (Gemini Visiting Committee and Mid-Term Management Reviews), the Kyoto and a proposed 2010 Future Science Workshops, and ultimately the start-up of Gemini's next International Agreement. In the end, all of these events are linked and need to be coordinated to ensure a coherent science based LRP emerges from this process that is consistent with the ambitions of our community yet also constrained by the resources available to ensure success.

The initial steps in the LRP process already occurred in 2008 with the formulation of components from each of the science operations, engineering, administration, and

development teams at Gemini. Some of the early findings of this process are in fact already reflected in the 2009 observatory plan. For example a new energy conservation initiative will be launched next year. Also under serious consideration is an initiative from science operations intended to fundamentally alter the operating paradigm for Gemini by providing essentially guaranteed data to observers through a more judicious use of our existing rollover program. Engineering proposed, among many initiatives, to develop a standalone development team to help protect and better define resources needed to develop new capabilities vs. maintain the telescopes.

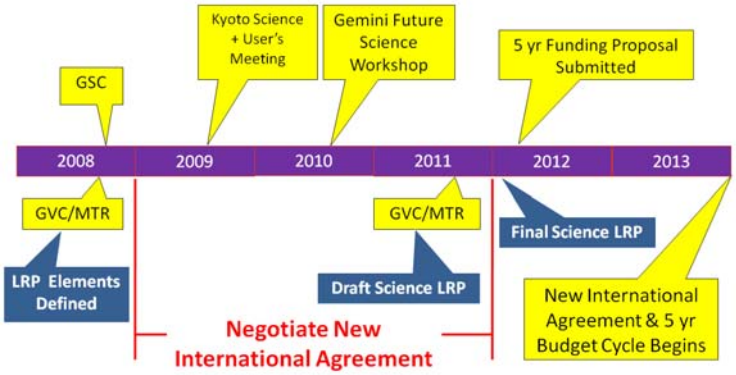


Figure I.5.1. The nominal timeline for the development of the science component of the long range plan is shown on the same timeline as various related key milestones, including GVC/MTR reviews and the negotiation period for the new International Agreement. This timeline is notional only and subject to change as details are refined.

Linked to all of this future activity is the negotiation of the next International Agreement which is due to expire in 2012. Dovetailing our already fairly sophisticated planning system with these important parallel activities will require considerable oversight and diligence in the years ahead at Gemini Observatory.

I.6 Community Engagement & Communications

In FY 2008 the AURA/Gemini Observatory Community Engagement Grants (CEG) program entered its second year and continued the success and impact that was seen in the program's first year in FY 2007. The program's funding was increased from $5,000 in year one to $6,000 (US) this year which was divided equally between the Gemini North (East Hawai'i) and Gemini South (Region IV, Chile) host communities. The goal of the program is simply to provide funding for programs that impact our host communities (La Serena and Hilo) in a significant way and promote the education, culture and overall health of the communities that Gemini calls home. Furthermore, this funding was made available to fund initiatives that would be impossible under the constraints of our existing Cooperative Agreement.

The CEG program entered its second year with very little need for the solicitation of proposals since the first year of the program provided strong word-of-mouth communications and Gemini's extensive community connections produced requests from more worthy programs than could be funded with existing resources. In the end a total of eight[1] proposals were

[1] One program (in Hawai'i) was funded at $250 but was never collected due to personnel changes (the teacher requesting the money changed schools) and the program was discontinued.

selected and funded from Chile and Hawai‘i and the following summaries present an overview of each funded program.

Gemini North Programs Funded:

1) Student Tickets for Hawai‘i Concert Society:

Funding at the level of $500 allowed the purchase of approximately 50 tickets for local students to attend events of the Hawai‘i Concert Society. Students were selected by financial need as well as geographical diversity. See Figure I.6.1.

Figure I.6.1. Members of the Spanish Brass Quintet visit Hilo High School where students received free tickets funded by AURA Community Engagement funding through the Hawaii Concert Society.

2) Robotics Program Equipment Support:

Funding at the level of $750 allowed the purchase of robotics equipment for economically disadvantaged students at Chiefess Kapiolani Elementary School in Hilo.

3) East Hawaii Science Fair Travel Support:

Funding at the level of $750 was provided in order to support up to three economically disadvantaged students with top science fair projects from East Hawai‘i to travel to Ohau to participate in the State Science Fair.

4) Sustainable Communities Conference Student Travel Support:

Funding at the level of $750 was provided for 3-4 economically disadvantaged students to attend a conference called Ho‘oulu Aina that deals with food/energy sovereignty in Hawaii on Kauai on June 11-15, 2008.

Gemini South Programs Funded:

1) Conference Room for El Molle School:

Funding at the level of $1000 was provided to close an open back yard to build a room that would be use for the school, for the community, as a library and other functions. See Figure I.6.2.

Figure I.6.2. Students utilize the enclosed space at the El Molle School in Chile which was built with support from the AURA Community Engagement funding at Gemini.

2) Support for Soccer School for Disadvantaged Children:

Funding at the level of $500 was provided to the Club de Futbol San Marino to benefit 4-5 kids between 8 to 10 years old that participate in soccer school all throughout the summer.

3) Restoration of El Tambo Church:

Funding at the level of $1000 was provided to assist in restoring El Tambo Church, one of the oldest and smallest churches in the vicinity of the Gemini South telescope area.

4) Videoconference Teacher Training for Concepción/La Serena Teachers:

Funding at the level of $500 was provided to help sponsor videoconferencing expenses for La Serena teacher workshops connecting with a Space Camp Teacher at the University of Concepción.