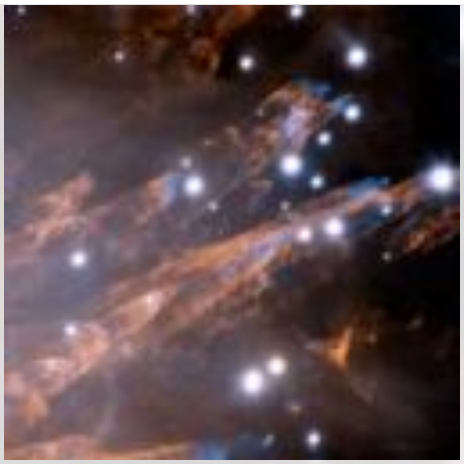

# 2007

# Annual Progress Report and Program Plan of the Gemini Observatory

Association of Universities for Research in Astronomy, Inc.



# Section A

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# Director's Summary & Overview

# A Director's Summary & Overview

Walk into the lobby at the Gemini base facilities in La Serena or Hilo and you'll notice a unique set of displays. Colorful LCD panels highlight the faces of Gemini staff members, reminding everyone of the breadth, depth, and diversity reflected in the people that keep the Gemini "engine" purring 365 nights a year. Nearby, you will find large framed posters summarizing the working culture we strive to achieve, emphasizing ideas like *trust*, *accountability*, and *integrity* (Figure A.1).

Figure A.1. Staff directory and Gemini's Working Culture display at Hilo Base Facility.

In the very near future, you will also see the mission statements of the various functional divisions at Gemini. These will capture how we intend to take an observatory crafted in the 20th century well into the 21st. Finally, you will also see large framed posters, signed by Gemini's senior management team, summarizing the core elements of our new health and safety policy. These are all foundational elements as we move Gemini's focus away from the high-energy construction phase that created these marvelous machines of discovery. Now we look forward to a lasting and sustainable science operations era that lets our community reap the rewards of the hard-earned investments made in these truly unique research facilities.

Those are the most obvious changes, made to be self-evident the moment you walk through our doors. However, there are more "behind" them, many with deep roots in the transformation of the Gemini Telescopes Project to Gemini Observatory. Central to these is the new annual planning process that engages both the staff and community to decide, at a detailed level, what tasks we should pursue (Figure A.2). This planning process, and of equal importance, the execution of the plans it creates, is crucial to the long-term viability of the Observatory. It is through this plan that the Gemini "engine" is throttled – *fast enough to keep pace with the demands of a technology-driven science like astronomy yet slow enough to avoid burning out our most precious resource, our staff*.

Figure A.2. October 2007 planning meeting in Santiago, Chile.

Gemini's new planning process has other functions. In the near term, it builds accountability into our actions as a team. Tasks integrated into our plan will have names and completion dates assigned to them, a procedure designed to inject integrity into our organization. That integrity will instill confidence and pride into our staff, as we demonstrate year after year that we can accomplish what we have committed to achieve. Our planning process and its outcomes will also help our advisory committees,

governing boards, and user community recognize that this special place called Gemini Observatory is both visionary and well grounded.

Readers of past Gemini Annual Reports will recognize this year's edition as a major departure from previous versions. The new look and content are all part of the same multifaceted transformation at Gemini designed to integrate and streamline our operations. The largest change in the pages that follow is the deep connection between the Observatory plan and this report. In essence, this report is designed to make it possible to quickly and easily identify the elements of Gemini's annual plan and gauge our progress in executing that plan. While the year-one (current year) component of the Observatory's plan is extremely detailed, it is actually the first phase of a five-year plan. The out-years (beyond year-one) in our plan are designed to identify important tasks, objectives, and milestones. Together, these comprise a strategy for reaching our long-range goals. The distinctions between the plan and its execution are important, and when woven together with deliberate and conscientious plan execution, represent a continuum of tasks, resources, and ambitions that collectively have a deep impact on Gemini.

Let's look in more detail at how we have restructured Gemini's Annual Report. First, we showcase the "Best Science of the Year." Placing this first in the Annual Report was no accident. It reflects our overarching mission to support forefront research intended to ultimately transform our understanding of the universe and our place in it. Metrics of scientific achievement are also listed in the form of peer-reviewed scientific publications and observing programs executed by the Gemini twins.

Next, we showcase Gemini's world-class staff members. They enable all of the previously described discoveries. Next, we explain our new organizational chart, followed by highlights of important achievements made in the local Gemini communities of Hilo and La Serena. This section, titled "Fulfilling Our Mission Through Community Involvement" reflects a key component of Gemini's mission. Our public information and outreach (PIO) teams in Hawai'i and Chile engage the local schools through educational programs such as *Journey Through the Universe* and *FamilyAstro* Nights (Figure A.3). Through these (and other) efforts, spearheaded by Gemini and involving dozens of non-Gemini astronomers and education professionals, literally thousands of children are exposed to the wonders of astronomy.

Figure A.3. FamilyAstro night at a Hilo area school.

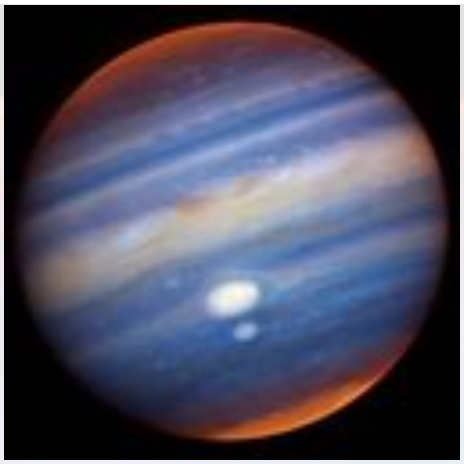
Such outreach programs are extremely fulfilling because, without a doubt, some small fraction of these children will turn to the stars and become the next generation of astronomers to use Gemini in the decades ahead. We are truly planting the seeds of possibility in the minds of tomorrow's generation of intrepid astro-voyagers, a legacy that an international facility like Gemini is uniquely poised to leave in its wake.

We then summarize examples of innovation and leadership in Gemini's staff. With programs like the world's first multi-conjugate adaptive optics system under development, pioneering science operations through our advanced queue-based systems, and a complete revitalization of our safety program, Gemini is forging "new ground" on many levels that deserve special recognition.

We describe areas of special achievement during the last reporting year. While our thrust is focused on maintaining regular science operations, we also have many achievements that are highlighted like the arrival of NICI, the establishment of a new on-line purchase requisition system, and accomplishments with reducing telescope downtime. The bulk of the remainder of the Annual Report is then devoted to succinct summaries of planned vs. achieved accomplishments for each functional group across the observatory. Tasks are briefly described and the completion rates for those tasks are listed, giving the reader insight into the strengths and weaknesses of our plan execution over the past year.

From there, mid- and long-range elements of Gemini's long-range plan are summarized in four sections, reflecting the 4 major divisions within Gemini's organizational structure. Key current-year findings from our advisory committees are then presented, to give the reader some perspective of how the Observatory "stacks up" through the eyes of our science and management advisory panels. Finally, a sampler of key strategic issues on our radar screen is provided to round out issues, risks, and mitigation strategies embedded in our 5-year plan.

These are the elements of our new Annual Report. We hope the readers of Gemini's future Annual Reports will learn who we are and what we do at Gemini Observatory. In the meantime, as we demonstrate our ability to make plans then execute them toward a common vision along a pathway defined by our plan, we will gain confidence in our ability not just take the next step in our journey, but to navigate our way to a vastly better "place" that exists well beyond our horizon and into our future.



## Section B

# Science at Gemini: The Year 2007 in Review

# B Science at Gemini: The Year 2007 in Review

## B.1 Science Highlights

The Gemini telescopes and instruments continued to serve a large multi-national community with a very broad range of scientific interests and goals. The multitude of forefront science areas explored by Gemini investigators vividly illustrates a pioneering approach, highlighted by some of the remarkable results published in 2007. These include studies of the nature of ices on the small icy moon of Pluto, Charon, at the edge of our solar system, the discovery of the most massive stellar black hole in the nearby galaxy M33 (three million light-years away in the direction of the constellation Triangulum), and exploring the most energetic objects – quasars at a redshift of 6 − showing them as they were, when the universe was barely one billion years old. These results are just a sample of the many published in the 120 scientific papers that appeared in the most recognized refereed journals during the last year.

**An Ice Machine in the Outer Solar System:** A team led by Jason Cook (currently at Southwest Research Institute) has provided the strongest evidence to date for the existence of a subsurface liquid ocean on Charon, the small icy moon of Pluto, the most distant "planet" in our solar system. Cook et al. conducted time-resolved spectroscopy of the Pluto/Charon system using the Gemini adaptive optics system ALTAIR/NIRI. They found striking spectral features of crystalline water and ammonia hydrates. Because water ice would become amorphous on a time scale as short as a few tens of thousands of years (due to ultraviolet radiation from the Sun and cosmic ray bombardment), some mechanism(s) must be at play that refresh the icy surface with new crystalline ice. The team argues that cryovolcanism is the most likely mechanism for surface renewal (Figure B.1). Radioactive decay provides the interior heat source that melts and creates liquid water and subsequently brings the water to the surface. Evidence on the surface suggests that Charon possesses a substantial abundance of ammonia in its interior. Ammonia mixed with water depresses the melting point of water and decreases the conductivity of ice. This allows liquid water to exist at a temperature as low as 176 K. There is no ocean on Charon now, but the ammonia-rich model permits water at the base of the ice shell.

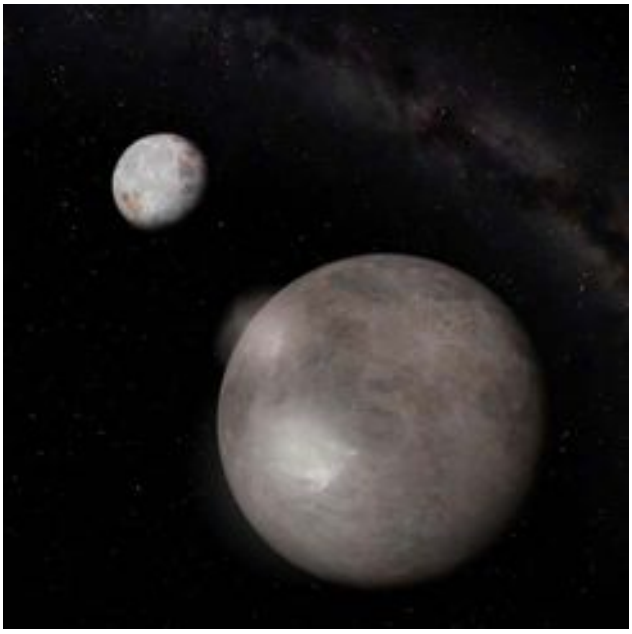


Figure B.1. Artist's conception of Charon (with Pluto in the background) against the backdrop of the Milky Way. The plumes and brighter spots depicted at left on Charon are thought to be created as water (with ammonia hydrate mixed in) "erupts" from deep beneath the surface. The material sprays out through cracks in the icy crust, immediately freezes and snows crystalline ice down onto the surface, creating a water-ammonia hydrate ice field. (This composite image includes Pluto and Charon models (enhanced), courtesy of Software Bisque. www.seeker3d.com, with plumes and ice fields added by Mark C. Petersen, Loch Ness Productions. Star field from DigitalSky 2, courtesy Sky-Skan, Inc.)

**The Gemini Deep Planet Survey:** David Lafrenière, René Doyon (both of University of Montreal) and a team of exoplanet experts have completed the Gemini Deep Planet Survey. Using the Gemini North Adaptive optics system ALTAIR/NIRI, they have searched for giant planets and brown dwarfs around 85 nearby stars younger than 100 million years of age. They found that the probability of the existence of at least one young Jovian (of 0.5 to 13 Jupiter masses) in the 10- to 50-astronomical units zone from the star to be 20%, at most. This study is the first systematic search for constraining the population of "outer" giant planets around other stars; it is also the most sensitive to date. The use of angular differential imaging in conjunction with NIRI/ALTAIR (the Gemini North facility adaptive optics system) enabled the team to reach the best sensitivities to date for detecting giant exoplanets whose projected separations from the parent star are greater than 0.7 arcsecond (Figure B.2). The upper limits of this survey, the most precise so far, leave little room for the existence of a swarm of giant exoplanets orbiting their host stars at distances greater than the size of our own planetary system.

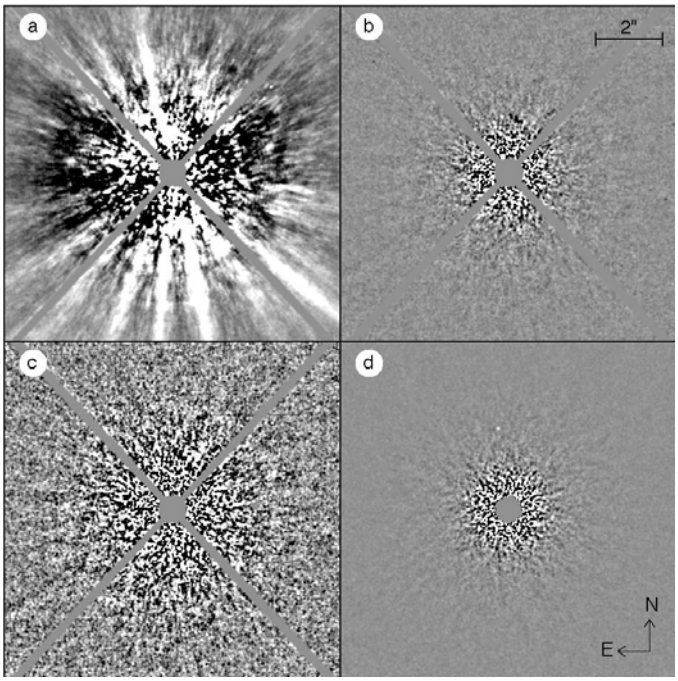



Figure B.2. Illustration of the speckle noise attenuation process achieved by the technique of angular differential imaging (ADI). Panel (a) shows a typical image after subtraction of an azimuthally symmetric median intensity profile; panels (b) and (c) both show, with a different intensity scale, the same image after ADI subtraction; and panel (d) shows the combination of 117 such speckle-subtracted images. The faint point source visible in panel (d) at (2.43", 7.3º) is one million times fainter than the star.

**Colliding Planetary Embryos:** Joseph Rhee (UCLA) and his collaborators identified a dusty 100 million-year-old Type F6 star in the Pleiades star cluster. Called HD 23514, it is one of the very few solar-type stars known to be orbited by warm dust particles. Follow-up work using L' and M' band infrared imaging with Gemini Near Infrared Imager (NIRI) and mid infrared spectroscopy with MICHELLE have revealed a noticeable infrared excess emission and a strong silicate feature around 9 microns (Figure B.3). These warm emissions betray catastrophic collision in evolving young planetary systems around an adolescent age solar-type star. The infrared spectrum of HD 23514 can be fit with a single temperature blackbody of 700 K. This would originate from dust located in the terrestrial planet zone at about a quarter of an astronomical unit from the parent star HD 23514.

Rhee et al. interpret the presence of so much hot dust as the result of colliding planetary embryos, i.e. a recent collision of relatively large rocky bodies similar to the encounter that produced the Earth-Moon system more than four billion years ago. Indeed, the collision that

generated the Moon would have sent a comparable mass of debris into interplanetary orbit as is now observed occurring at HD 23514.

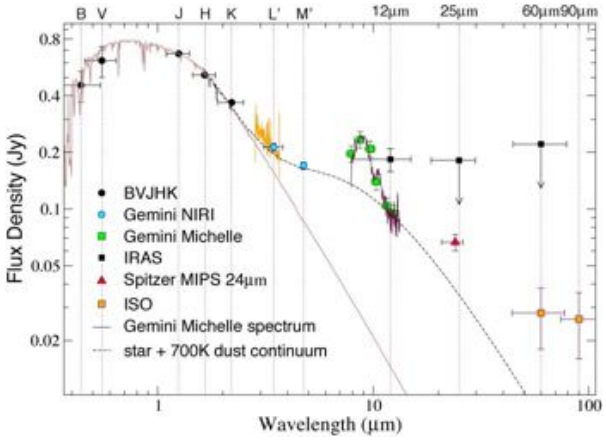



Figure B.3. Spectral energy distribution of the dusty 100 million year old solar-type star HD 23514 in the stellar cluster Pleiades. The unusual mid infrared excess is most noticeable in the thermal infrared region. There is also a strong silicate feature around 9 microns.

**Most Massive Stellar Black Hole Found in Eclipsing Binary:** Observations from the Gemini North multi-object spectrograph (GMOS) and the orbiting X-ray Observatory *Chandra* have led to the discovery of the most massive known stellar black hole in the nearby spiral galaxy M33, about 3 million light-years away. The M33 X-7 black hole was identified by a team led by Jerome A. Orosz (San Diego State University). Intriguingly, the black hole now orbits an exceptionally large companion star, which by a coincidence also periodically eclipses the black hole from our perspective on Earth. The edge-on nature of the orbit has allowed derivation of accurate masses and other fundamental parameters of the system.

The binary system includes a primary that is a massive blue supergiant of type O7 with a 70 solar-mass O7 star and a 15.7 solar-mass black hole. The members of this strange and spectacular pair orbit each other in slightly more than 3.45 days (Figure B.4). The progenitor star of the black hole must have been even more massive than the current primary, at probably more than 100 solar masses.

Figure B.4. Artist's representation of M33 X-7, a spectacular binary system with a black hole in the nearby galaxy M33. In this system, a supergiant star 70 times more massive than the Sun (large blue object) and a stellar black hole (located at the center of accretion disk shown in orange here) are revolving around their common center of mass in 3.45 days. Illustration courtesy of the Chandra X-ray Observatory.

**Are Short Gamma Ray Burst Playing Tricks?** Gamma ray bursts (GRB) are among the most energetic explosions in the universe. Alicia Soderberg (CalTech) and Edo Berger (Princeton University) conducted an analysis of nine recent short gamma-ray bursts (GRBs) obtained with

Gemini, Magellan and the Hubble Space Telescope (Figure B.5). Unexpectedly, they found that the progenitors of these GRBs reside in faint host galaxies at redshifts as great as z = 1.1 and beyond. Furthermore, the host galaxies of these short GRBs (with R ~ 23–27 magnitude) can be more than a hundred times fainter than those of previously known short GRBs. The hosts of the recently observed short GRBs are therefore starkly different from the first few short GRB hosts which were all much closer at z < 0.5. A paradigm shift on the nature of the progenitors may be in order.

Furthermore, some bursts produce $10^{51}$–$10^{53}$ ergs in their initial emission. This is at least two orders of magnitude larger than for the low-redshift short bursts. The existence of low-redshift short GRBs has been used to argue for long progenitor lifetimes, greater than 10 billion years, and against a substantial population of short GRBs at high redshift.

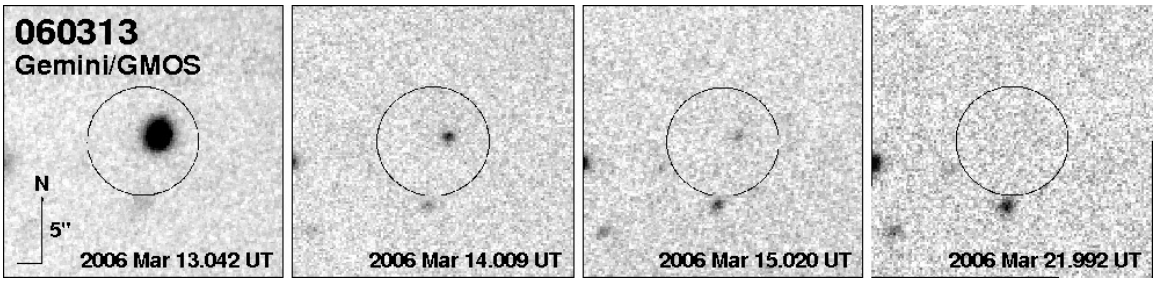



Figure B.5. Afterglow of GRB 060313 monitored with GMOS-N in the r-band showing the fading behavior of the burst. No host galaxy is visible at the position of the afterglow.

**Birth Control in Massive Galaxies at High Redshift:** An international team led by Mariska Kriek (Leiden Observatory and Yale University) has found that 45% of a small sample of massive high-redshift galaxies have very low rates of star formation or lack such activity altogether (Figure B.6). The existence of "dead" massive galaxies at high redshift, at a time when the universe was between a quarter and a third of its current age, is surprising. This work puts a new twist on the growing evidence from several studies that most massive galaxies formed very early in the history of the universe.

Kriek's team used the Near Infrared Spectrograph (GNIRS) at Gemini South to study twenty-six galaxies with redshifts in the range of 2.0 < z < 2.7. They found a surprising fraction of galaxies with no detected emission lines. The chosen galaxies are relatively massive with a range of stellar mass of $0.9 – 4.6 \times 10^{11}$ solar masses ($M_{sun}$). Galaxies in this sample show a star-formation rate varying by a factor of a hundred between the lowest and most active ones. Some show no activity at all.

The star formation in these galaxies has been strongly suppressed. Feedback mechanisms like supernovae or mass loss driven by active galactic nuclei could indeed produce dead massive galaxies at high redshifts. Injection of huge amounts of mechanical energy and momentum over a relatively short period may remove a huge fraction of the galaxy gas in a short time and heat the remaining interstellar medium, making it very stable against further gravitational collapse.

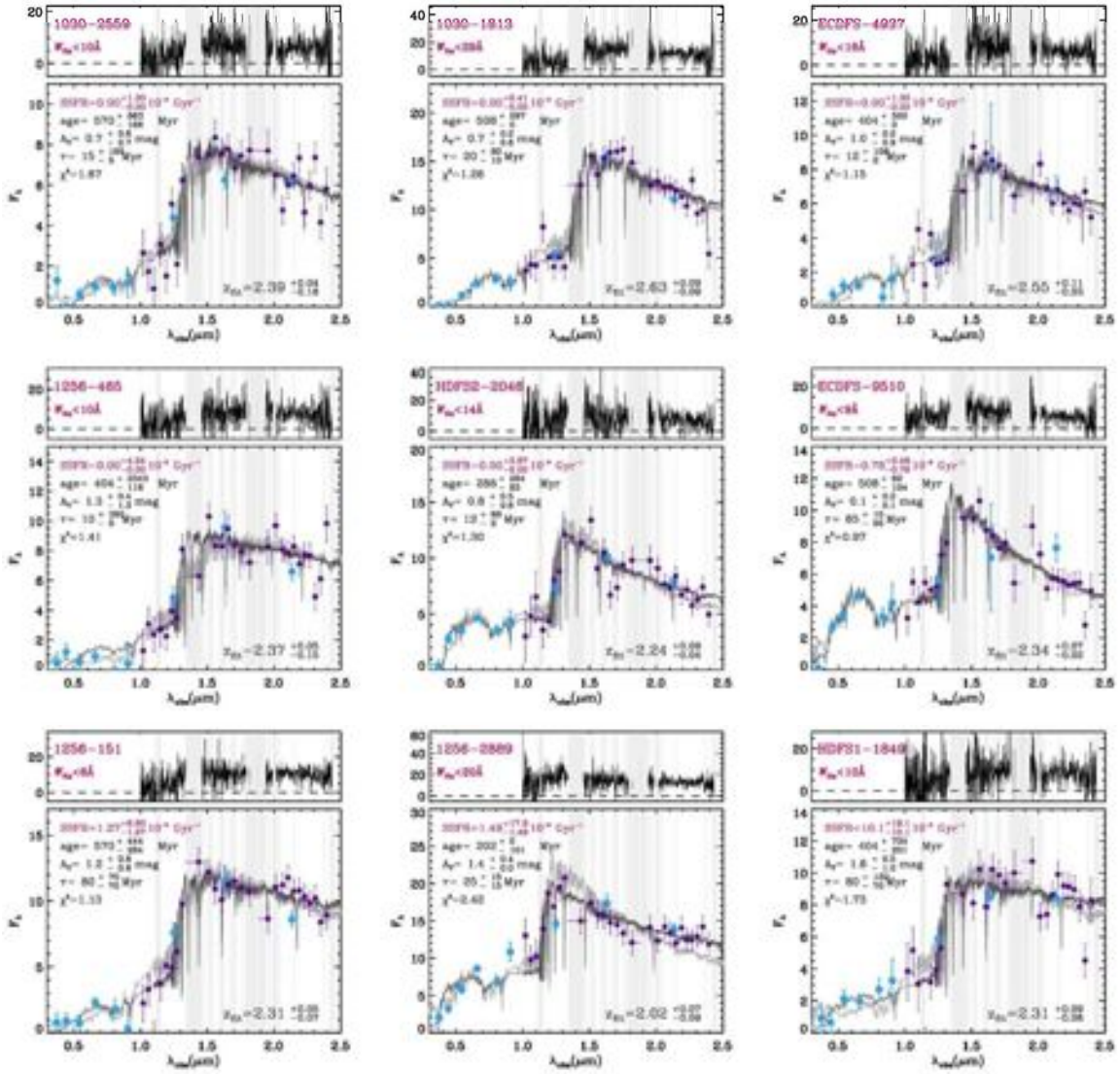


Figure B.6. Infrared spectra of several distant massive galaxies obtained with the Gemini Near Infrared Spectrograph (purple), and optical to near-infrared photometry (blue) of nine "dead" galaxies. These galaxies show no hydrogen alpha emission, which indicates that their star formation rates are extremely low.

**Most Distant Quasars Probing the Epoch of Re-ionization:** The first quasars in the history of the universe are thought to have been the first generation of light-emitting objects. Quasars are powerful emitters of ultraviolet radiation – so strong that they are believed to have lit up the universe in a process called "reionization". Chris Willott (University of Ottawa) and a large team of astronomers have identified four new quasars at redshift greater than z = 6 (about 13 billion light-years away) in wide-field imaging with MegaCam at the Canada-France-Hawaii Telescope. Follow-up spectroscopy with GMOS at the Gemini South Telescope (and on the Hobby-Ebberly Telescope) allowed the team to determine accurate redshifts, or distances. The most distant of their four new objects is also the most distant quasar, CFHGS J2329-0301, known at present and lies at z = 6.43 (Figure B.7).

The team also used the GMOS optical spectra to investigate constraints on the ionization state of the universe at that age. Between the period of recombination (when protons and electrons combined into neutral hydrogen as the universe cooled during rapid expansion), and reionization

(caused by the first quasars) the universe stayed in a state that is referred to as the "Dark Ages" because of the absence of light sources. From the analysis of these four distant quasar spectra, the authors suggest that reionization was well underway before z = 6.4, but was still not complete by z = 5.7.

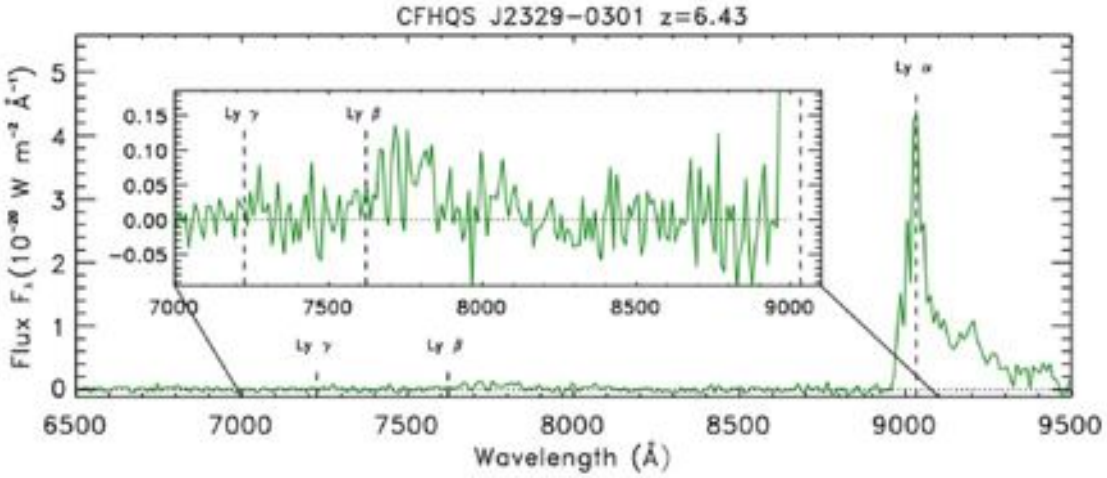



Figure B.7. GMOS-South spectrum of the highest redshift quasar known at a redshift z = 6.43. The wavelength interval between the Lyman alpha peak and the point at which the flux drops to zero at ~8950Å gives the size of the quasar proximity zone.

**Frenetic Growth of Supermassive Black Holes in the Early Universe:** Beyond being the most luminous and energetic objects in the universe, quasars are surmised to be powered by extremely massive black holes. Linhua Jiang (Steward Observatory, University of Arizona) led a team of astronomers in the United States and Germany in the study of some of the most distant and youngest known quasars. The six distant quasars they observed at redshifts between z = 5.8 to 6.3 correspond to a period when the universe was only about a billion years old. Using the Gemini Near Infrared Spectrograph (GNIRS) at Gemini South and the Near-Infrared Imager (NIRI) at Gemini North, the team measured these very young quasars to be already super-enriched in heavy elements. The high metallicity found at this redshift indicates that vigorous star formation, and fierce element enrichment, occurred in quasar host galaxies in the first billion years of cosmic time (Figure B.8). This is consistent with other studies that have shown little chemical evolution up to the highest-known redshift.

Chemical abundances in the broad line regions (BLR) are important in understanding the history of star formation in the host galaxy. In particular, the ratio of iron (Fe) to the oxygen family elements (such as oxygen, carbon and magnesium, also called the *alpha* elements) is expected to have a strong correlation to age in young systems. Oxygen is produced and ejected very quickly in massive stars, while iron comes from long-lived intermediate-mass stars. Hence, most iron enrichment happens at least one billion years after the initial starburst and later.

Very luminous quasars in the early universe also betray the rapid growth of black hole mass when the first generations of galaxies and quasars formed. The bulk motions of the broad-line region are used to determine the mass of the central black hole. Jiang et al. measured the masses of central black holes of their quasar sample to be between 1-10 billion solar masses. It is remarkable that billion-solar-mass black holes can form less than a billion year after the Big

Bang. This requires seed black holes of a few thousands of solar masses forming even much earlier, (at z ~ 20), that could grow by a factor of 3 million times (15 e-foldings) to z ~ 6 in a few hundred million years to produce black holes with the masses found in this sample.

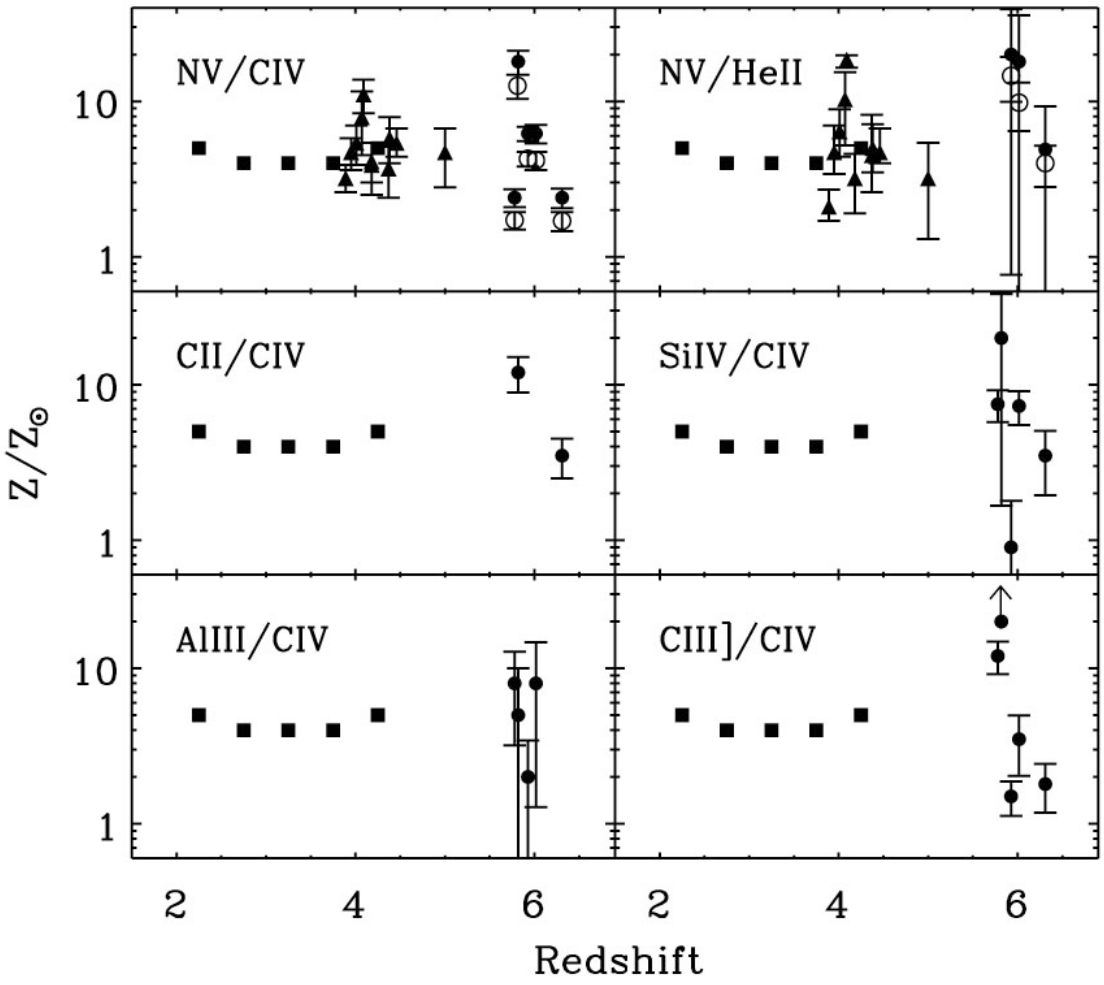



Figure B.8. Quasar broad-line region abundances compared to solar abundances derived from the ratios of several ions measured in the near-infrared spectra of the broad line region. The filled circles are derived from the GNIRS study.

## B.2 Staff & Community Publications

In early September 2007, the 400th Gemini paper was accepted for publication in a major refereed astronomical journal. This paper, titled "SNLS Spectroscopy: Testing for Evolution in Type Ia Supernovae", 2007, Astronomy & Astrophysics, was published by Ph.D. student T. J. Bronder and 22 co-authors, all members of the *Supernovae Legacy Survey* team. The team includes researchers from the United Kingdom, Canada, France, Portugal, and the United States, and illustrates the growing role of multi-national large scientific teams. The article reports on the supernova candidate spectra observed with the Gemini Telescopes during the first 34 months of the Supernovae Legacy Survey, 87 of which have been identified as SNe Ia at a median redshift of z = 0.720. The study demonstrates that there exists a sample at high redfshift objects with

properties similar to those of nearby supernovae. Correlations between Type Ia SN properties and host galaxy morphology are also found to be similar at low and high z.

The total number of papers published in the main refereed journals is expected to be about 120 for the year 2007. Members of Gemini science staff are authors or co-authors on about 45 (about 1/3) of the papers in 2007 (10 as first author); the relatively large number of co-authorship indicates their close involvement with the research conducted by our community of users.

The list of community users and Gemini staff publications can be found at http://www.gemini.edu/files/governance/annual_reports/2007/AppendixII.pdf.

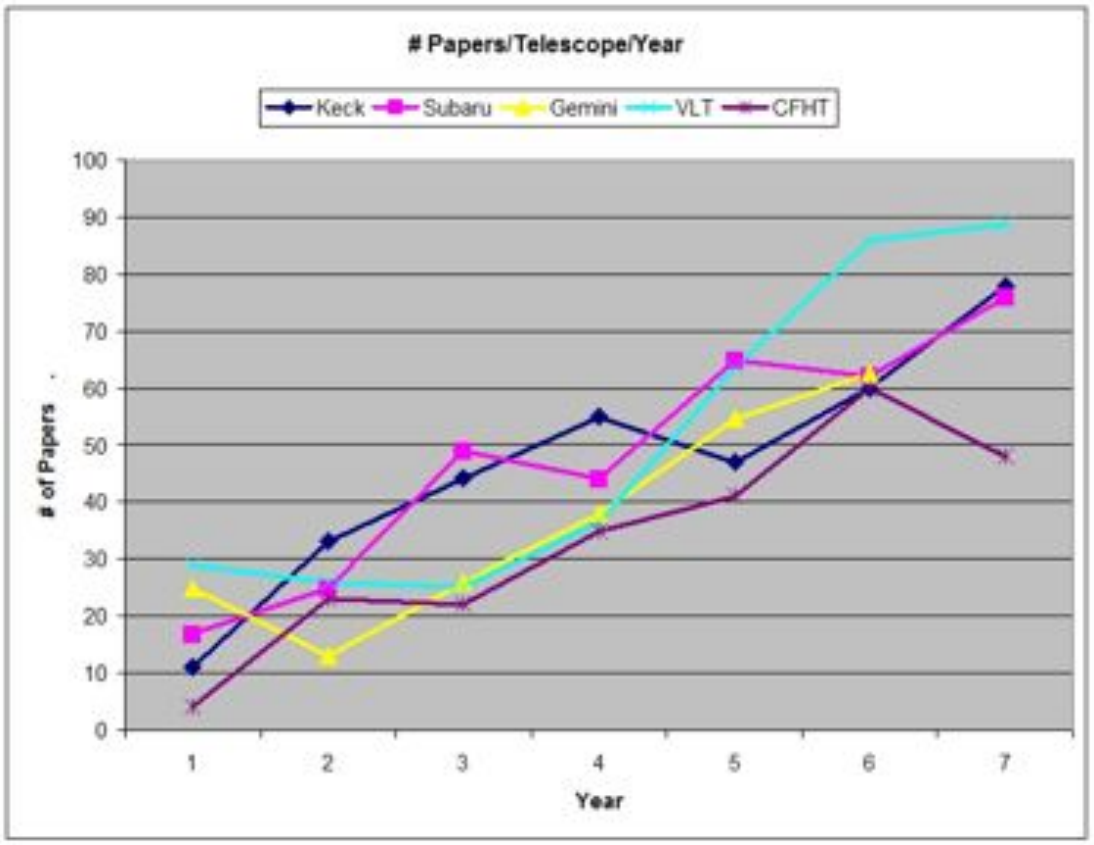



Figure B.9. The rate of Gemini refereed papers published normalized on a per-year per-telescope basis for several of the large ground-based telescopes. This manner of presenting output takes into account the fact that some observatories have a single telescope (Subaru) others several (Gemini and Keck have two; VLT has four). The total number of publications as a function of the Gemini instruments is shown on Figure 10; these are cumulative numbers since the beginning (2002 is taken as Year 1, the first year of a significant number of papers). Papers based on the use of adaptive optics (AO) and mid-infrared instruments each represent 15% of the total number of the refereed papers based in part or completely on Gemini data.

## B.3 Executed Observing Programs

### B.3.1 Community Users Research Programs (Semesters 2006B and 2007A)

The Gemini North and South telescopes were operated predominantly in queue mode for Semesters 2006B and 2007A. Of the 240 programs scheduled on Gemini North in these two semesters 92.5% were queue scheduled while 89.4% of 179 Gemini South programs were queue scheduled.

There were a total of 10 classical programs scheduled on Gemini North in 2006B, 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 2006B. There were also ten classical programs scheduled on Gemini South during Semester 2006B. The Gemini community had five programs scheduled on Subaru, in service mode, as part of the time exchange with Subaru. The Subaru programs on Gemini were executed in queue mode.

In 2007A the number of classical programs on Gemini North dropped to eight including two Keck exchange programs. The Gemini community had three programs scheduled on Keck and four programs on Subaru as part of the time exchange with these observatories. There were nine classically scheduled programs on Gemini South in 2007A, all but two of which were with the Phoenix spectrograph.

Semester 2006B saw an extended run of the high-resolution mid-infrared spectrograph, TEXES, a "guest" instrument on Gemini North. A total of five programs were scheduled in a mini-queue block of sixteen nights in November. Unfortunately, this run was shortened by an earthquake. Indeed Gemini North 2006B operations were severely disrupted on October 15th, 2006, when a 6.7 magnitude earthquake occurred off the west coast of the Big Island. This earthquake damaged several of the telescopes on Mauna Kea including Gemini North. The Gemini North damage was primarily in the secondary mirror control mechanism. In total, Gemini North was off-line for four weeks before it was fully repaired and re-commissioned (see Earthquake Recovery in Hawai‘i in section E.1.4.2 for details).

Scheduled programs can be found at
http://www.gemini.edu/files/governance/annual_reports/2007/AppendixI.pdf.

### B.3.2 Gemini Staff Research Programs in 2007

During the year covered by this report, PhD. 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 presents a representative sample of the areas investigated using the suite of optical, near infrared and mid infrared instruments on both 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 the torus 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 New Organizational Chart

Figure C.1. The new Gemini organizational chart was inspired by the structure of a tree, like this mighty oak. In Gemini's new functional paradigm, the Directorate's function is analogous to the trunk which supports the rest of the staff – the "branches" of the tree.

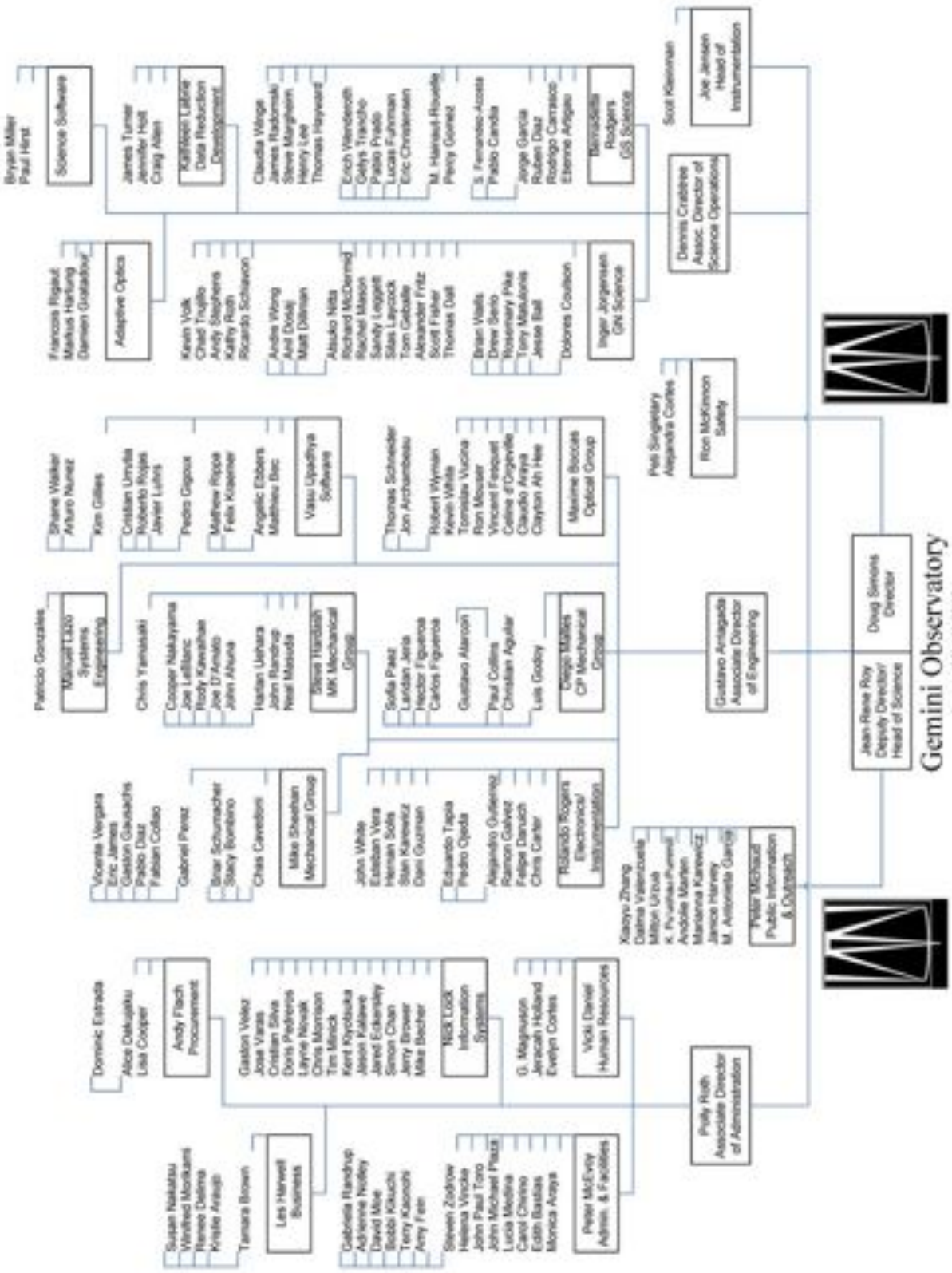
As mentioned before there are many facets to the cultural changes that Gemini Observatory is undertaking. Among them is a whole new look to our organizational chart (see Figure C.1 and page 23). The typical organizational chart lists all of the members of a staff with lines indicating reporting chains, all feeding up to senior managers and ultimately the overall leader (i.e. CEO, President, Director, etc.). This type of organizational chart is pervasive and in subtle ways has become ingrained in working cultures around the globe for centuries. Implicit in this structure is that the value or importance of a particular member of the staff is somehow linked to his/her position on an organizational chart. This in turn tends to drive subtle (and pointless) forms of competition within the staff, as they map out their position (and implied importance) relative to others within the organization. A simple search of organizational charts in use around the world, from businesses to city governments, to even religious organizations, shows how universal this interpretation of organizational charts has been for centuries.

Though admittedly counter culture, at Gemini Observatory we are building a team of players, not a hierarchy of competitors. All members of Gemini's team are important because each brings special skills, knowledge, and expertise to collectively fulfill a complex mission. Getting astronomers, engineers, or distinguished Board members to Gemini meetings or the summits of Cerro Pachón or Mauna Kea is just as important as the knowledge they carry. Ensuring that paychecks are issued every two weeks, parts are ordered, and new staff receive professional and courteous orientation, are all key functions that critically support Gemini's discovery machine just as much as the data that are collected each night by our science staff.

To help instill an awareness and appreciation that we are all important members of a team driven to achieve a common mission, the Gemini organizational chart was inverted. The Director and Deputy Director now lie at the bottom of Gemini's organizational chart. No longer implicit in Gemini's organizational chart is a support role for the rest of the staff to meet the needs of the Directorate – in fact the opposite is true in the operations paradigm at Gemini. Inspired by the

form and function of a tree, Gemini's Directorate forms the foundation (trunk) which in turn supports the needs of the rest of the staff – the branches and leaves of our Gemini tree.

Closer inspection of our structure reveals another change from the past – the four divisions of Gemini are well-defined and include engineering, science, administration, and development. Communications to/from the Directorate naturally run through these well-defined branches in our organizational chart. Furthermore, to emphasize the importance of our new safety and outreach programs, the safety program manager is a direct-report to the Director and the public information manager reports directly to the Deputy Director. Finally, our structure is "grounded" in our mission statement, which serves to remind everyone that the needs of our mission supersede the needs of any individual on the staff and provides the ultimate foundation for our observatory.


Gemini Observatory
Last modified 11/02/07
Doug Simons Director
Jean-Rene Roy Deputy Director/ Head of Science
Gustavo Arriagada Associate Director of Engineering
Polly Roth Associate Director of Administration
Ron McKinnon Safety
Dennis Crabtree Assoc. Director of Science Operations
Joe Jensen Head of Instrumentation
Peter Michaud Public Information & Outreach
Science Software
Adaptive Optics
Data Reduction Development
Bernadette Rodgers GS Science
Ingar Jorgensen GN Science
Vasu Upadhya Software
Maxime Boccas Optical Group
Diego Maltes CP Mechanical Group
Steve Hardash MK Mechanical Group
Mike Sheehan Mechanical Group
RGando Rogers Electronics/ Instrumentation
Manuel Tapia Systems Engineering
Andy Fisch Procurement
Nick Look Information Systems
Vicki Daniel Human Resources
Peter McEvoy Admin. & Facilities
Les Harwell Business

## C.2 Fulfilling Our Mission Through Community Involvement

### C.2.1 Educational Outreach Programs

Gemini's Public Information and Outreach program is a multi-faceted effort that serves our partnership, users, staff, the media and a core constituency in our local host communities – Hawai'i and Chile. The often quoted expression "… all politics are local…" applies to any organization's education and outreach efforts as much as it does to politics. It is critical that an observatory like Gemini foster excellent relations in our local host communities if it is to ultimately succeed in a global context.

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.


Figure C.2. Cover of the Hawaii Tribune Herald newspaper insert on astronomy in Hawai'i that was managed by Gemini's PIO Office.

While part of a broader education and outreach program, the Gemini Observatory local outreach efforts are diverse and encompass a broad cross-section of our communities from educators, students and parents to community leaders. Because resources are limited, we are careful to identify our audiences and deliver our programs to those most likely to be impacted by our efforts.

The following samples highlight a few of the innovative and forefront activities in local outreach organized by the Gemini Public Information and Outreach Office. 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 years (such as the *StarTeachers* teacher exchange program).

**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 4th year) partners other Mauna Kea observatories, the Hawai'i State Department of Education and multiple community organizations and businesses.

**FamilyAstro:** FamilyAstro is a program of the Astronomical Society of the Pacific that was originally funded by the NSF. It 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 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 (was chaired by Gemini staff in 2006) and other visitor centers and educational organizations (like the Hawai'i State Department of Education).

Figure C.3. StarLab portable planetarium presentation.

**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.3).

**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.

**StarTeachers:** This local teacher exchange program between Hawai'i and Chile has been implemented twice (2003 and 2005). In each instance three teachers from each host community (Hawai'i and Chile) were selected and implemented videoconferencing technologies to teach remotely while sharing an actual exchange with a partner teacher in the other's community. This program is planned for another implementation in 2009 for the International Year of Astronomy and will likely engage most of the Gemini partnership. In 2003, Gemini was awarded the Gabriela Mistral Medal in education based on the success of the StarTeachers program in Chile (see Figure C.4).

**Virtual Tour:** The Gemini Virtual Tour is presented at multiple kiosks in our local communities and distributed broadly to the public, students and educators. The tour provides a complete interactive "snapshot" of the Observatory environment, including the science and career opportunities available. A module on career awareness is currently nearing completion.

**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.

Figure C.4. Gabriela Mistral Medal awarded to Gemini for the StarTeachers program.

**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.

**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.

**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).

## C.3 Examples of Gemini Innovation and Leadership

The following section highlights several areas of innovation and leadership at Gemini in key areas such as science operations, engineering, technology, outreach and safety where we pushed frontiers in 2007.

### C.3.1 Queue Planning Systems

Both Gemini telescopes operate in full multi-instrument queues with all mounted instruments available for rapid switching during all queue nights. This capability improves the efficiency of the queue and also allows Gemini to make the best scientific use of all observing conditions as the instruments complement each other. To maintain high efficiency our staff put considerable effort into careful planning of each night of observing. Full multi-instrument queue planning was

initiated at Gemini North in semester 2005A, with Gemini South following in semester 2005B. Prior to this, both telescopes had been scheduled in queue mode but with only one instrument available each night. The following describes high-level principles in the multi-instrument queue planning process and the current status of the queue planning software as now fully deployed.

**Queue Planning Principles:** The queue planning principles have focused on optimizing the efficiency at night as well as increasing program completion rates. Both have direct implication for the science productivity of Gemini. An assigned PhD science staff member, the Queue Coordinator, makes a detailed plan for each night (with a view of all the programs in the queue and their possible timeline of execution). Each telescope has six queue coordinators who share sequentially the nights between them. A nightly plan contains several plan variants to cover different observing conditions, such that the observer can switch smoothly from one to the other, should the conditions change during the night.

**Queue Planning Software:** To produce nightly plans the Queue Coordinators use the Queue Planning Tool (QPT), an innovative program developed by the Gemini software group, which interfaces to the Observing Database. QPT gives a graphical interface for the Queue Coordinator to put together the plan variants for the various observing conditions for a given night. The detailed planning is currently done manually, though QPT does provide some information on the relative priorities of the available observations. Since typically only one plan variant is in fact executed, the Queue Coordinator builds the following night's plan starting from the past night's unexecuted plan variants.

Figure C.5 shows a typical view of the QPT for one of the plan variants for a Gemini North night (UT 2007 Oct 18) during which GMOS-N and NIRI were available for use. NIFS had been taken off the telescope to prepare for the installation of TEXES. The upper left of the QPT window lists the various plan variants for the night, each defined by a set of observing conditions. One of the plan variants is highlighted. The lower left QPT window lists observations available for scheduling in the observing conditions of the highlighted plan variant. The right hand side of the full QPT window shows for the highlighted plan variant, from top to bottom: Elevations versus time for the scheduled observations, sky background information for the highlighted observation, lists of scheduled observations, and details for the highlighted observation.

Once the Queue Coordinator has put together the plan for the night, it is published on the internal Gemini web site for the observer to access during the night.

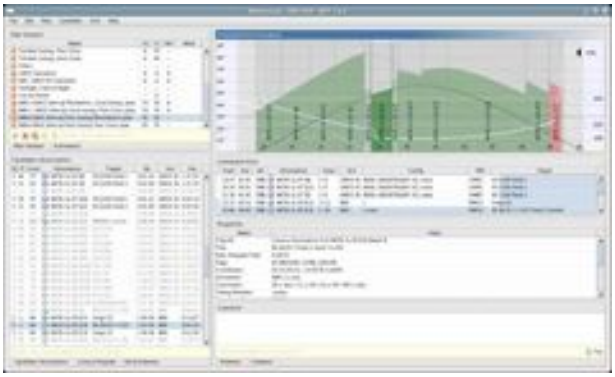


Figure C.5. Typical view of a plan variant in QPT.

Future improvements of QPT are planned to include semi-automatic creation of the plan variants given priority scoring of the various observations and handling of multi-night planning to aid top-level queue management.

### C.3.2 Multi-conjugate Adaptive Optics (MCAO)

Since the early 1990s the emergence of adaptive optics systems has allowed large telescopes (8- to 10-meter class) to scan both northern and southern skies with the sharpest possible views in the near-infrared. However, the scientific exploitation of such systems is still limited to small regions (10 to 20 arcseconds) around a relatively bright reference source (with visual magnitudes brighter than 17). Now, imagine an enhanced adaptive optics system that covers a much larger fraction of the sky and provides uniform image compensation over fields significantly larger than the natural isoplanatic patch. This is the aim of the multi-conjugate adaptive optics (MCAO) project that is nearing completion at Gemini South.

The advent of MCAO is recent. New adaptive optics system designs were introduced at the beginning of the 21st century to combat both the induced limited sky coverage and the limited field of view. Initially laser guide star systems (still limited by the so-called "cone effect") were implemented on large telescopes (Lick Observatory, Starfire, Gemini and Keck for instance). More recently, MCAO has arrived, with only a few systems currently under development (Gemini, the Very Large Telescope and the Large Binocular Telescope, for example). The evolution of adaptive optics systems, as well as a comparative case for MCAO are presented in Damien Gratadour's article "From Classical AO to MCAO" starting on page 12 of the December 2006 issue of *GeminiFocus*.

The design of Gemini's MCAO system will offer unique advantages in terms of astronomical capability. Complete end-to-end adaptive simulations have allowed an assessment of our MCAO performance for the current design.

The first gain to be realized by using MCAO will be in the increased sensitivities of the observations. In the case of broadband imaging at 2.2 microns, MCAO has a 1.2- to 1.7-magnitude advantage over NICMOS (the near-infrared camera onboard HST) and classical adaptive optics systems.

Second, while such classical systems offer 44% sky coverage in the H band near the galactic plane, MCAO will offer 69% sky coverage in the same region of sky. However, since MCAO requires three natural guide star tip/tilt guides, sky coverage of classical adaptive optics systems at the longest wavelengths and near the galactic pole is better (35% at 2.2 microns, compared to 24% for MCAO), but MCAO recovers the advantage at shorter wavelengths and for low galactic latitudes (12% in the J band compared to 7% for classical AO). Overall, there is a moderate advantage in sky coverage for MCAO: the fact that MCAO is less wavelength-dependent enables better multi-wavelength imaging, a requisite for programs requiring color-color diagnostics.

The third major advantage brought by MCAO is a gain in the corrected field of view. For programs that need enhanced fields of view, MCAO provides a 10 to 20 multiplex gain, that enables new science and efficiency increases.

Finally, a uniform point-spread function over a wide field of view is a key feature that is unique to MCAO. Although a 0.1-magnitude error can be achieved in some cases on fields of 10 – 30 arcseconds with classical adaptive optics, a uniform point-spread function with MCAO will vastly improve the accuracy of the image/spectra analysis. More generally, it is the experience of adaptive optics users that data reduction is a critical problem because of the lack of proper and simultaneous point-spread function calibration which adds to the spatial variability of the point-spread function over the field. Having a large uniform field goes a long way toward solving this problem: if a star is present in the field of view, it can be used for the whole 1 by 1 square arcminute uniform field. Since, by definition, there are three stars less than 19th magnitude needed as tip/tilt guide stars in a 2-degree diameter field, the probability of having a least one in the central 1 square arcminute is high (60%).

For more information on the status of the Gemini MCAO system see Sections D.2.3 and E.1.4.4 of this document.

### C.3.3 Safety

During the past year, Gemini has made great strides in establishing a world-class safety program that is unique in the astronomical community. Following are samples of the types of programs that have or are in the process of being established, these include:

**Establishing the Safety Baseline:** Gemini invited a group of well-seasoned safety and risk management professionals to conduct a thorough baseline audit of the existing safety system and requested them to make recommendations for improvement.

**Safety Leadership Team:** The Observatory Director, supported by the Deputy Director and Associate Directors, formed the Safety Leadership Team (SLT) on the 21 June 2007, to lead the Gemini safety initiative. The agreed objective of the Team was:

*"The SLT is the leadership for the Gemini safety drive and shows commitment and involvement in safety and is the forum for setting safety objectives and approving the Gemini Safety System and Standards."*

The SLT is the driving force behind the Gemini Safety System and approves all Standards and safety and health initiatives. The Team meets monthly to review safety Standards and policies and to direct the safety system efforts. This top down safety leadership has led to the revitalization of the Gemini safety program.

**Safety and Health Policy:** The Safety Leadership Team compiled and issued the AURA – Gemini Health and Safety Policy and all members signed the policy, which is the leading document in the safety system and guides the safety vision of Gemini. The policy reflects the commitment of Gemini to the safety and health of its employees, visitors, contractors and families.

**Safety Restructuring:** Part of the safety initiative was a decision to have a safety person at each observatory and to hire a safety manager reporting directly to the Director. This was

accomplished, and as part of this restructuring, the term *Safety Officer* was changed to *Safety Coordinator* to reflect world's best practice and to move safety from a safety policing mode to a motivational, educational role by making managers at all levels responsible for safety.

**Safety System:** Gemini has embarked on a world's best practice safety and health management system that is risk-based and audit driven. The Gemini Safety and Health Management System has been adapted to suit conditions and circumstances within the observatory and the standards set by the system will exceed OSHA requirements.

**OHSAS 18,001:** The O*ccupational Health and Safety Assessment Systems (OHSAS)* standard is the current internationally accepted accreditation for safety management systems. International accreditation is awarded after achieving a predetermined standard that is verified by a thorough audit process. Gemini's objective is to achieve this accreditation by the end of 2009.

**Leadership Training:** The introduction of the system has created the need to train all levels of leadership at Gemini in basic safety management skills. Based on the success of the first *Modern Safety Management* seminar the Safety Leadership Team took the decision that all Gemini employees at both sites will attend the 8-hour session.

**Management Accountability:** As part of the Gemini Safety System a process is in place to make leaders at all levels responsible and accountable for the safety of their employees and respective work areas.

**Risk Assessment:** Using the principle of the critical few, high-risk maintenance tasks carried out in the observatory and now being identified by a risk assessment process and job safe practices are being written. Training in this process has already commenced.

**Driver Training:** All Gemini employees have attended the 8-hour behind-the-wheel Safe Driver's Program in an effort to improve driving skills and thus reduce driving risk to employees. Affiliated organizations have also sent employees to attend these training courses.

**New Safety and Health Website:** To ensure effective communication and immediate access to the Gemini safety system Standards and information, a new safety website is currently under construction. The progress on the website has been previewed and approved by the SLT.

**Safety Orientation Training:** A revised safety orientation presentation has been written and this safety orientation is presented for new employees once a month. Employees will also be asked to participate in the respective base facility safety committees that will be formed shortly.

**Sharing Safety:** Gemini shares its safety initiatives with neighboring organizations and observatories. This sharing includes outsiders attending the Gemini safety training courses and driver training sessions. Liaison efforts on safety and health issues with other Observatories and safety organizations is ongoing.

## C.3.4 Local Outreach

For the past year Gemini has continued (and expanded) its widely acknowledged leadership role in local outreach programming in our host communities in Hawai'i and Chile. Section C.2 elaborates on the philosophy and programmatic implementation of these programs while section E 1.7 reports on specific progress during the period of this report.

Indicative of this leadership position is the wide acceptance of Gemini's outreach programming and the partnerships that have emerged from our various successes. The most significant partnerships that have emerged have been with local school systems. In Hawai'i this is exemplified by the staff and financial support that the state Department of Education has provided to support the Journey Through the Universe program in East Hawai'i. In Chile the AstroDay Chile program that was initiated in early 2007 illustrates the partnerships that we are able to foster with our local business communities as well as other astronomical research institutions.


Figure C.6. Hilo Union School thanks Gemini for a FamilyAstro program.

Gemini has also been at the forefront of establishing partnerships with astronomy education institutions in our host communities. In Hawai'i we have been instrumental in the development of the 'Imiloa Astronomy Education Center located across the street from Gemini's Hilo Base Facility. By participating in everything from the development of exhibits to the selection of planetarium technologies and guest lectures we are widely recognized as a key supporter of the Center. In addition Gemini has provided support for the CADIAS education center in Chile (outside La Serena in the direction of Cerro Pachón) and like we did for the 'Imiloa center in Hawai'i, we donated our outdated summit console to the center for a display in which our Virtual Tour program is featured for visitors to use as a kiosk.

Finally, Gemini's local outreach effort has begun an initiative to share the enthusiasm of our staff with local students in order to build a workforce for the future. While not an innovation in itself, we are incorporating interactive CD-ROM technology complemented by classroom printed materials to deliver this message more effectively to local students.

The combination of leadership and innovation has propelled Gemini's outreach effort to the forefront and made Gemini a recognized leader in our communities. Our vision to share the universe with humanity continues to move forward and will build on the foundation already established.

## C.3.5 Earthquake Readiness Workshop

In the wake of the October 2006 earthquake in Hawai'i, Gemini played a key role in organizing the first-of-its-kind *Earthquake Workshop*, in Kona, Hawai'i on March 23rd, 2007. With the same vision of being better prepared for an event that will eventually strike our facilities in Chile,

Gemini and AURA have taken the leadership to organize a second workshop in Chile on December 3-4, 2007. Instead of emphasizing a review of damages, repairs and lessons learned, the *Chile Observatories Earthquake Preparedness Workshop* will aim at developing a better understanding of our weak areas and developing preventive measures to protect our staff and equipment.

More specifically the purpose of this workshop is to establish the potential for significant seismic events to adversely affect our people and equipment in Chile and to generate action items to protect our human and scientific assets prior to a major earthquake. These action items will drive safety planning and the generation of response and recovery procedures needed to properly protect all of our assets in Chile.

In March, we had the participation of about 60 people from all the Mauna Kea observatories in the Kona *Earthquake Workshop*. For the December workshop in Chile we will have participation of all major Chilean observatories, existing and planned: Gemini, CTIO, SOAR, ESO (Paranal and La Silla), Carnegie, ALMA, TMT and LSST. The workshop is also intended to promote collaborations between all Chilean observatories with regards to seismic risk.

# Section D

# Achievements During the Past Year

# D Achievements During the Past Year

Given the diversity of key achievements attained in the past year it is necessary to present only a representative sample in this section. Those shown here (Section D) have been selected because they reflect key improvements in operational efficiency or delivery of core products or support services. Following these key achievements are reports (Section E) from each operational unit on specific elements of the observatory's 2007 operational plan with the status of each as of the end of August 2007, the nominal ending period of this report.

## D.1 Operations metrics

### D.1.1 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. However, the available data from August 2004 through February 2006 make it possible to assess the effect of the multi-instrument queue nights compared to the single instrument operation, and also to compare Gemini North and Gemini South. The numbers thus derived are actually a good description of current performance.

For each night, open shutter time was extracted from the FITS headers of the obtained observations. For the mid-IR instruments (MICHELLE and T-ReCS) the tracked open-shutter efficiency includes the overhead from nodding + chopping. This means one should expect the listed 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 what is listed in the table as "open-shutter" efficiency for the mid-IR instruments.

The observing conditions for each night were assessed. 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 to force 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.

Table D.1 summarizes the open shutter efficiency in the period August 2004 to February 2006. The open shutter efficiency in stable observing conditions is typically between 60% and 70%, with peak values larger than 80%. The open shutter efficiency in less stable observing conditions is typically 5-10% lower than in stable conditions. The near-IR instruments on Gemini North and Gemini South have comparable open-shutter efficiencies. GMOS-N has about 5% higher open shutter efficiency than GMOS-S.

The use of multiple instruments has no effect on the open shutter efficiency at Gemini North in stable (good) conditions and less stable conditions, while at Gemini South the open shutter

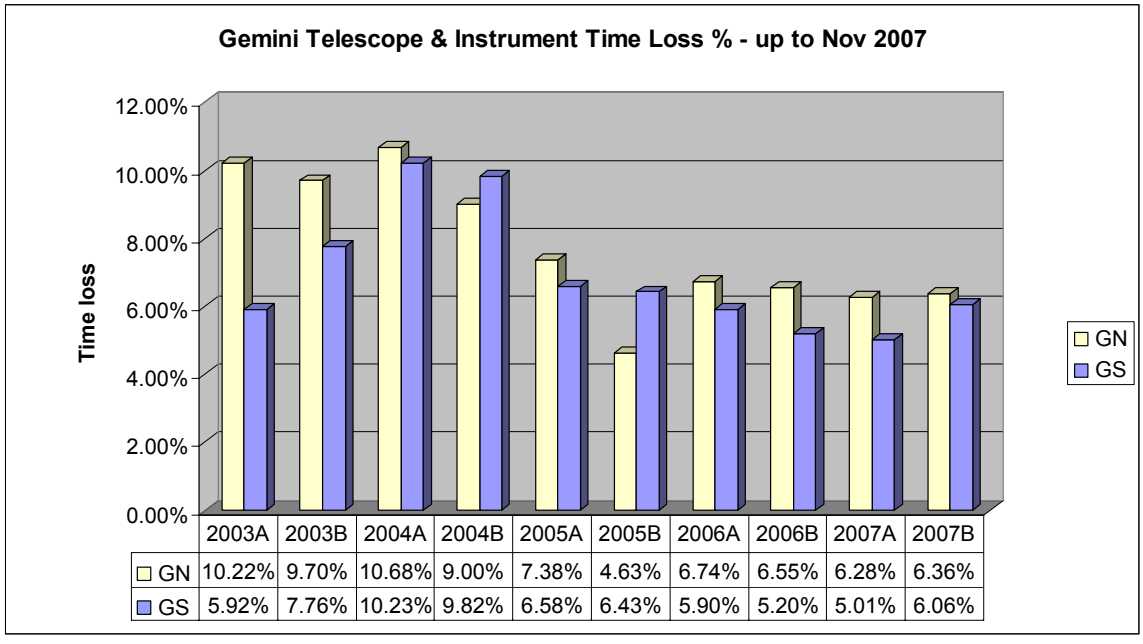
efficiency is about 5% lower than the average of the nights during which only one instrument was used. The significance of the listed differences has been confirmed using a Kolmogorov-Smirnov test.

| Instrument(s) | Open Shutter Efficiency (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. | Average | | | | | | | | |
| | | Weather stable (good) | s.d. | # nights | Weather less stable | s.d. | # nights | Weather unstable | s.d. | # nights |
| GMOS North | 87.5% | 70.6% | 8.4% | 37 | 67.8% | 11.5% | 30 | 55.3% | 14.3% | 11 |
| NIRI (w/ and w/o Altair) | 80.7% | 61.0% | 8.2% | 31 | 50.7% | 13.3% | 20 | 37.4% | 10.2% | 8 |
| Michelle | 87.8% | 58.7% | 9.3% | 8 | 49.1% | 11.0% | 2 | 51.8% | 10.9% | 4 |
| GMOS-N / NIRI (w/ and w/o Altair) | 83.2% | 63.3% | 8.8% | 42 | 59.4% | 8.9% | 38 | 53.4% | 11.2% | 16 |
| Gemini North: 1 instrument (+Alt) | 87.8% | 65.4% | 9.7% | 76 | 60.5% | 14.8% | 52 | 48.5% | 15.0% | 23 |
| Gemini North: multi-inst (+Alt) | 84.8% | 64.9% | 8.9% | 80 | 59.8% | 9.3% | 60 | 53.0% | 10.5% | 20 |
| Gemini North | 87.8% | 65.2% | | 156 | 60.1% | | 112 | 50.6% | | 43 |
| GMOS South | 87.1% | 66.0% | 8.5% | 44 | 63.6% | 11.7% | 52 | 48.2% | 9.8% | 13 |
| GNIRS | 87.6% | 61.0% | 11.3% | 21 | 53.7% | 9.9% | 27 | 41.3% | 9.3% | 10 |
| T-ReCS | 80.7% | 68.0% | 9.1% | 19 | 67.2% | 7.3% | 9 | 50.3% | 8.3% | 2 |
| Phoenix | 83.6% | 60.4% | 9.4% | 8 | 55.3% | 8.4% | 9 | 40.7% | 5.9% | 5 |
| GMOS-S / GNIRS | 80.3% | 58.4% | 9.0% | 35 | 54.7% | 9.7% | 15 | 55.6% | 5.0% | 3 |
| Gemini South: 1 instrument | 87.6% | 64.8% | 10.1% | 92 | 60.4% | 11.8% | 97 | 44.8% | 11.5% | 30 |
| Gemini South: 2 instruments | 84.5% | 58.9% | 9.2% | 47 | 55.6% | 11.7% | 28 | 61.0% | 15.6% | 6 |
| Gemini South | 87.6% | 62.8% | | 139 | 59.3% | | 125 | 47.5% | | 36 |

Table D.1. Open Shutter Time, August 2004 - February 2006. These values are representative of those achieved in 2006B and 2007A.

## D.1.2 Telescope Down-Time

An important general statistic of observatory performance is the time lost due to failure of equipment, telescope systems, instruments or computers and networks (see Figures D.1 – D.5). In 2006B and 2007B, fractional downtime at both sites continued their slow decrease compared with previous semesters, to reach between 5% to 6% – or an average of about 78 hours of time lost to technical faults per semester. It is to be noted that Gemini does not maintain support technical staff on site during the night nor during weekends/holidays. Nonetheless a robust on-call system is in place and works generally very efficiently at solving most faults.




| | 2003A | 2003B | 2004A | 2004B | 2005A | 2005B | 2006A | 2006B | 2007A | 2007B |
|---|---|---|---|---|---|---|---|---|---|---|
| GN | 10.22% | 9.70% | 10.68% | 9.00% | 7.38% | 4.63% | 6.74% | 6.55% | 6.28% | 6.36% |
| GS | 5.92% | 7.76% | 10.23% | 9.82% | 6.58% | 6.43% | 5.90% | 5.20% | 5.01% | 6.06% |

Figure D.1. Gemini Telescope & Instrument time loss percentage through November 2007.

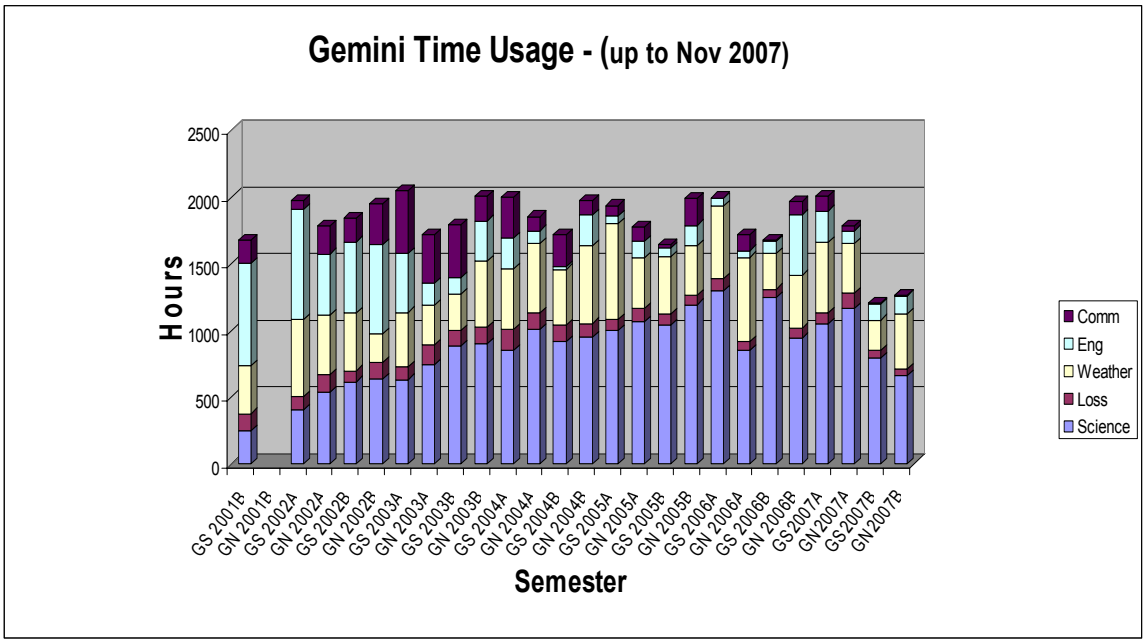
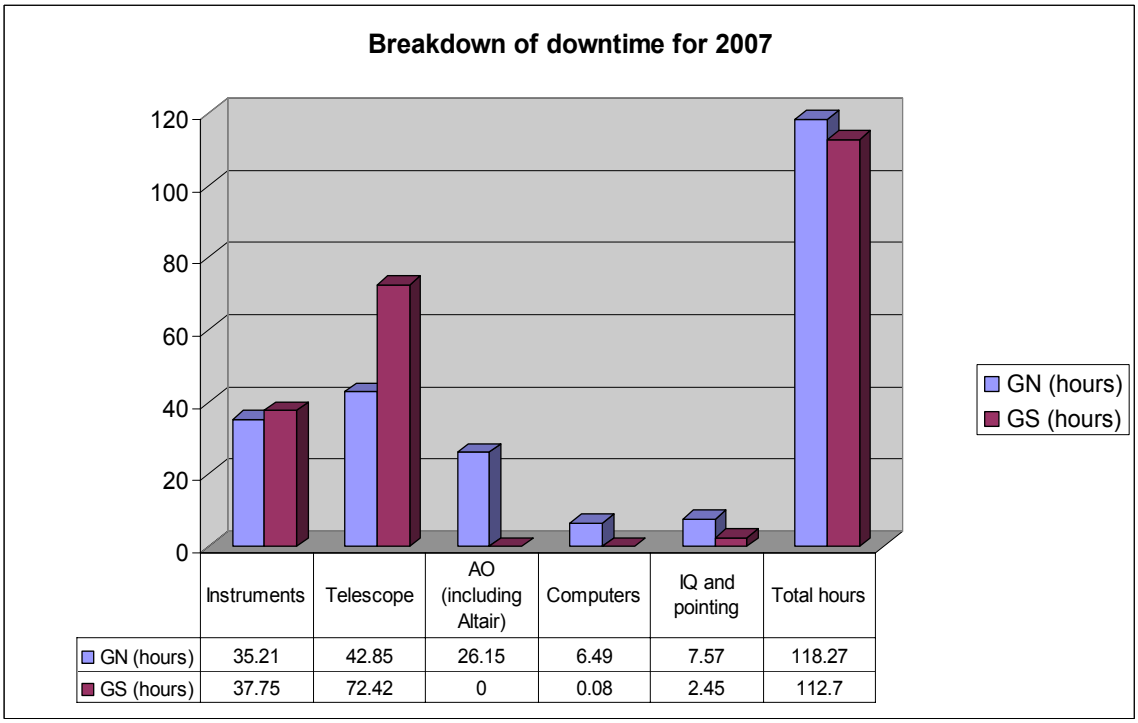
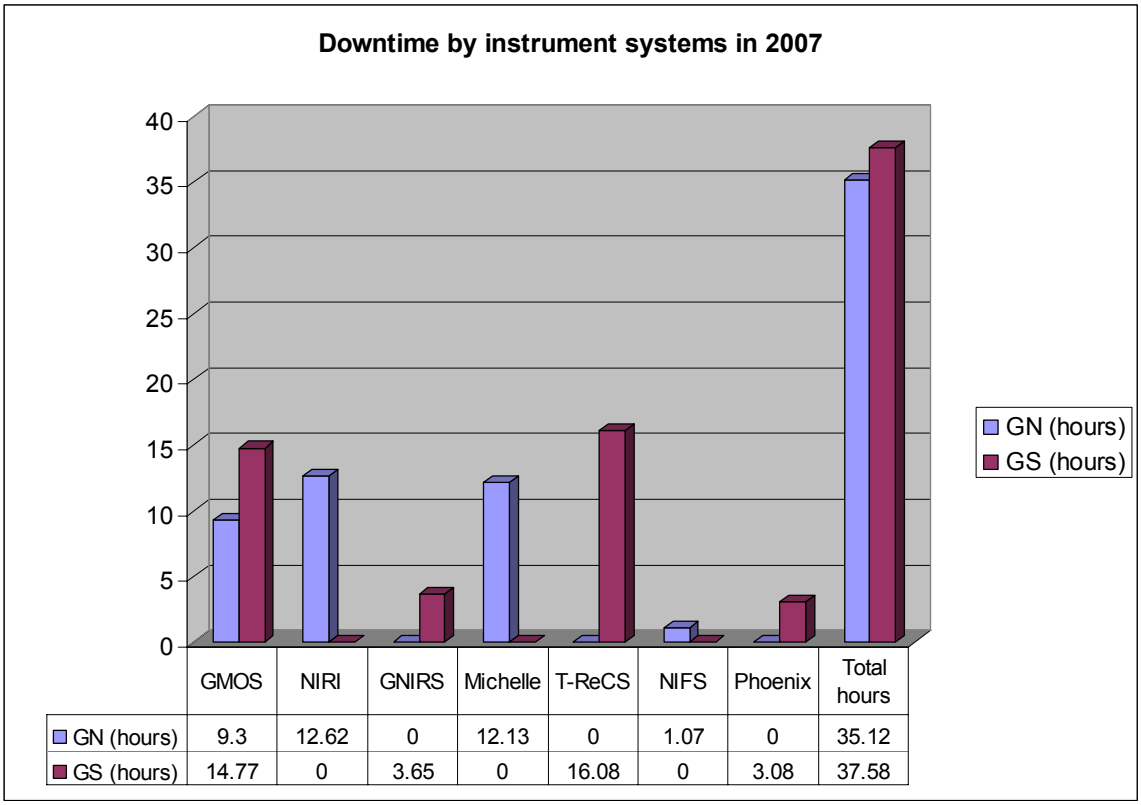



Figure D.2. Gemini time usage through November 2007.



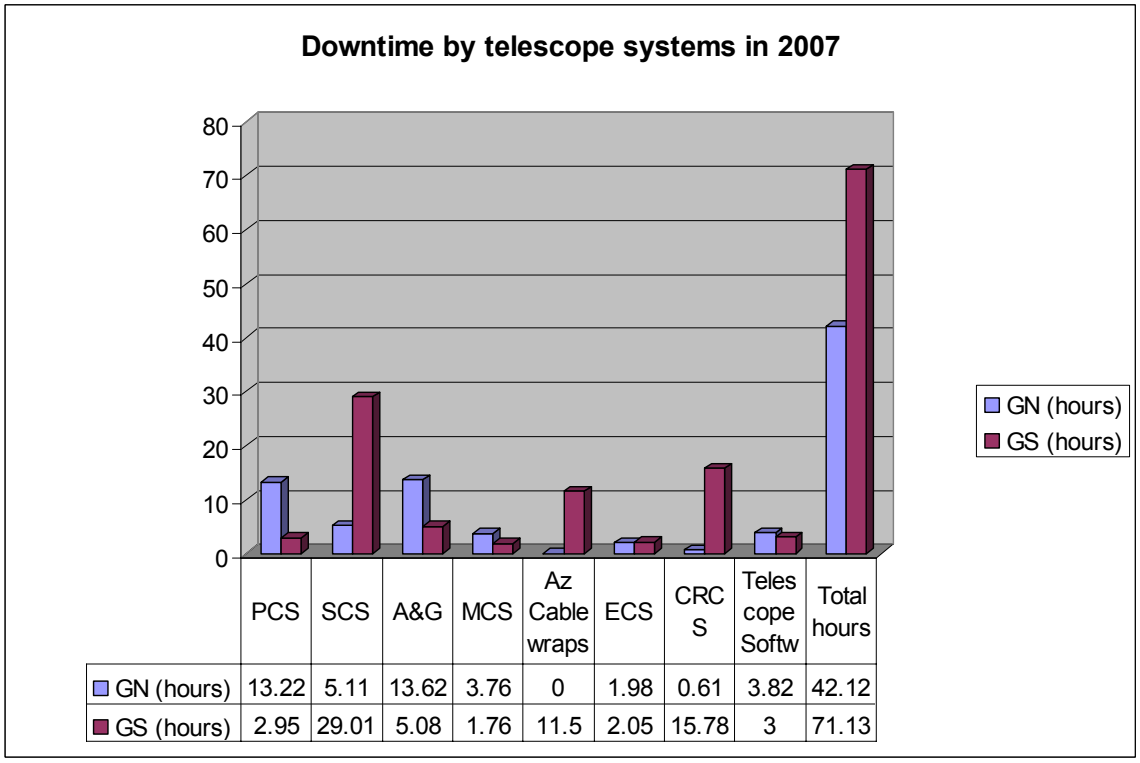

| | Instruments | Telescope | AO (including Altair) | Computers | IQ and pointing | Total hours |
|---|---|---|---|---|---|---|
| GN (hours) | 35.21 | 42.85 | 26.15 | 6.49 | 7.57 | 118.27 |
| GS (hours) | 37.75 | 72.42 | 0 | 0.08 | 2.45 | 112.7 |

Figure D.3. Gemini breakdown of downtime for 2007.




| | GMOS | NIRI | GNIRS | Michelle | T-ReCS | NIFS | Phoenix | Total hours |
|---|---|---|---|---|---|---|---|---|
| GN (hours) | 9.3 | 12.62 | 0 | 12.13 | 0 | 1.07 | 0 | 35.12 |
| GS (hours) | 14.77 | 0 | 3.65 | 0 | 16.08 | 0 | 3.08 | 37.58 |

Figure D.4. Gemini breakdown of downtime by instrument systems in 2007.




| | PCS | SCS | A&G | MCS | Az Cable wraps | ECS | CRCS | Telescope Softw | Total hours |
|---|---|---|---|---|---|---|---|---|---|
| GN (hours) | 13.22 | 5.11 | 13.62 | 3.76 | 0 | 1.98 | 0.61 | 3.82 | 42.12 |
| GS (hours) | 2.95 | 29.01 | 5.08 | 1.76 | 11.5 | 2.05 | 15.78 | 3 | 71.13 |

Figure D.5. Gemini breakdown of downtime by telescope systems in 2007.

### D.1.3 Science Time Delivered to the Community

Gemini tracks completion rates for queue programs, open shutter efficiency, acquisition times and weather losses for both telescopes. In addition, we have investigated how observing conditions and program length may affect the probability of a program getting data. 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

The following summarizes the main points from these metrics:

**Delivered Science Time:** The Gemini Director, in consultation with the Gemini Science Committee and the Operations Working Group (made of representatives of each National Gemini Office), recommends to the Gemini Board the number of science nights to 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.2 summarizes the planned and delivered science nights for 2006B and 2007A, 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. In 2006B, Gemini North was closed for a month for recovery work from the magnitude 6.7 earthquake that occurred on October 15, 2006. 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 when possible. Furthermore, at Gemini North some of the classical nights are exchange nights with the W.M. Keck Observatory, 3 and 4 nights respectively in 2006B and 2007A. At Gemini South, most of the classical nights are for PHOENIX, not offered in queue mode at that time. The latter accounts for 14 and 13 nights in 2006B and 2007A, respectively.

| 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-2006B | 166 | 123 | 6 | 74% | 23% | 5.0% |
| GN-2007A | 157 | 157 | 19.5 | 104% | 22% | 6.0% |
| GS-2006B | 138 | 184 | 24 | 133% | 18% | 5.3% |
| GS-2007A | 127 | 150 | 13 | 118% | 25% | 4.7% |

Table D.2. Delivered science time.

**Completion Rates for Queue Programs:** 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 the 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 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 the major partners to have their appropriate share of Band 1 time.

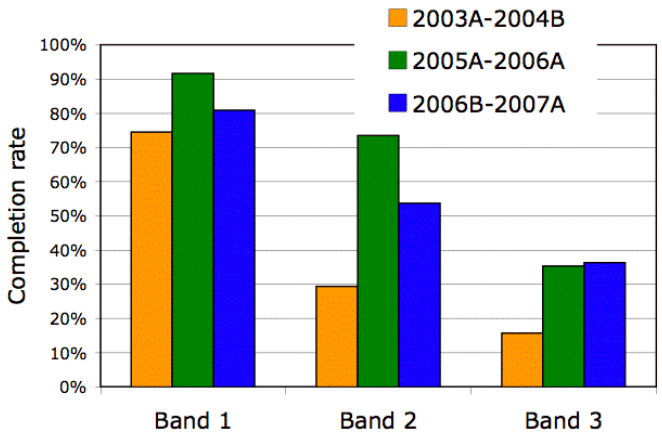



Figure D.6. Summary of the completion rates by band in the semesters 2003A-2004B, 2005A-2006A, and 2006B-2007A. This figure includes both Gemini North and South.

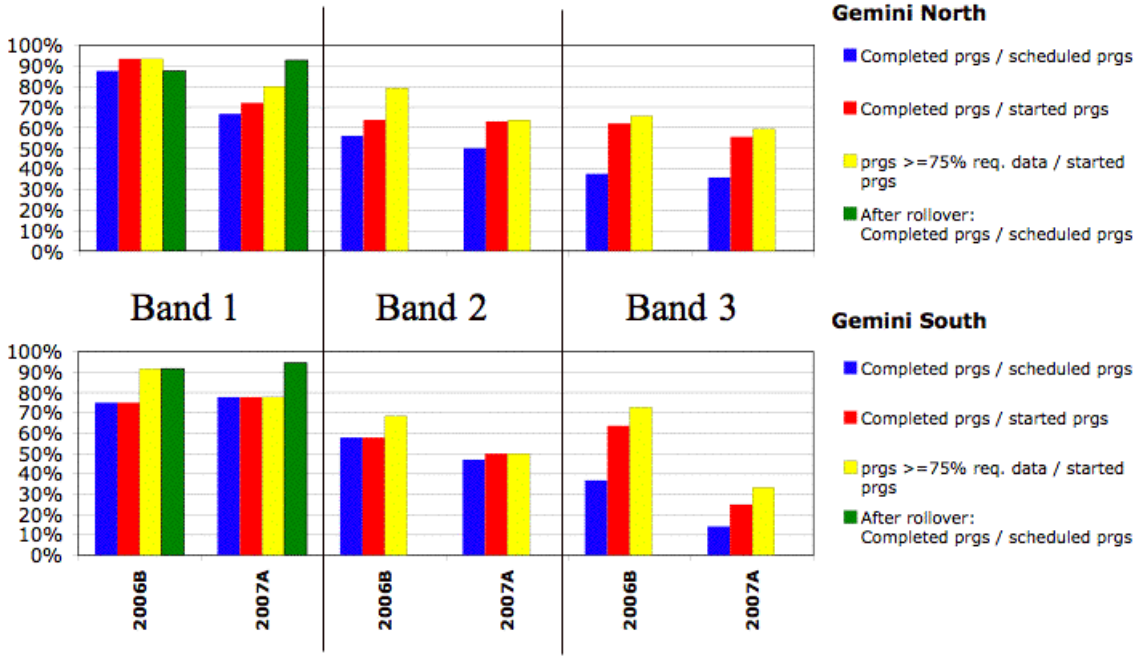



Figure D.7. Details of the completion rates by band for semester 2006B and 2007A.

Figure D.6 compares the completion rates in the earlier semesters (2003A-2004B) with those of the semesters 2005A-2006A and semesters 2006B-2007A. Both Gemini sites are included in the

figure. Detailed information for semesters 2006B and 2007A, as of UT August 11, 2007, is shown in Figure D.7. For all the completion statistics, target-of-opportunity programs have been excluded as the completion of these depends on the availability of triggers rather than planning on Gemini's part.

The completion rates in band 1 and 2 in semesters 2005B-2006A were 90% and 73%, respectively. While in 2006B-2007A these decreased to 81% and 54%, respectively. The earthquake at Gemini North significantly affected the completion rates at Gemini North in 2006B. The change in ranking band size in 2007A may have contributed to the decrease in the completion rates for 2007A, though other factors like the uneven RA distribution of targets especially for the queue on Gemini North and the failure of GNIRS on Gemini South, also contributed. It is important to note that there are still active programs with rollover status from 2006B and 2007A, which if completed will bring the band 1 completion rates to about 90%, see Figure D.6 for details.

**Acquisition Times:** The acquisition times are tracked from the records in the observing database. From an earlier study of this, it is known that the median time to slew and acquire a guide star for a new target is about 6 minutes. Data have not yet been assembled for semester 2006B and 2007A. Table D.3 summarizes the data for 2005B and 2006A that we recently compiled and analyzed.

In addition to the slewing and guide star acquisition time, there is an overhead for the 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 an image of the object through the slit, after alignment, while this is not done for MICHELLE.

| | # obs | Acq. time [min] |
|---|---|---|
| Telescope slew + guide star acq.<br>same as imaging acqusition w/o AO | | 6.0 |
| Instrument mode | # obs | Acq. Time [min] |
| GMOS-N / GMOS-S Longslit | 217/136 | 13.6 / 14.8 |
| GMOS-N / GMOS-S MOS | 65/41 | 14.7 / 15.6 |
| GMOS-N / GMOS-S IFU | 74/73 | 15.6 / 15.8 |
| NIRI / GNIRS Longslit | 162/465 | 9.0 / 9.8 |
| GNIRS IFU | 24 | 13.4 |
| NIRI+ALTAIR NGS imaging | 179 | 5.0 |
| MICHELLE / T-ReCS Longslit | 103/47 | 6.5 / 17.9 |

Table D.3. Statistics on acquisition times, 2005B+2006A.

## D.2 New Gemini Facilities

### D.2.1 The Near-Infrared Coronagraphic Imager (NICI)

Gemini’s latest addition to its instrument suite at Gemini South is the Near-Infrared Coronagraph (NICI) that arrived at Cerro Pachón in January 2007. NICI is the first Gemini instrument

designed specifically to search for and analyze the properties of planets orbiting other stars, and one of the first in the world optimized to image the light directly from the giant planets orbiting at large astrocentric distance around nearby stars. With an internal 85-element adaptive optics (AO) system onboard, dual imaging cameras with narrow-band methane filters, and an optimized coronagraph, NICI is designed to take advantage of Gemini's unique strengths to find exo-planets by imaging. Each camera has its own detector and set of methane filters, maximizing sensitivity to giant planets with methane in their atmospheres.

NICI passed acceptance tests in Hilo in October 2006, and was shipped to Chile in late 2006. The Gemini and Mauna Kea Infrared (MKIR) team, under the leadership of Doug Toomey, Mark Chun, Chris Ftaclas, Tom Hayward, and Manuel Lazo, assembled NICI and tested it in the lab at Gemini South. NICI was installed on the telescope in mid February, and saw first light on the night of February 20, 2007. The first observations demonstrated good coronagraphic performance and showed that the AO system was behaving as expected. The AO performance was limited by vibrations in the Gemini secondary mirror (M2) control system and by the thickness and resonances of the original deformable mirror (DM).

During the following months, Gemini engineers worked to improve the stability of the secondary mirror control system, and a new DM from the University of Hawai'i was delivered. The new DM has significantly greater stroke and higher resonant frequencies, meaning it could be used at greater gain under worse seeing conditions than the original DM. The new DM performed very well in lab tests, and was tested on the sky in July 2007. The results of that run were very encouraging with measured Strehl ratios greater than 50% at 2.2 μm (microns) which is in line with the expected performance.

The initial tests revealed a number of issues that must be resolved before regular science operations with NICI can begin. First, the electronics enclosures built were inadequate to keep all the NICI electronics cool enough for regular operations on the telescope. The heat exchangers in the enclosures have been rebuilt and the ventilation improved. The high-level software development by MKIR and Gemini staff continued throughout the last year, and additional work is needed to make NICI work as an integrated part of the Gemini queue. Finally, there are some problems with the dual-array controllers that must be fixed in order to have reliable low-noise performance on the telescope. Some array controller issues that appeared to be minor inconveniences during early testing turned out to be limiting factors when NICI was tested at the limits required to detect relatively faint planets. These issues will be addressed and corrected during the final months of 2007. We expect NICI planet finding observations to begin early in 2008.

NICI is the most specialized of Gemini's instruments thus far, and meeting its science goals requires a large survey of nearby stars conducted over several years. In 2005, Gemini awarded ~50 nights of observing time to a team led by Michael Liu and Mark Chun (University of Hawai'i), and Laird Close (University of Arizona), to conduct the NICI planet search survey. This survey will search for massive planets (like Jupiter) around nearby young stars. With a census of young planets, the NICI campaign team will address important questions about the distribution of masses and separations of planets in the outer regions of other solar systems, the effect of the mass of a parent star on the chances of planets forming, and the properties and compositions of young giant planets. Most planets that have been discovered around other stars are detected indirectly via their gravitational influence on their parent stars (the radial velocity

technique). NICI will find a very different class of planets than the radial velocity searches do because it will preferentially find the giant planets orbiting farther out, in regions of their planetary systems comparable to those occupied by the giant planets in our own solar system. Unlike the radial velocity instruments, NICI will be able to detect the infrared light from the planets directly, revealing much about their masses and temperatures.

### D.2.2 The Gemini North Adaptive Optics Laser Guide Star System

During the one-year period October 2006 to October 2007, the Gemini North Adaptive Optics Laser Guide Star (LGS) system was in its commissioning phase. The complex tasks of commissioning the LGS system were basically completed in February 2007. The commissioning process had begun in the spring of 2006. The LGS system consists of three control loops (Laser, tip/tilt and focus) that must interface with the existing telescope control software (TCS) at rates of up to 1 kHz. No other Gemini instrument has as many control loops operating at such a high bandwidth. In addition, significant and non-trivial technology development was required to procure and operate the laser, which is a state-of-the-art laser operating at high power. The result of this work is that the LGS system can now provide near diffraction-limited images to both NIRI for near-infrared imaging and long slit spectroscopy and NIFS for near-infrared integral field unit (IFU) spectroscopy.

We started using the LGS for science programs in February 2007. The Adaptive Optics system ALTAIR can now be operated both in the natural guide star (NGS) or laser guide star modes. The LGS system was designed to provide near diffraction-limited image quality in the near-infrared domain of a larger region of sky than a traditional NGS system. This is achieved by projecting a V ~ 9 artificial "star" onto the sky for high-order loop correction using a ~ 10 Watt laser tuned to the 589 nm sodium layer. High-order aberrations are corrected using the laser. An NGS is still required for correction of both focus and tip/tilt since neither of these terms can be corrected using the laser. However, the requirements for a guide star for the LGS system are much less restrictive than for an NGS system, corresponding to a three astronomical magnitude gain in depth and a 10-fold increase in sky coverage, from about 3% of the sky to about 30%. This allows better than 0.1 arcsecond angular resolution with a S/N increase of a factor 2 to 3 over non-AO.

The LGS system has been used predominantly on the variety of science targets from Science Verification and Queue programs: imaging of globular clusters, detection of stellar and solar system binaries, mapping of extended emission regions, spectroscopy of embedded star forming regions in our galaxy, IFU and long-slit spectroscopy of galaxy cores and spectroscopy of solar system targets. Images of the Orion "Bullets" (Figure D.8) and the interacting system of galaxies of Arp 229 (Figure D.9) illustrate Gemini's new AO capability.

During optimal conditions, the AO LGS efficiency is not much lower than with the NGS AO system. LGS setup time is from 6 to 11 minutes longer than a non-AO setup (average 6 minutes for the simplest non-AO setup), mainly due to the complexity of setting up three control loops rather than a single one. The spread in this setup time is due to the complexity of a setup: an on-axis bright star is much easier to acquire than a very faint off-axis star. Although we consider these setup times to be acceptable, considerable progress remains in operating LGS efficiently in the GN Queue, as discussed in the next section.

Figure D.8. This image of the Orion nebula "bullets" was taken with LGS and NIRI at f/14 through the Fe II, H2 (1-0) and K-band filters and then combined into one color composite image. Emission on scales smaller than 0.1 arcsecond (2 pixels) is apparent, which is a factor of 6 better than previous ground-based images of this region. The image is about 50 arcseconds across.

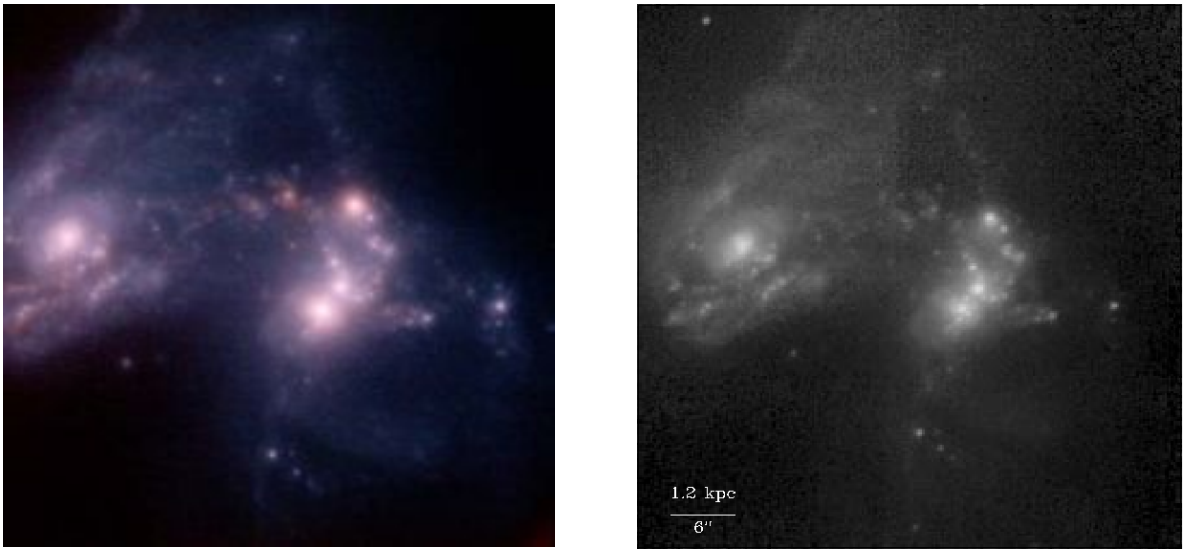



Figure D.9. The interacting galaxies of Arp 299. The LGS system has provided an unprecedented view of these interacting galaxies, which can provide valuable information about the astrophysical processes that can trigger star formation. Left is a false color H-band (blue) and K-band (red) f/14 NIRI LGS image. Right is an H-band image from the Hubble Space Telescope. The LGS image provides a factor ~3 improvement in resolution over the Hubble image at the same wavelength regime.

Although the base commissioning is essentially done, the LGS system still needs more work to be fully integrated into the Gemini North Queue observing system. Of largest concern is the fact that the LGS system suffers from more time in a fault state than other more mature systems. Also fault recovery and routine operations are more challenging for the operator than with other instruments. The Gemini science staff and engineers have identified several areas where improvements can be made. These improvements fall under five key categories: (1) software upgrades to make the system more robust and make error recovery more automated especially at

the operator/telescope control level, (2) hardware upgrades to make critical subsystems more reliable and robust, (3) hardware and software upgrades that will maximize the system's usefulness to the science community, in particular upgrades that can relax the natural tip/tilt star requirements, (4) training of the observatory staff astronomers and operators to use the system in the most efficient manner, and (5) providing useful information to the users of the system so they can understand what the technical limitations of the system are and how it can be used in the most optimal manner.

Overall, the road from commissioning to science use of the LGS system has provided a technological and scientific boost to the Gemini North telescope. This is the most complex instrument currently in use at the Gemini Observatory. This has necessitated a growth of the observatory staff and of our users to maximize the usefulness of this new mode of observing at Gemini. The experiences learned in the current LGS system will become even more useful when the Multi-Conjugate AO (MCAO) system becomes operational at Gemini South. Already several "lessons learned" have been imported by Gemini South.

### D.2.3 Major Milestones in the Integration of Key MCAO Sub-systems

The critical technologies and systems that are being integrated in the Gemini South Multi-Conjugate Adaptive Optics (MCAO) system passed several important milestones during the period of this report but most significantly during the last six months. We received the remaining subsystems of the AO module, CANOPUS, in July 2007. The natural guide star wavefront sensor (NGS wavefront sensor, from EOS Technologies), the laser guide star (LGS) wavefront sensors (from the Optical Sciences Company (tOSC)) and the real-time computer (also from tOSC) went through a three-week integration process in July/August which culminated with the first successful laboratory closed-loop tests of the entire system. This is a world's record – with three operating deformable mirrors and signals from five LGSs and three tip-tilt guide NGSs.

Second, an important review of the MCAO project occurred in early September 2007. This review, mandated by the Gemini Board of Directors, coordinated by National Science Foundation (NSF), and chaired by Norbert Hubin (European Southern Observatory) assessed the project management and technical risks, and the impact of the GNIRS recovery effort on the MCAO project schedule. Excerpts from the executive summary of the committee report include the following: *"The review committee believes that the Gemini MCAO team has the necessary past experience to develop this challenging and unique MCAO facility. The committee acknowledges the motivation and dedication of the MCAO team to complete the development of this facility [...] The committee is concerned by the lack of dedicated systems engineering for this project and the lack of global error budget monitoring, which might lead to the MCAO facility not meeting the top level requirements [...] There are a number of technical risk areas which have been highlighted by the project team, and acknowledged by the review committee, but no single major technical show stopper [...]*"

Several other MCAO subsystems saw significant progress in the last year. Work on the 50-watt solid-state laser, designed and built by Lockheed Martin Coherent Technology (LMCT), made significant progress, and we are confident that the power requirement will be met. A laser power of 35 watts has already been demonstrated in the laboratory at LMCT, and no show stopper is seen. The 50 W solid-state laser is scheduled to be delivered to Gemini South in April 2008. The

laser service enclosure design is completed and fabrication has started. For the Gemini South Telescope, the laser support structure (an extension of the telescope elevation platform) design is ongoing. The beam transfer optics opto-mechanical installation has started. The laser launch telescope is to be installed on the telescope secondary mirror (M2) structure at the end of October 2007. Significant software and fabrication efforts have resulted in successful field tests of the aircraft traffic-monitoring camera, ASCAM, in July 2007. ASCAM is currently being upgraded with an Apogee CCD, and final integration is ongoing. After another round of field tests at Cerro Pachón in October, it will be tested next to the Palomar Observatory aircraft detection system in California and then installed on Mauna Kea in January 2008. A second unit will be built for Cerro Pachón (see Figure E.10 in Section E of this document).

### D.2.4 Reqless Procurement System & Other Administrative Innovations

The Administrative Program has had several notable achievements in fiscal year 2007. A list of these and a short description of each follows.

**Travel Service Improvements:** Prior to 2007, travel arrangements for Gemini staff, review committees, contractors and the like were made by various Gemini support personnel who had many other duties in addition to travel responsibilities. In 2007, a Travel Coordinator position was developed for Gemini North and a reorganization of duties was undertaken at Gemini South in order to identify a travel arrangement counterpart in Chile. The result was an efficient, albeit small, group devoted mainly to travel services. This has enhanced efficiency throughout the organization, saving time for travelers and, we expect, may result in an overall savings in travel costs in the future.

**Web-based Software to Aid Staff Designated as Foreign Nationals:** The complex worlds of immigration and income tax come together in the payroll and human resource departments at Gemini. These worlds are confusing for everyone, including the experts. In 2007, the accounting staff undertook a project to identify web-based software that would help foreign nationals to go on line and determine their withholding status for payroll taxes and would provide an on-line tax preparation software for their federal tax returns. By mid-year, the software had been identified, procured, and set up for use. The on-line tax return was available in early April for employee use. Accounting and Human Resources personnel attended a mandatory tax and software training program in Texas in September. As the fiscal year drew to a close, Human Resources personnel had begun working with staff members to use the on-line program. By calendar year end, all of the many Gemini foreign nationals should be enrolled in the program.

**Upgrade of "Control" (the Budgeting Software Program):** Ordinarily, a software upgrade would not make the list of notable achievements. However, this software update easily fell into the classification of "project." This was not simply a case of putting a DVD into the computer and running a setup.exe file. This required migrating data into a SQL database, revising our account number format, consolidating historical data into a separate area, training staff to use the completely revised user interface and re-creating budget status reports from scratch. The ancient version of this budget and reporting software was extremely versatile and met our needs for multiyear budgeting and reporting. The new, improved version is even better, and will set us up for real-time, on-demand reporting.

**Deployment of a Web-based Purchase Requisition System:** In 2007, Gemini successfully implemented an online requisitioning system to replace the use of paper requisition forms. This web-based requisitioning system significantly reduces the labor required to process requisitions and purchases by eliminating manual entry of data from paper forms into the accounting system, and creates the possibility for continued productivity gains through improved web-based access to purchasing history and status information. The new system was originally developed by NOAO, and now that Gemini and NOAO are using the same online requisitioning system we are able to share the costs of continued development (planned modules include online travel requisitions and check requests) and provide technical support to each other.

**Establishment of Management and Leadership Training Programs:** An assessment of the state of Gemini included the observation that there were a lot of talented and technically gifted individuals in leadership positions who had never received any formal training in management, supervision or leadership. In 2007, the Human Resources department successfully launched a systematic and comprehensive training program that would address these learning gaps. Appropriate training programs were identified and individuals were enrolled, both in Hilo and La Serena, in these classes that would provide education in supervision, management and leadership skills. The program will be on-going and will continue to train established leaders as well as individuals who are identified as new-comers to supervisory or management roles.

**Completion of the Installation of VOIP telephones:** The Information Systems Group completed the installation of the voice over IP telephone that enabled us to remove the legacy PBX phones and system. This innovation adds convenience to our multisite observatory by allowing phone calls from one extension to another anywhere in our system (Chile, Tucson and Hawai‘i) by dialing only the three or four digit extension number rather than the long string of numbers required for an international phone call. The Observatory is also realizing significant savings in our international phone call costs.

# Section E

# Gemini Observatory Plan 2007 Overview and Status Reports

# E Gemini Observatory Plan - 2007 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 2007 operational plan. As a preface to these individual reports a summary of FTE distributions among units is presented to provide an overall staffing "snapshot" of the observatory at the close of this report (end of August, 2007). Each of the reports that follow the FTE distribution includes a summary of key activities and a status report for each unit from the first (2007) planning process held in Miami in February 2007.

## E.1.1 FTE Distribution

The Table E.1 below shows the staffing plan for calendar year 2007 in full-time equivalent (FTE) person-years. The column labeled "Actuals" represents a projection of staff presence from January 1, 2007 through December 31, 2007 based on what actually occurred through September 30, 2007, 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. The chart is separated into functions within each fund.

| FTE BUDGET AND ACTUALS 2007 | | | | |
|---|---|---|---|---|
| (FTE-Years) | | | | |
| O & M | 2007 | | | |
| Function | Budget | Actuals | Delta | % Delta |
| Administration | 27.49 | 25.77 | 1.72 | 6.3% |
| Information Systems | 13.88 | 13.38 | 0.50 | 3.6% |
| Public Information Office | 7.75 | 7.62 | 0.13 | 1.7% |
| | 2.42 | 2.23 | 0.19 | 7.9% |
| Engineering | 57.12 | 53.44 | 3.68 | 6.4% |
| Science Support | 43.57 | 43.01 | 0.56 | 1.3% |
| Research | 12.33 | 7.11 | 5.22 | 42.3% |
| Directorate | 5.00 | 5.00 | 0.00 | 0.0% |
| Totals | 169.55 | 157.56 | 11.99 | 7.1% |

| Facility Devel. Fund | 2007 | | | |
|---|---|---|---|---|
| Function | Budget | Actuals | Delta | % Delta |
| Engineering (AO System) | 14.13 | 10.00 | 4.13 | 29.2% |
| | | | | |
| Instrument Devel. Fund | 2007 | | | |
| Function | Budget | Actuals | Delta | % Delta |
| Instrumentation | 2.50 | 0.53 | 1.97 | 78.9% |
| | | | | |
| Total FTEs | 2007 | | | |
| | Budget | Actuals | Delta | % Delta |
| All FTEs | 186.18 | 168.09 | 18.09 | 9.7% |

Table E.1 Observatory FTE Budget and Actuals.

Table E.1 also shows that the observatory will have 18 FTEs less available than planned activities would have required, and this is a problem. However, these numbers should not be interpreted to mean that we have less staff available than we have had in prior years. The 2006 – 2010 staffing plan reflected a steady, and fairly dramatic, planned increase in staff to accomplish the goals established for the future. The Figure E.1 below shows the planned staffing increase compared to the actual FTE presence in the past four years. Gemini Observatory has steadily increased staffing levels, but it has not been at the planned pace.

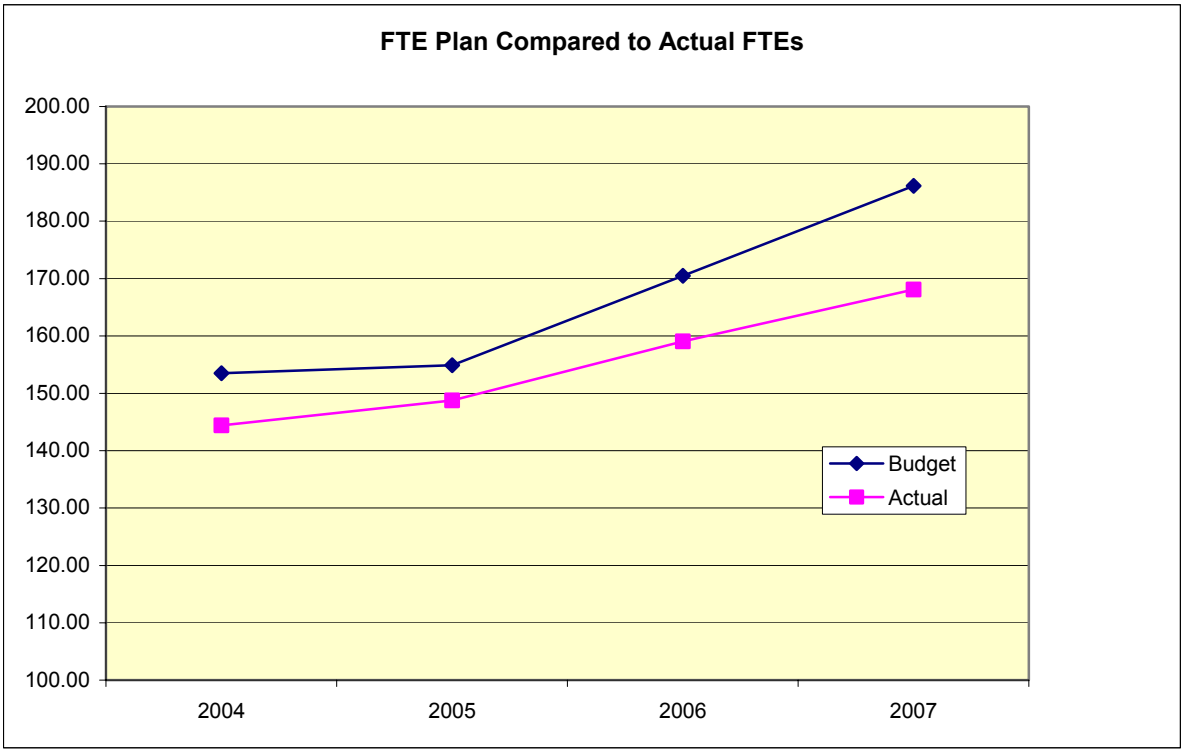



Figure E.1. Gemini FTE Plan vs. Actuals.

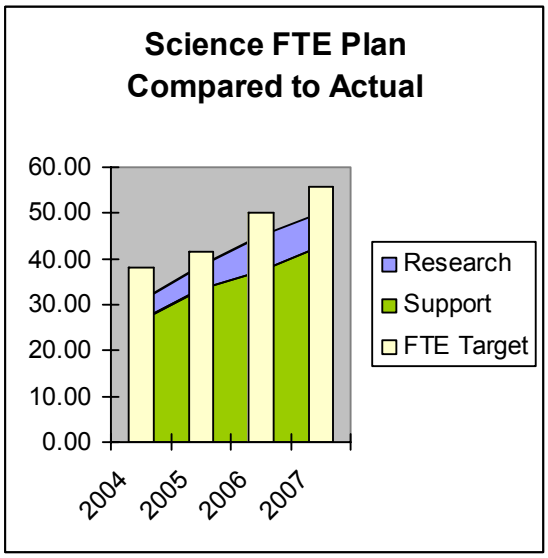
The Table E.2 below re-groups the first FTE chart into functional groups experiencing different circumstances with respect to the staffing plan. A brief explanation for each group follows this chart.

| All Funds | 2007 | | | |
|---|---|---|---|---|
| Function | Budget | Actuals | Delta | % Delta |
| Total Science | 55.89 | 50.12 | 5.77 | 10.3% |
| Total Engineering | 71.25 | 63.44 | 7.81 | 11.0% |
| Aspen Staffing | 2.50 | 0.53 | 1.97 | 78.9% |
| All Other | 56.54 | 54.00 | 2.54 | 4.5% |
| All FTEs | 186.18 | 168.09 | 18.09 | 9.7% |

Table E.2. FTEs by functional groups.

**Science:** The 2006 – 2010 plan called for steady and ambitious growth in science staffing in order to accommodate the shift from a mixed classical and queue-observing environment to one that could accommodate 100% queue observing. While there has been steady growth in the size of the science staff, the numbers of science staff has been about five FTEs lower than planned in

the last two years. The staff plan is represented by the yellow bars in the graph in Figure E.2, and the green and blue filled in area behind the FTE target bars represent the actual FTE effort devoted to support and research time respectively. The support time falls very close each year to the budgeted time, with the effect that any science staffing shortage is being garnered from the science research time. This is not an acceptable solution and recruiting efforts are ongoing.



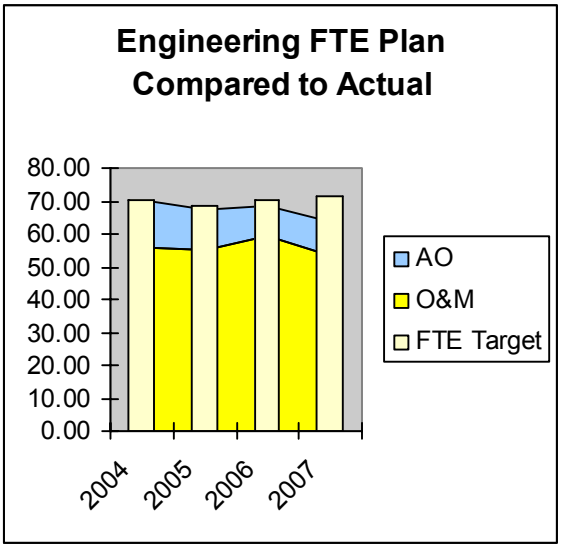




Figure E.2. (left) and E.3. (right) showing Science and Engineering FTE planned vs. actuals.

**Engineering:** The engineering staff plan has remained relatively steady ranging from about 68 to 71 FTEs. The plan was to shift engineering staff working on MCAO to operations and maintenance over time, with the original idea being that the shift would be complete by the end of 2006. In Figure E.3, the staff plan is represented by the yellow bars, and the yellow and blue filled area behind the FTE target bars represent the actual FTE effort devoted to operation and maintenance (O& M) and AO activity respectively. As the Figure E.3 depicts, there is still considerable effort being dedicated to the development of MCAO (indicated as "AO" on figure), leaving the effort available for O&M at a lower level than planned. In addition, the full engineering staff count is at its lowest point in these four years, further decreasing the level of effort available for O&M. The reduction in the number of staff members is concentrated mainly in the software engineering area (2.17 FTE) and in the electronic engineering area (4.44 FTEs) where the observatory is having difficulty finding experienced and available laser and instrumentation engineering personnel.

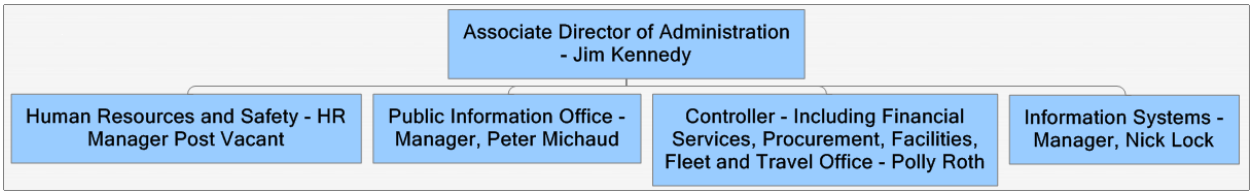
**Aspen Instrumentation Program:** The plan allowed for the hiring of 2.5 FTEs to manage the Aspen Instrumentation Program. One individual was hired in July, and offers have been made for the two remaining positions.

**All Others:** This group represents the Directorate, Information Systems, Human Resources, Accounting, Purchasing, Safety, Administrative Support, Travel and the personnel taking care of the Facilities and Fleet. The 2.54 FTE difference between planned and actual staffing represents, by and large, the lag from normal turnover in these positions. This number is slightly larger than in past years, but does not appear to signal a long-term trend.

## E.1.2 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 Purchasing.

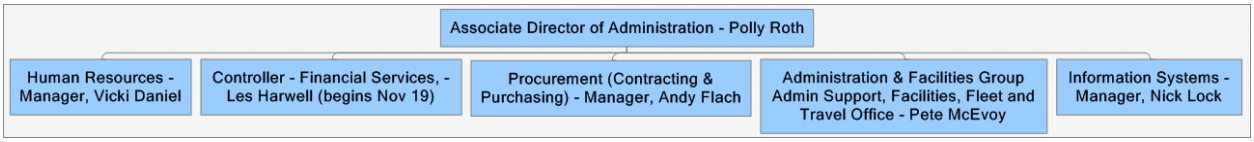
Fiscal Year 2007 proved to be a year with significant organizational and management changes within the Administrative Program. The Fiscal Year began with Jim Kennedy at the helm as Associate Director of Administration, with the Administrative Program parsed into four main groups as shown below.




Several significant changes occurred in the first quarter of the fiscal year. First, the search for a Human Resources Manager, a post that had been vacant for over six months, culminated in the selection of Vicki Daniel, an experienced and energetic addition to the Gemini team. Secondly, the Gemini Director's emphasis on Safety as a top priority for our future led to the decision to move Safety from under the aegis of the Human Resources Department and to set it up as a separate department with its own manager. A Safety Consultant was hired to lead the safety effort while Jim Kennedy led the search for a Safety Manager who would ultimately report directly to Doug Simons. In the meantime, Jim Kennedy directed the activities of the newly formed, stand-alone Safety Department. Third, the Controller Group, which had grown over time to be a sort of administrative catch-all, was split into two groups, one retaining the basic financial functions of accounting, purchasing, budgeting, forecasting, reporting and compliance, and the other concentrating on support and infrastructure functions such as facilities, fleet, administrative support, travel and visitor services. A mid-year snapshot looked like this:


A final phase of reorganization took place due to a combination of factors. There was the planned move of Safety to the Directorate once the manager was in place, a natural migration of Public Information Office interaction from Administration to Science as observing time ramped up and, finally, the not altogether unexpected but still somewhat surprising announcement that Jim Kennedy was going to retire after over 25 years of dedicated service to AURA, the last 10 years at Gemini Observatory. A search for a new Associate Director was undertaken, and Polly Roth, Gemini's Controller for 10 years, was selected to assume the Associate Director responsibilities on August 1, 2007, simultaneous with Jim's departure.

As fiscal 2007 drew to a close, the Administrative Program had taken on a new look. The Safety Department, under the management of Ron McKinnon, had migrated to the Directorate; the Public Information Office, managed by Peter Michaud, was under the direction of the Deputy Director, Jean-René Roy; and the Controller Group was modified once more by the extraction of all Contracting and Purchasing functions into a Procurement Group that will be headed by long-time Gemini Manager, Andy Flach, beginning in October 2007. The recruitment for a new Controller was concluded in early October and Les Harwell, a CPA with experience in public accounting, non-profit accounting and long-term budgeting will begin work in Hilo in mid-November. The year-end snapshot of the Administrative Program looks like this:




The groups within the Administrative Program are described in more detail below, and along with a report on their calendar 2007 projects to date.

### E.1.2.1 Administration Support and Facilities

October 2006 saw the creation of the Administration & Facilities Group (AFG) at Gemini. This group was 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. The new group now handles all these functions at both sites but “under one roof,” so to speak.

The principal benefits of this change are two-fold. Firstly, the change facilitated greater focus on the key issues and personnel involved in Gemini’s budget forecasting, financial analysis, control and reporting, accounting, contracting, purchasing and overall compliance management across the Observatory, as, prior to the change, many of the administrative services mentioned above also competed for the attention and time of Gemini’s Controller. Secondly, the change has stimulated the idea of greater teamwork and collaboration in the administrative area between both of the sites and a move towards uniform services of a high quality standard.

As organizations cross thresholds in size, speed of development and complexity, changes of this nature in administrative support are not uncommon. This particular change, however, also responded to staff feedback and ideas from management, including administrative managers and staff who met with the Director during the period after taking up his post, when he spent time seeking their opinions about needed improvements at the Observatory. The period reported on has been one of transition and consolidation of the group.

Goals for this new group are to focus the administrative effort at the Observatory, not telescope, level; to implement the best from both sites and improve service standards; to reduce confusion for administrative users about where to obtain the services they require and about the standard of service delivery; and to reduce any possible duplication of effort in service provision.

The work of the 13 staff in this group is divided into five main areas:

**(1) Directorate Services:** These are all the close, direct and detailed administrative support tasks that senior executives in any fast-paced organization like Gemini can't manage without. The Director & Deputy Director plus the six Associate Directors and Heads, equally distributed across the two sites, gain more time to concentrate on the "big picture" by relying heavily on their support staff for their agenda and meeting coordination, the organizing of presentation material, follow-up with key contacts and personal help in juggling the very many daily demands placed on them. These services also encompass the detailed logistics planning that goes into the more than twenty major committees held during the year as part of the Observatory's governance, oversight and planning.

**(2) Visitor Support:** This work is geared towards ensuring that work related visitors to the each telescope receive local support from the base they are visiting from before their arrival until when they leave, including the arranging of local in-town accommodation and mountain lodging, transport, catering, office space, support for any Science talks that might be given during their visit, liaison between the visitor and their Science, Engineering or Administration host on logistical issues, even on-the-spot help in handling any of those typically unforeseen inconveniences that can arise for any traveler abroad, even if they are not necessarily work-related, just to ensure that their stay is as productive as possible.

**(3) Facilities & Infrastructure:** This work is dedicated to supporting Gemini's non-dome infrastructure; providing all building services, except at the telescopes themselves. These are the Gemini Northern Operations Center in Hilo, Hawai'i; the Gemini Southern Operations Center in La Serena, Chile; the annex buildings at the "Casa Verde" (Green House) office structure and "Casa Ocho" (House Eight) on the AURA Campus in La Serena; the Hale Melemele (Yellow Building), rented temporary office space in Hilo; and Gemini offices at the University of Hawai'i mid-level facility on Mauna Kea (Hale Pohaku) and in the AURA Round Office Building on Cerro Tololo, Chile. This group also has responsibility for a warehouse known as the Foreign Trade Zone (FTZ) at the Hilo airport, which is leased from the State of Hawai'i, in addition to two areas of warehouse space at Gemini South that have been leased from AURA in Chile as well as the scheduling, maintenance and assignment of the Observatory's 20+ vehicle fleet plus contracted transport services, such as the bus that transports staff from the La Serena base to the telescope at Cerro Pachón.

**(4) General Administrative & Secretarial Services:** The staff in this area are involved in a wide variety of tasks from greeting staff at the base building's Reception desks and via the switchboard, to working as administrators of some of the Observatory's key planning and document management software, providing translation services; scheduling and overseeing conference areas, document, mail handling and performing updates to many of the Observatory's web-based administrative schedules.

**(5) Travel:** Gemini's active involvement with its seven country partnership and its unique two sites mean that efficient travel arrangements are a key operational requirement. Gemini is a very dynamic organization; plans are constantly subject to change and travel arrangements must always be set up to take these pressures into account while providing the best possible support to the travelers making the long trips back and forth. Part of the restructuring under the AFG meant

the recruiting of specialized travel assistance and the centralizing of travel services at Gemini North, to reflect that in place at Gemini South.

In addition to the five core work areas described above, the following new initiatives were initiated during the period of this report and their completion rates indicated as of August 31, 2007 (Table E.3).

Table E.3. Summary of Band 1 2007 tasks for Administration Support and Facilities

| TASK TITLE | TASK DESCRIPTION | PERCENT COMPLETE |
|---|---|---|
| Implement Driving Safety Plan @ GN | Implement all elements of driving safety plan at Gemini North except move DVD production to band 2 | 80% |
| Consider vehicle replacements @ GN | Review Gemini North vehicle fleet status and organize suitable replacements during 2007 | 100% |
| Consider vehicle replacements @ GS | Review Gemini South vehicle fleet status and organize suitable replacements during 2007 | 100% |
| Resolve Vehicle Maintenance Issues @ GN | Review vehicle fleet maintenance at Gemini North and breach the gap between internal customer and supplier expectations | 100% |
| Improve HVAC @ GN | Improve HVAC system at HBF and seek opportunities for energy savings | 40% |
| Multicopiers/scanner @ HBF | Obtain multicopier/scanners for Gemini North | 50% |
| Promote common transport use @ GS | Review transport arrangements at Gemini South with AOSS, with a view to competitive bidding of common transport requirements | 55% |
| Review Janitorial Services @ GN | Review Janitorial services @ GN | 85% |
| Ensure AFG assistance to HBF-X move in preparations | Support building work for Gemini North extension and ensure adequate HBF-X move in preparations | 25% |
| More systematic Facilities Maintenance via Maintscape | Begin utilizing the Maintscape software system to manage facility maintenance planning and reporting | 50% |
| Optimize Committee Mtg Planning | Develop a tool to standardize Committee Meeting Planning North & South | 60% |
| Travel Service Improvements | Select and train Travel Coordinator for Gemini North | 97% |
| Select & Train AFG Team Leader @ GN | Select and train Senior Admin Assistant at GN (Facilities bias) | 97% |
| Forklift for GN | Obtain forklift for Gemini North - look into rental options | 90% |
| Safety Concerns HBF Front Lobby | Review Safety Concerns at HBF Front Lobby | 75% |
| HBF Phonebaord & Receptionist Ergonomics | Review HBF Phoneboard and Receptionist Ergonomics | 65% |
| CP Dorm | Construction of the CP Dorm - first modular portion of 5 rooms - move to administration | 33% |

A customer survey taken by Gemini staff at the close of this period indicated the following satisfaction levels (Figure E.4) with the services provided by the Administration & Facilities Group.

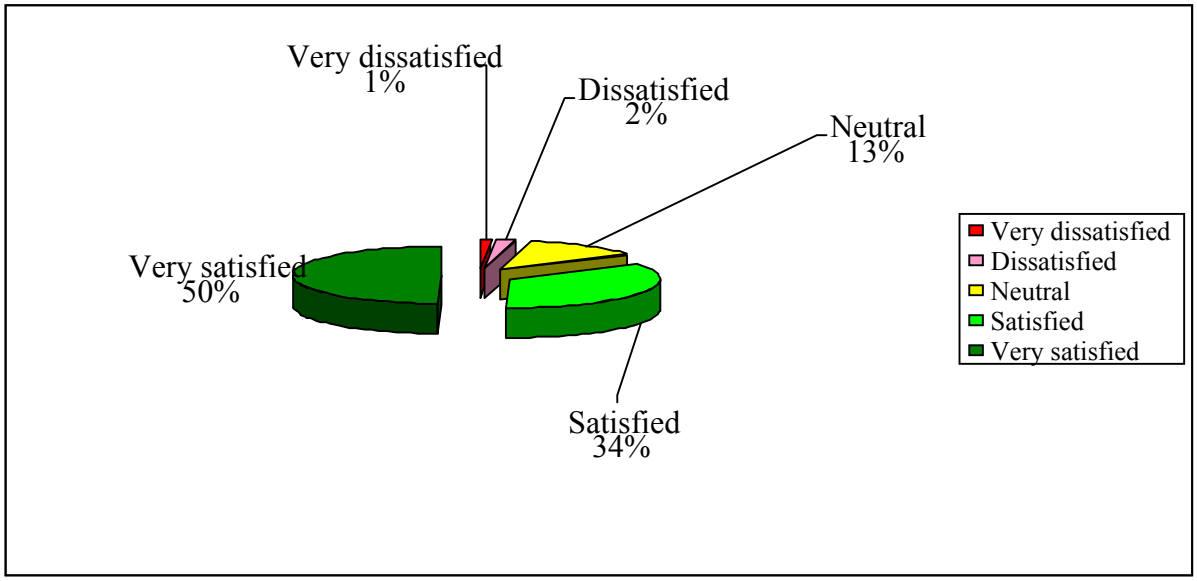



Figure E.4. Staff satisfaction survey results of services provided by Administration & Facilities Group.

### E.1.2.2 Human Resources

As of October 31, 2007, Gemini Observatory has a total staff of 181 employees, including Chilean nationals and those who are considered temporary and/or part-time staff. The employee head count at Gemini North (Hilo) is 93. There is one employee in the Tucson Gemini office. The Gemini South (La Serena) staff has remained constant at 88. Overall, Gemini Observatory employs 94 international hires of which 53 are Chilean. Gemini has staff from 18 countries, including the United States.

A human resources manager was hired in December of 2006. The department continues to streamline its operations in order to expedite and assist the managers with the hiring process. We currently have 20 open positions that need to be filled as soon as possible. Human Resources has become more

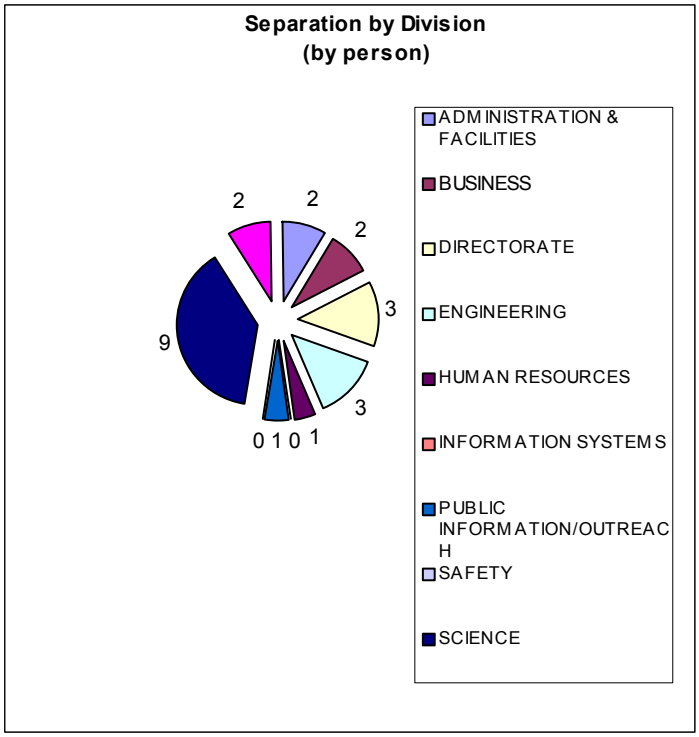
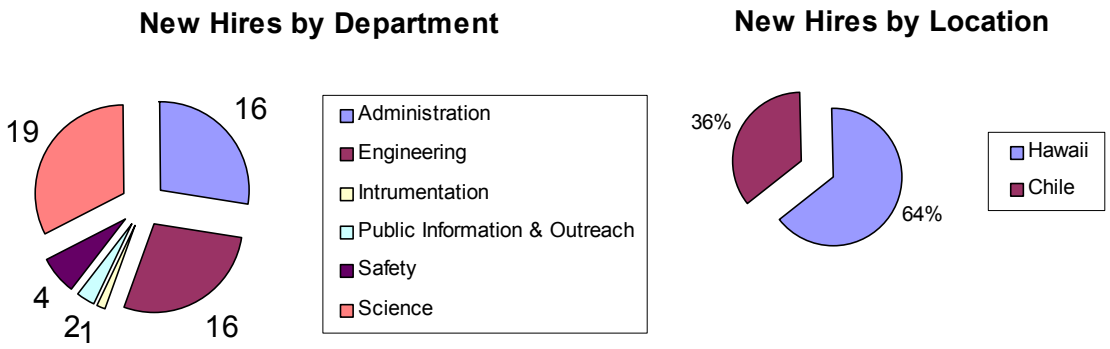



Figure E.5. A summary of staff departures by observatory division.

proactive in its recruiting efforts, initiating personnel requisitions, updating advertisements, and setting up interviews in a timely fashion. We continue to work with the hiring managers in reducing the openings at the observatory.

The turnover for the past fiscal year, ending September 30, 2007, was at 14% (see Figure E.5 on previous page). This is the first year that the turnover has been tracked. This percentage includes those that left at the end of their employment term. The most common reasons listed for leaving were personal reasons (26%), followed closely by a fixed contract ending (22%).

**Recruitment And Relocation:** Gemini has hired 58 individuals during the calendar year 2007. These 58 include interns and outside agency staff.




Figures E.6 (left) and E.7 (right). Details on new hires by Department and Location at Gemini.

Of these, twenty-three were relocated from areas outside Hilo or La Serena. There have been challenges with the current relocation company. The department of Human Resources has handled these challenges in a proactive matter, and has been more aggressive in demanding prompt and efficient service. The Human Resources department continues to offer outstanding service to our recruited staff. They are provided with orientation and other assistance in locating housing, obtaining driver's license, greetings at the airport and other services.

**Visa Processing:** This year to date, Human Resources processed 22 visas, including Permanent Resident card (green cards). The Table E.4 indicates the current visas that we hold for staff members.

| Visa type | Current holders |
|---|---|
| H-1B | 13 |
| J-1 | 5 |
| L-1 | 19 |
| O-1 | 1 |
| TN | 6 |

Table E.4. Current visas held for Gemini staff.

Gretchen Magnuson has been instrumental in expediting the visa process. She has reduced the turnaround time for the processing by researching and submitting the forms in house, rather than using outside counsel. Timely reminders are sent regarding renewals and needed documents.

Recently, Gemini obtained an L-1B visa for a technician, and was proactive in providing the necessary documentation to obtain this approval.

**Benefits and Compensation:** This year has been a time of change and challenge in the salary arena. Many of the salaries were out of range and Human Resources was tasked with developing a strategy to rectify the discrepancies. With the AURA Science Salary schedule being corrected, those individuals affected by these grades have had their salaries corrected. Gemini continues to participate in other relevant surveys, and salaries for other grades will be corrected within the next year. A new performance evaluation system will be implemented in 2008, which will meet the requirements of all departments and better match pay to performance.

The Human Resources has added value to the benefits for those at Gemini North. Benefit Services Group was hired as an outside administrator of the Flexible Spending Accounts. Because the company will promote this service, more employees will have an opportunity to take advantage of the pre-tax benefits of the accounts. Vision care was added to the Cigna Health plan for those at Gemini South. Human Resources continues to search for better health care options for both locations.

The Human Resources Managers at AURA have formed a committee to review the pension plan periodically to ensure that the investments we offer remain competitive. The first meeting will be held in late 2007.

**Training:** This has been a year of training for Gemini Staff. Beginning in February, Gemini North managers began attending a series of one-day basic managerial seminars. To date, most have attended five of these courses. In August, the Gemini South managers attended a three-day team-building training workshop that was very beneficial. In July, forty-one managers and supervisors attended a 3.5-day retreat conducted by Landmark Education Business Development. The course is a foundational program designed to bring about a fundamental shift in what people see as possible, and thereby create an environment for, and commitment to, the success of the organization's objectives. The success of the retreat is evident in that many have initiated and attended the various follow-up sessions. A second retreat will be held in January 2008.

The Human Resources continue to search for additional training courses for all staff to attend. It is anticipated that a 2008 training plan will be put together by December.

The following new initiatives were executed during the period of this report. Due to the cycle of planning/execution, these projects are all scheduled to be completed by the end of 2007. Table E.5 lists these initiatives and the current percentage of completion as of the end of August, 2007.

Table E.5. Summary of Band 1 2007 tasks for Human Resources.

| TASK TITLE | TASK DESCRIPTION | PERCENT COMPLETE |
|---|---|---|
| Review of Internal Salary Structure | Review current salary structure; implement any necessary adjustments to ensure fairness and consistency in each job group | 70% |

| | | |
|---|---|---|
| Implement Leadership Training | Offer intensive workshop to department head managers to ensure that the Gemini Mission is agreed upon and implemented consistently within and between locations and departments | 100% |
| New Role of HR | HR as a strategic partner in setting policy and formalizing hiring process by working proactively with managers on policy development and initiating human resource-related forms and documents | 60% |
| Update all Gemini Policies | Update all procedures and policies to ensure compliance with DOL laws and to ensure policies are consistent with Gemini's Mission and Working Culture and are implemented consistently and fairly | 30% |
| Upgrade ABRA | Incorporate AOSS Staff into ABRA. Would need to increase number of files in ABRA. Current system at 150 Ees only - upgrade to 300 | 10% |
| ABRA HR in Chile | Install ABRA-HR in Chile | 1% |
| Salary Surveys | Participate in industry salary surveys. Review wage and benefit surveys to ensure that Gemini remains competitive in current marketplace | 75% |
| Develop Supervisory/Managerial Training Matrix | Offer basic supervisory classes to current managers and supervisory staff to assist in the transition of project mentality to sustainable operation mentality | 60% |
| Revamp Recruiting Procedure | Expedited through use of eRecruiter; minimize labor intensity by use of online scheduling program; improve offer letters; minimize interview panels | 20% |
| Relocation Assistance Program | Develop more comprehensive relocation assistance program for both locations; develop more comprehensive new hire orientation to include detailed introduction into the culture of Gemini and working living in Hilo/La Serena | 100% |
| Third Party Administrator for FSA | Utilize third party administrator for the FSA benefit to comply with HIPPA regulations and to provide staff with educated knowledge regarding their accounts | 90% |
| ABRA and Crystal Report Training | HR staff in Chile and HI to attend classes | 20% |
| Basic training | Offer basic training classes for all staff, including communication, time management; customer service, how to multi-task; basic computer classes, ie excel, word, access - move to band 1 | 20% |
| Employee Satisfaction Survey | Implement Employee Satisfaction Survey utilizing outside party to compile statistics - move to band 1 | 0% |

### E.1.2.3 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 resource. Nevertheless many projects have also

been completed. Table E.6 summarized the band 1 tasks worked on by the group. A project summary is listed below:

**Email MS Exchange:** By far the biggest project undertaken by the ISG in recent years was the migration of all staff email from the aging UNIX Sendmail system to a MS Exchange cluster located at both sites. Email is considered to be the most important communication tool within the observatory, so it was not a trivial task to deploy a completely new system and migrate everyone across without losing any email.

**Network Upgrades:** The ISG invested a significant amount of money this period to replace network hardware, some of which is more than six years old. Several days of telescope time was lost during this period due to catastrophic hardware failures. These weaknesses have since been analyzed and produced a networking strategy for building a more robust network architecture. A pair of Cisco 6509 catalyst switches has been installed on Mauna Kea. These switches are inter-linked and thus can provide some level of redundancy. This fault-tolerant design has also been applied at the Hilo base facility. Similar upgrades are planned for Gemini South in early 2008.

**IP Telephony:** Also noteworthy, Gemini has now completely converged its communication technologies to a single standard – everything over IP. The legacy PBX equipment at both sites was taken offline during this period. The conversion to Voice over IP (VoIP) is expected to pay for itself many times over, due to reduced long distance / international toll charges and free cross-site direct dial communication.

**Storage and Backups:** Another area that required significant investment was the infrastructure required to store and recover important data. The ISG chose Netapps "filers" for reliable storage on spinning disks; these units also support multiple file systems and advanced features such as a configurable "snapshot" function for recover from accidental file deletion or modification. SUNstore tape libraries recently installed at both summits and base facilities protect important data from accidental deletion or modification. A full backup is stored off-site at the Bank of Hawai'i.

**NSF Security Preparations:** Many Band 1 projects are linked to the pending National Science Foundation (NSF) security review, which was initially expected to occur sometime in the fourth quarter of 2007. However, at the third NSF cyber-security summit attended by the ISG manager and AD for Operations, we were informed of the insertion of "Article 51" into the cooperative agreements and that we had at least another six months to write an initial report (based on our own risk assessments) and prepare for compliance. The technologies and changes required for compliance will be the ISG main focus in early 2008.

Table E.6. Summary of Band 1 2007 tasks for the Information Systems Group.

| TASK TITLE | TASK DESCRIPTION | PERCENT COMPLETE |
|---|---|---|
| Gemini Email Service Upgrade | Replace aging email service based on Sendmail to a modern feature rich email & scheduling solution. | 100% |
| Telescope Operations Workstations | Replace aging Solaris workstations with a powerful Linux environment. | 40% |

| | | |
|---|---|---|
| HBF Core Switches Upgrade | Replace old Cisco 5500 catalyst with a redundant pair of modern Cisco 6509 series switches | 100% |
| IS Security Polices – NSF | Write IS Polices, email, backup, passwords, EAR/ITAR etc ... | 15% |
| 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. | 2% |
| Replace Pachón core switch | Upgrade old Catalyst 5500 with a modern 6509 series | 100% |
| Deploy Certificate Services – NSF | Provide the ability to issue and maintain staff digital certificates | 30% |
| Upgrade Core SUN Servers | DHS, real-time and boot servers etc. Most are at least six years old, slow and high risk of failure resulting in potentially long periods of downtime and lost science. | 2% |
| Complete GEA migration (GN/GS) | Migrate GEA off the unreliable Penguin servers and place on more robust hardware from SUN | 80% |
| Complete Installation of IP Phones | Site-wide deployment and remove legacy PBXs. Supporting both systems costs time and money. Hilo voice mail system is old and could fail anytime | 100% |
| Upgrade Firewalls – NSF | Upgrade PIX IOS to version 7.3.2 from 6.3.3 | 50% |
| Deploy Single-Sign-on Solution - NSF | Newer version of IOS, also supports split tunneling, | 5% |
| HBF-X Network and Phone | Plan network & phone infrastructure for HBF-X | 20% |
| Enterprise Backup Solution | Current backup system is old and cannot meet the present demand. Risk of losing science data or time if machines fail or are damaged by events or fire. | 100% |
| Complete WiFi upgrade | Replace old Linksys APs with Cisco Aironet Series. Apply WPA and Radius authentication. | 95% |
| GS Eng Lab VC Upgrade | Enhance SBF Eng Lab VC facility to support large meetings | 100% |
| Deploy new secure FTP service | Replace old FTP server (fornax) with a new flexible solution. | 100% |
| Network and Computing Standards - NSF | Despite our efforts to standardize we constantly face divergence such as users installing whatever flavor of Linux takes their fancy. | 1% |

### E.1.2.4 Controller Report (Includes Purchasing)

During the year of this report, the Controller Group responsibilities included all accounting, budgeting, financial reporting, forecasting, compliance, contracting and purchasing functions of the observatory. Our daily work consists of such tasks as payroll, paying bills, buying goods and services, 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/Property Accountant, a Payroll Accountant, an Accounts Payable Clerk, a Contracts Manager, a Purchasing Agent, a Purchasing Assistant, and a part time Clerk assisting with payroll and purchasing.

**Challenges:** Our challenges this year related mainly to a heavy workload. The accounting and purchasing teams have only a few members each, making any extended vacancy difficult to manage. While both teams are fairly broadly cross-trained in their respective areas, the workload is such that any absence makes it challenging to keep up with the most essential daily work. There were two position vacancies, usually a rare occurrence in this group, that required that essential tasks be shifted to the individuals remaining and added to their already heavy workload. There was a six-week vacancy in the Payroll Accountant position, a position whose tasks absolutely must be covered immediately. Additional high demands were placed on the accounting group when the Controller was promoted to the Associate Director position before a replacement Controller was identified. As a result, the Controller Group had significantly less manpower than planned.

**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 2007 and the percent complete status as of the end of August 2007. Projects that we are certain will be at least 90% complete (if not 100% complete!) in calendar 2007 are the Expatriate Assistance Software project, Web-based Time Cards for AOSS Gemini Employees and the upgrade of Control. The Import/Export Compliance System project proved to be much larger than we had anticipated when we took it on, and by year-end we will have devoted even more time to it than we had planned in the beginning. We are not yet certain if we will exceed 75% completion of the re-scoped project by year-end. The project to improve compliance awareness has made progress, with the addition of our Cooperative Agreement and associated documents to our web site and annotated where compliance responsibilities are noted. What remains to be done is to assign each responsibility to an individual, to ensure their awareness and knowledge of the requirement. The purpose of the project is to spread compliance responsibility more sensibly across the Observatory rather than to concentrate it in a small group of individuals. This project will likely be transferred into 2008.

The one cancelled project is the planned hiring of a temporary helper with the purpose of relieving permanent staff of routine tasks so that they could concentrate on timesaving innovations. In mid-year we determined that the overall staffing of the group needed to be reviewed in light of the increasing workload. As part of the final stage of reorganization described in the general description of the Administrative Program, the Procurement Group was set up independently of the Controller Group, responsibilities were reassigned, and this temporary position was cancelled in favor of creating a long-term position in the new Procurement Group. The new position will begin in October 2007.

Table E.7. Summary of Band 1 2007 tasks for Controller.

| TASK TITLE | TASK DESCRIPTION | PERCENT 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. Tax prep on line is an option. | 75% |
| NSF Management and Cost Review Preparation | Preparation for NSF Cost Review | 100% |
| Improve Compliance Awareness | Develop system to assign compliance with Cooperative Agreement provisions or other legal requirements to responsible individuals. | 18% |
| Improve Import/Export Compliance | Review and revise import/export compliance procedures with AURA Corporate assignee and implement necessary changes. | 35% |
| Web-based purchase requisition system | Paperless Requisition software implementation (Reqless). Allows input of requisitions from the web, automatic circulation for electronic approvals. | 100% |
| 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. | 0% |
| Upgrade Control | Upgrade Control (budgeting and financial reporting software) to current version. Simplifies data entry, more versatile reporting, eliminates freezing of program. | 85% |
| FT 1 year temp | One FT temporary person for one year. Bright, detail oriented to free up time for Andy, Tamara and Renee so that they can get Reqless and Control upgrade up and running with more breathing room. | Cancelled |

## E.1.3 Development Program

### E.1.3.1 The Instrument and Facilities Development Program Mission

The instrument and facilities development group plays a key role in achieving Gemini Observatory's mission to explore the universe by providing our astronomical community with the tools it needs to answer fundamental astrophysical questions. Astronomy is a technology-sensitive endeavor. 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 in 2007 a central function of the observatory, as critical to its long-term success as the nightly collecting of photons with the existing facilities.

As part of its mission, the development group assisted by providing the Gemini user community with the facilities, instruments, and observing infrastructure needed to probe the most important questions identified by representatives of the Gemini partnership within the budget allocated. This included upgrades to the observatory infrastructure such as the adaptive optics or the acquisition and guidance systems, procuring new filters or enabling new observing modes of existing instruments, enabling visitor instruments, procuring new instrumentation, conducting feasibility studies or competitive design studies for promising instrument concepts, and developing the procedures and infrastructure needed to execute large "campaign" surveys or

observations to address questions that would otherwise be beyond the ability of a single team or Gemini partner to answer. The team worked 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 group was also engaged in the projects that are designed to make the long-term goals of the observatory a reality through strategic planning and collaboration.

To produce forefront science and continue to compete in the global market of astronomy, we worked to update our instrument suite. The second generation of facility instruments is now nearing completion. The Near-Infrared Coronagraphic Imager (NICI) was delivered to Gemini South in January 2007 as described previously. The near-infrared multi-object spectrograph FLAMINGOS-2, after multiple delays, is scheduled to arrive at Cerro Pachón in mid-2008. GNIRS is being repaired and will return to service on Gemini North in early 2009. The Gemini South Adaptive Optics imager (GSAOI) is ready for use with MCAO. At Gemini North, we arrange for the use and support of the visiting mid-infrared echelle spectrograph TEXES during semesters 2006B and 2007B.

The development group is managing and supporting the designs studies and the construction of the next generation of Aspen instrumentation. Two of the new Aspen instruments (the Gemini Planet Imager, GPI, and the Precision Radial Velocity Spectrometer, PRVS) have been designed explicitly 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 the instruments across a large enough field of view to explore the first luminous objects in the universe.

### E.1.3.2 Phase 2 Instruments (GNIRS, NICI, FLAMINGOS-2)

At the end of April 2007, the Gemini Near-Infrared Spectrograph (GNIRS) suffered a temperature controller failure that resulted in overheating. As GNIRS was warmed up for routine cold head service, the fast warm-up system and vacuum pumps were used following normal operating procedures that had been successfully used a dozen times before. The fast warm-up system has a completely independent hardware controller that shuts off power to the heater resistors when the temperature set point is reached. For some unknown reason the controller failed, and GNIRS was continuously heated until it reached temperatures near 200° C.

When Gemini staff members recognized the problem, they shut the heaters off and allowed GNIRS to cool passively. After the instrument had cooled, the dewar was opened and the main components inspected by a team of Gemini and NOAO engineers and scientists. The initial inspection showed that some components with low melting points were damaged, but most components were clearly fine. The plastic Delrin™ parts, which are mostly used as lens or filter spacers, had melted, and the resin in the load-bearing G10 fiberglass components were weakened to the point that some had cracked or failed. The most significant loss was the InSb Aladdin 3 science detector, which contains a layer of the low-melting point metal Indium. The detector and

mount will have to be replaced. Some optics, including the diffraction gratings, will require cleaning, repolishing or recoating. Many of the damaged parts, including the entrance window, detector mount and the filters, will be replaced with spares already on hand at Gemini. The fiberglass struts were replaced prior to shipping GNIRS to Hilo. The dewar and optical bench, most mechanisms, wiring, motors and electronics were not damaged.

The Aladdin 3 replacement detector has been ordered. Raytheon will deliver two devices that meet our specifications to National Optical Astronomy Observatory (NOAO), and we will choose the best detector for GNIRS (based on thorough testing at NOAO). In addition to the science detector, we are also procuring a HAWAII-1 HgCdTe array for the on-instrument wavefront sensor in GNIRS. At present the science detector procurement is the pacing item in the GNIRS recovery effort.

Once the cleaning and assessment is complete, GNIRS will require a complete optical alignment with new Delrin™ spacers in the lens assemblies. All the mechanisms will be reinstalled and tested. The detector mount and electronics will be tested. When the Aladdin 3 science detector is installed, the existing array controller will need to be tested and the new detector characterized in GNIRS.

Taking into consideration the science output of both telescopes and the instrument suite across the sites, the Gemini Science Committee recommended that GNIRS be deployed on Gemini North after its repair. Following optical alignment and testing, GNIRS will be recommissioned at Gemini North, where it will be possible to use GNIRS with ALTAIR, the facility AO system, for lower background and exquisite image quality.

Work to complete integration and testing of the FLAMINGOS-2 near-infrared multi-object spectrometer and imager continued at the University of Florida in Gainesville. FLAMINGOS-2 will provide wide-field imaging and multi-object spectroscopy across a circular field of view six arcminute in diameter. When fed with the multi-conjugate AO system (MCAO), FLAMINGOS-2 will provide a nearly diffraction-limited multi-object spectroscopic capability over a field of view more than an arcminute across. In the past few months, the Florida team has integrated all the optics, electronics, mechanisms, and detectors into FLAMINGOS-2, an important milestone in the integration and testing the instrument.

The Florida team conducted a number of cold tests, in which the mechanisms were tested and a number of problems fixed. All cryogenic motors were replaced, and the mechanisms are now all working reliably. Initial flexure tests showed that the instrument performs within specifications. A number of vacuum problems in the multi-object spectrometer fore-dewar were identified and fixed. Some additional baffling was added to reduce stray light. The detector has been installed and aligned. The current schedule is to complete the integration and testing by April 2008, and ship the instrument to Gemini South shortly thereafter.

To address how the first luminous objects formed, and how they ionized the neutral hydrogen in the universe less than a billion years after the Big Bang, a team led by Roberto Abraham at the University of Toronto is building a special tunable filter composed of two Fabry-Pèrot etalons in series. At redshifts greater than $z = 6$ the Lyman-alpha emission from hydrogen is shifted into the near-infrared J and H bands (1.1 and 1.6 microns, respectively). A set of very narrow filters is being designed to take advantage of the dark gaps between bright atmospheric OH (hydroxide)

emission lines. The etalons have been built and are now under testing in Canada. They will be installed in the FLAMINGOS-2 mask foredewar for dedicated observing campaigns with the MCAO system in 2009.

### E.1.3.3 Aspen Instruments (GPI, PRVS, WFMOS, GLAO)

The following sections summarize the current status of the Aspen instruments:

**Gemini Planet Imager (GPI):** The Gemini Planet Imager (GPI) is currently being designed and built by a collaboration led by the Lawrence Livermore National Laboratory. A large consortium of institutions in the U.S. (Lawrence Livermore, 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) and Canada (the Herzberg Institute of Astrophysics and the Université de Montréal) is involved in building a specialized high-order AO coronagraph designed to see self-luminous planets around young stars. GPI is a coronagraphic instrument with its own sophisticated on-board 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 low-resolution (R = 45) integral field spectrograph to help identify planets and characterize their atmospheres.

GPI is the first of the Aspen instruments to advance beyond the conceptual design phase. During the past year, the GPI team passed its preliminary design review and is now progressing towards a final design review in mid-2008. The current schedule is for GPI to be completed and ready for testing on the telescope toward the end of 2010. The campaign to survey ~2000 stars to find young giant planets will begin shortly thereafter. The science goals of the survey are being developed along with the instrument, and the design decisions made thus far are tightly coupled to the requirements of the science case. The science team that will carry out the planet search will be selected in 2008.

**Precision Radial Velocity Spectrometer (PRVS):** The Precision Radial Velocity Spectrograph (PRVS) is designed to be a high-stability fiber-fed bench spectrograph sensitive from 1 to 1.6 μm. Its principal science mission is to conduct radial velocity searches for planets orbiting low-mass M-dwarf stars, which are very numerous in the solar neighborhood and brightest and near-infrared wavelengths. Planets in the habitable zones of M-dwarf stars have short-period orbits, and the low-mass stars will wobble more due to the influence of the planets. PRVS will answer important questions about how common terrestrial-class planets may be in the universe. PRVS will be highly complementary with optical radial velocity searches, with transit searches by missions such as KEPLER or COROT, and will also provide a sample of terrestrial-mass planets for follow-up imaging by the James Webb Space Telescope (JWST).

Two competitive PRVS conceptual design studies were completed in October 2006, and the team led by the United Kingdom Astronomy Technology Centre (ATC) was selected to build PRVS. The PRVS team includes the University of Hawai‘i Institute for Astronomy, Pennsylvania State University, and the University of Hertfordshire. Funding for PRVS was delayed until May, 2007. A final construction contract for PRVS was negotiated with the ATC, but it was not approved at the November 2007 Board meeting because of the uncertainty resulting from the announced intention of the U.K. to withdraw from Gemini. At that time, the Board expressed concern about

funding both WFMOS and PRVS in the absence of the U.K. as a partner, and chose to proceed with the WFMOS conceptual design studies. No further work on PRVS will be conducted until a decision on the U.K. situation is finalized and the Aspen budget clarified.

**Wide-field Fiber Multi-Object Spectrometer (WFMOS):** WFMOS is the highest-ranked instrument to emerge from the Aspen process. It would permit about 4,500 simultaneous spectra to be taken across an approximate 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 more than two years ago, Gemini and Subaru Observatory (National Astronomical Observatory of Japan) agreed to explore the possibility of a collaboration on WFMOS. The instrument would be installed on the Subaru telescope, a much better platform than Gemini for such a massive, wide-field prime focus instrument. In exchange for observing time on Subaru, Japanese astronomers would 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 imaging instrument known as HyperSuprime Cam, leading to further cost savings. HyperSuprime is now in design, and the Japanese scientific community is solidly in support of the HyperSuprime and WFMOS science missions.

In October 2005, the Gemini Board agreed to begin competitive Conceptual Design Studies for WFMOS. In May 2006, while contract negotiations were still in progress with two teams, the Gemini Board decided to suspend the studies until adequate funding could be found. A few months later, in September 2006, the funding for the design studies was committed, and Gemini began the challenging process of re-engaging the design study teams, a process that has taken all year and is still under way. The contracts with two competing international teams (one led by the Anglo-Australian Observatory, and the other now led by the Jet Propulsion Laboratory) were approved by the Board in November 2007, and the teams began work early in 2008. The conceptual design studies will be completed during the first quarter of 2009.

Meanwhile, Gemini has been actively engaged in negotiations with the Japanese, and is exploring possible 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 with institutions and around the world.

**Ground Layer Adaptive Optics (GLAO):** GLAO is a specialized AO system concept that uses five 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 several arcminute across with 0.2- to 0.3-arcsec resolution (FWHM) across the field. The effect of improving image quality is to reduce integration times for a wide range of existing and future 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 system emissivity in the mid-infrared will be significantly improved using the adaptive secondary mirror.

Initial computations of the effectiveness of a GLAO system were based on atmospheric data from Cerro Pachón. Since the ground layer turbulence on Mauna Kea may not be as common or

as significant as at Gemini South, the next step in the GLAO development was to make a detailed measurement of the ground layer turbulence on Mauna Kea. The Mauna Kea Site Monitoring (MKSM) project, under the direction of Mark Chun at the University of Hawai'i, is now nearly complete after collecting data for most of 2007. The MKSM project runs two specialized instruments on a small telescope. To date, more than 20,000 atmospheric profiles have been collected. They represent a variety of weather conditions during all seasons.

The MKSM data will be fed into GLAO numerical models during 2008. The model results will indicate the efficiency gain likely to be achieved with a GLAO system on Mauna Kea. The results will be used to decide whether or not to conduct a conceptual design study for GLAO in 2009, after the WFMOS conceptual design studies are finished.

### E.1.3.4 Instrument and Facilities Development Tasks

Table E.8 details the development tasks for 2007. A few tasks show very little progress in 2007 (e.g., NICI campaign, F-2 narrow-band filters, GLAO modeling). These tasks are contingent on other tasks being completed first. *Note that many of the tasks associated with new instrumentation, such as NICI commissioning, are "owned" by the engineering or science groups*. Please refer to the tables in those sections for details.

Table E.8. Summary of Band 1 2007 development tasks.

| TASK TITLE | TASK DESCRIPTION | PERCENT COMPLETE |
|---|---|---|
| GPI support | Management oversight of GPI contracts, execute PDR, provide engineering support for software and design development, provide data on Gemini performance | 88% |
| NICI Campaign | Start executing NICI campaign observations | 15% |
| FLAMINGOS-2 narrow band filters (F2T2 and UNB) | F2T2 is being built in Canada, but requires Gemini support to integrate into F-2, and later to install for operations. Ultra-narrowband filters just need to be ordered and installed. | 15% |
| Mauna Kea Site Monitoring Campaign | Measure the ground-layer seeing profile over a period of a year to assess potential of GLAO. | 90% |
| GLAO modeling | Modeling effort to understand the implications of the Mauna Kea Site Monitoring results and proceed to a conceptual design for GLAO, if appropriate | 5% |
| PRVS support | Negotiate design and construction contract, management oversight, provide engineering support, software design guidance, and Gemini performance data | 70% |
| WFMOS design study support | Contract negotiation for conceptual design study contracts, conduct CoDR and down-select, provide competing teams with systems engineering support, manage communications with Subaru | 70% |

| | | |
|---|---|---|
| New software and management hires in Instrument development program | We have Board approval to hire a project manager and a software engineer to help with Aspen instruments | 75% |
| New Instrument spares procurement | Order spare parts for new instruments (NICI and F-2 in particular) | 25% |
| TEXES support | Management, science, and engineering support to bring TEXES back to Gemini for 2007B | 90% |

## E.1.4 Engineering Program

### E.1.4.1 Engineering Team Mission Statement and Overview

The mission of the Gemini Engineering Team is to work professionally and efficiently in order to provide scientists with the necessary tools to explore the universe in humanity's quest to answer astronomy's greatest questions.

During the period covered by this report (September 2006 – August 2007), the team accomplished a wide variety of tasks (see Table E.9), which directly support the observatory's mission and ongoing operations in the short, medium and long terms. In addition, the engineering team has been fully integrated into the observatory-wide annual planning process that is currently in its second year of implementation.

In order to accomplish the diverse set of tasks assigned to the engineering team, the team is organized into the following groups:

- Electronics and Instrumentation
- Mechanical Systems
- Software
- Optics and Adaptive Optics
- Systems Engineering
- Cerro Pachón Site
- Mauna Kea Site

In the following sections of this report, the engineering team's progress on key elements of the 2007 operational plan, which was developed at the first planning retreat held in Miami in February of 2007, is presented. Of the 37 tasks assigned to the engineering team, at least 12 were "mission-critical", which is considered essential for the reliable and smooth day-to-day and night-to-night operations of both telescopes, and most of the mission-critical tasks have been successfully executed. In the case of other tasks that, due to their nature, do not have a precise deadline, we are confident that they will be successfully completed before the end of 2007. Most of these remaining tasks are associated with the everyday operations and maintenance of the observatory.

### E.1.4.2 Operational Support

Keeping the observatory systems maintained and up-to-date is a core function of the Engineering Team. Apart from daily preparations for nighttime operations, this function is often extremely dependent upon highly unpredictable occurrences. Thus resource allocation planning is challenging. The two most significant operational impacts of an unpredictable nature were the major Hawai‘i earthquake in October 2006 and the accidental over-heating of the Gemini Near Infrared Spectrograph at Gemini South in April 2007. The following elaborates on these significant operational support tasks that the Engineering Team completed during the period of this report.

**Earthquake Recovery in Hawai‘i:** On October 15, 2006 at 7:07 am HST the island of Hawai‘i was hit with a magnitude 6.7 earthquake centered about 16 kilometers (~10 miles) west of Waikoloa, or about 60 kilometers (~37 miles) west of Mauna Kea. The result at Gemini North was that we were forced into shutdown mode for 25 days to assess damage and make the necessary repairs to the telescope and systems. The structure most severely damaged was the secondary mirror tip-tilt system in which a Zerodor® rod was fractured and multiple telescope structure (including the azimuth hydraulic bearing system) and instrument systems needed to essentially be re-commissioned before normal operations could resume. Gemini North was back on the sky well before early estimates predicted. To protect the observatory systems against future incidents, we also implemented at Gemini South several modifications to the plant room, coating chamber and office area as lessons learned from the Hawai‘i events.

In response to the earthquake, the engineering team led and participated in the Mauna Kea Observatories Earthquake Workshop in March 2007. The team is also closely involved in a second workshop on earthquake readiness that Gemini will sponsor on December 3-4, 2007 in Chile. At the time of this report, all major observatories in Chile (existing and planned) have committed to participate, which include Gemini, CTIO, SOAR, ESO (Paranal and La Silla), Carnegie, ALMA, TMT, and LSST. The workshop intends to promote collaborations among all observatories in Chile with regards to seismic risk.

**GNIRS Recovery Plan:** In April 2007, a problem with the Gemini Near Infrared Spectrograph (GNIRS) thermostatic control caused an over-heating of the instrument and triggered the implementation of an aggressive recovery plan. This plan included the shipment of GNIRS to the Gemini instrument lab in Hilo to be repaired at the Gemini North Base Facility (Figure E.8). The instrument’s re-commissioning will be done on Mauna Kea and GNIRS will become part of the Gemini North instrument suite. GNIRS is currently being disassembled in Hilo in preparation for the damage assessment of optical components by Gemini and NOAO personnel. The current schedule is to transport GNIRS to Mauna Kea after its fourth cool-down cycle in February of 2009.

Figure E.8. GNIRS optical assembly is moved into the clean-room in the instrument lab at the Gemini North Base Facility.

**Laser Guide Star Operations:** The engineering team has provided support of the monthly Gemini North laser guide star (LGS) runs for the ALTAIR-LGS system (Figures E.9. & E.10). This has been an important year of transition and learning for our new laser operations team that has enabled several laser guide star runs with very low downtime due to laser faults. Servicing was contracted to Lockheed Martin Coherent Technologies (LMCT) to support more on-site training and software troubleshooting. The main residual issue with the laser is the instability of the wavelength lock, which needs to be monitored closely by hand during operations at night.

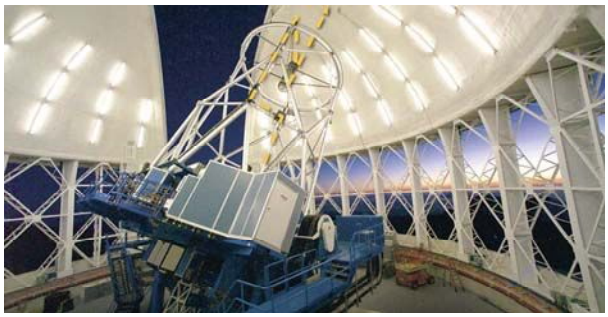


Figure E.9. The laser beam path along the Gemini North telescope structure is traced by orange dashed line.

**GS Laser Cutter:** The procurement of the Gemini South cutting machine is near completion. The cutter went through factory acceptance in July 2007 and will be delivered to La Serena at the end of November. In collaboration with CTIO, a dedicated room is being built in the La Serena AURA compound. This equipment will be fully commissioned by February 2008, and will be used to cut the GMOS-S and Flamingo-2 masks (as well as masks for an optical multi-object spectrograph mounted on the 4-m SOAR telescope).

Figure E.10. Testing of the ASCAM all-sky camera system for satellite/aircraft tracking during LGS use.

**Active Optics and Image Quality:** Beyond the regular M1/M2 look-up table revision for active optics, very little work has been done in this area since the 2007 priority was lowered. We hope to resume work in 2008 with a series of improvements.

**Other Initiatives:** In addition to the above operational support by the engineering team, a number of other notable accomplishments include:

- Implementation of a corporate approach to engineering. This is a concept to provide an observatory-wide web-based Project Planning Management tool and a Documentation Management tool aimed to standardize the working environment to improve productivity and efficiency within the observatory.
- Providing technical support for the new Hilo Base Facility Expansion construction project which is on target for completion in mid-2008.
- Completion of Gemini South control room refurnishing.

### E.1.4.3 Maintenance of Telescope and Enclosure Systems

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

**Telescopes Maintenance Shutdowns:** In addition to the unplanned shutdown of Gemini North due to the earthquake, there were four major systems maintenance shutdowns implemented during the period of this report. Two of these four were not part of the original 2007 plan; they were added later to address a serious reliability issue on the telescope enclosure shutters at both sites. The amount and quality of engineering design effort invested in shutdown preparation have been important criteria, and have helped moving forward with important upgrades to the secondary mirror system and enclosures.

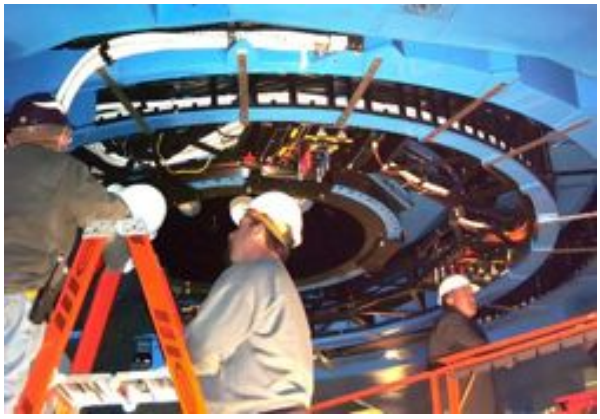


Figure E.11. Bottom end work during shutdown.

**Gemini North and South Dome Bogie Pintle Upgrade:** In late 2006 into January 2007 both sites combined engineering staff resources to have successfully completed the labor-intensive upgrade to the bogie pintle screws. This was necessitated by numerous bogie failures due to a design flaw in the original system.

**Gemini South Cassegrain Wrap Maintenance:** In April, Gemini South engineers successfully replaced all of the helium hoses in the Cassegrain wrap. After ~6 years of fatigue loading two of the eight hoses developed micro cracks and were no longer useable. For reference, in 2006, the group replaced all of the Gemini North hoses for the same reason. Based on this history, it is anticipated that these hoses will need replacement every five years. All subsequent replacements shall be based on the procedures and tools carefully developed during the process this year.

**Secondary Mirror (M2) Support Upgrades:** In April, the Mechanical Group supported the lab testing and ultimate replacement of the failing, obsolete, M2 five position sensors as well as the M2 X,Y positioner sensors at Gemini South. In June, following additional lab testing and hardware development, the position sensors at Gemini North were replaced with new and improved micro-encoding sensors. This work also required the development and testing of a different set of hardware and collimation methods specific to the new sensors.

**M2-3 Procurement:** Gemini has a contract with the French company Sagem (formerly REOSC) to fabricate a high-quality spare secondary mirror (M2-3). Issues with the final figuring resulted in slow progress. Factory acceptance was organized in December 2006 but some of the tests (in particular the center of gravity) did not pass the requirements. Since the scientific priority for the installation of the new mirror on Gemini North was lowered, we have continued the contract at a slow pace, negotiating the delivery and shipping (now scheduled by the end of 2007). We have

not planned commissioning this mirror in 2008 (although coating might be done in parallel with the M1 shutdown).

**Coatings:** No protected Ag re-coatings were scheduled in 2007 at Gemini. We continue with the usual maintenance: weekly $CO_2$ cleaning and in-situ wash every semester (done at Gemini South in October 2006 (for the fourth time), in April 2007 (for the fifth time) and October 2007 (the sixth time); the in-situ washing process was suspended at Gemini North due to some weakness in the film adhesion on the glass and fear of delamination under contact. As of August 2007, the reflectivity at 2.2um is 98.0% at Gemini North and 97.7% at Gemini South. At both sites we are now slightly outside the requirement of 0.5% emissivity loss from fresh coating (R = 98.5%). The next coating planned is for Gemini North in 2008 (the current coating will be four years old), and Gemini south in 2009 (when its current coating will be five years old).

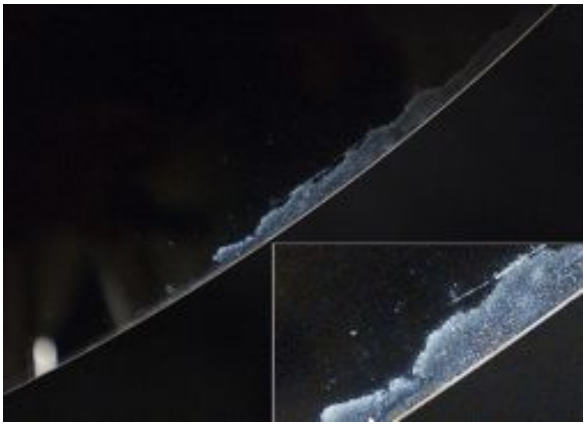


Figure E.12. Delamination of coating on M2.

**Gemini North and South Shutter Cable Carrier and Cable Replacement:** Both Gemini North and South have, over the past few years, experienced a number of failures on both the upper and lower shutter cable carrier and cables on the enclosure. The root cause of the failures was "over population" resulting in severe cable corkscrewing and cable abrasion. In 2007, the Mechanical Group engineered the selection and testing of a new, larger carrier system, designed modifications to the existing carrier trough and developed procedures and tools necessary for its replacement. In June and August 2007 the upper and lower systems (respectively) were replaced at Gemini North, and in October both the upper and lower systems will be replaced at Gemini South.

**Engineering Safety Projects:** The following safety initiatives were accomplished at Gemini South during the period of this report:

- Modification of the procedure for the in-situ wash.
- Installation of a work platform at the bridge crane for the replacement of chains at the top and bottom shutter.
- Improvements at the helium compressor station.
- Improvement at the workstations in the instrument lab.

The following safety initiatives were accomplished at Gemini North during the period of this report:

- Procurement/installation of equipment to rescue someone inside the mirror cell; practice rescue procedures.
- Fabrication of portable safety barricades to delineate no-entry areas.
- Modification of enclosure snow/ice clearing procedures.

- Improvement in housekeeping to reduce clutter.

### E.1.4.4 New Instruments

Engineering support of new instruments has focused on the commissioning of the Near Infrared Coronagraphic Imager (NICI) at Gemini South. During the period of this report NICI had two runs on the telescope with encouraging results. Engineering efforts have focused on the integration of the instrument into the observatory system, both from the software point of view and in the mounting hardware and redesign of the thermal enclosure cooling system to match the heat dissipation of the NICI electronics. In addition to this, the engineering team has supported the visiting TEXES instrument. This is a high resolution mid infrared spectrograph used at Gemini North in 2006B and 2007B.

While the engineering team has been involved in new instrument development support for FLAMINGOS 2, GPI, PRVS and WFMOS, the majority of the engineering effort in this area has been directed toward Multi-conjugate Adaptive Optics (MCAO - CANOPUS) for the period of this report.

**The Multi-conjugate Adaptive Optics Project (MCAO):** The most important milestone for the MCAO Project was the integration and testing of the MCAO Adaptive Optics bench (CANOPUS). The MCAO team was able to close the loop in July by testing the main CANOPUS functionalities using calibration sources and injecting disturbances. The test included five laser guide star wavefront sensors, three natural guide star wavefront sensors, three deformable mirrors and the tip-tilt mirror. This is believed to be a world's record for the number of elements integrated and tested in an astronomical AO system.

Figure E.13. The MCAO optical bench in mid-2007.

Before the end of the year we plan to do on-sky tests of the laser launch telescope and the beam transfer system at Gemini South. Another important milestone was the three-day MCAO management review held in September 2007 where the MCAO team prepared a very thorough set of presentations for the review committee. The committee was exposed to a broad overview to allow them to identify the strengths and weaknesses of the project. The outcome of the review was a very useful report that will help to improve key aspects of the project and assure their timely completion.

The MCAO Project mobilizes many entities of the engineering group. The Optics Group leads the engineering effort on the design and construction of the beam transfer optics, the management of the laser contract, the integration and testing of Canopus and the all-sky camera (ASCAM) (for aircraft/satellite monitoring, see Figure E.10) as well as the engineering and design of the laser system support structure and the laser service enclosure.

### E.1.4.5 Software

The Software Group provides software tools and support for ongoing telescope operations as its highest priority. As time and priorities allow the Software Group supports engineering activities associated with facility and instrument development programs. The group consists of seven Real-Time Software Engineers and Three High-Level Software Engineers, shared between Gemini North and Gemini South. The group successfully recruited two new Real-Time Software Engineers this year to fill permanent positions vacant at each sites. One to Two Real-Time Software Engineers are currently involved to provide a full-time development effort towards the Adaptive Optics Program. One Software Engineer at each site is providing 24/7 operational supports for 100% availability of the telescopes for nighttime observing.

Following are key accomplishments for the period of this report:

High-Level Development Group (HLDG) Achievements:

**Public Phase-1 Tool (Vinchuca Release) for 2007B:** The Phase-1 Tool (PIT) is used by the astronomers for proposal preparation and submission to all of the Gemini partner countries. The proposals are then ranked and evaluated for time allocation at the Gemini Telescopes. For semester 2007B a new version of PIT was released on March 1, 2007 (code-named Vinchuca). It provided several changes and improvements, including band-3 scheduling support, guide star selection, catalog access, and reports requested by the Time Allocation Committees and National Gemini Offices. HLDG also provided a special PIT version and support for the special request for proposals after the GNIRS incident.

**Public Phase-1 Tool and Observing Tool Release for 2008A:** The Phase-1 Tool for 2008A (code-named Tabano) release was made on September 1, 2007. This was primarily a maintenance release with two new features including enhancements to band-3 support and support for multiple backend servers at Gemini.

**Observing Control Release(OCS) for 2007B and 2008A and Public Observing Tool:** The OCS is comprised of several applications and services that collaborate to support observing at Gemini. They include the Observing Database (ODB), the Observing Tool (OT), the Electronic Observing Log (e-obslog), and the Web Database-Access server (WDBA). There were two major OCS releases and these releases featured:

- Phase 2 Checking, which continually examines the science program configuration as edits are made, finds the significant problems, and reports them to the user along with suggested corrections;
- An auto-update service, which automatically downloads OT updates and handles the complex process of updating science programs.

**Queue Planning Tool Releases:** The Queue Planning Tool (QPT) is a Java-based desktop application that allows queue coordinators to produce nightly observing plans using a visual drag-and-drop interface. QPT performs all the routine constraint calculations automatically, allowing the user to build high-quality plans confidently, without worrying about things like accidentally pointing at the moon. Two updates of the QPT were provided in February and June 2007 addressing over 20 features requested by the science staff.

**Completed Port of OCSWish Package to GCC/Linux:** OCSWish is a software package used by high-level applications to interact with the real-time systems in the observatory. HLDG completed the port of the OCSWish package to the GCC compiler and Linux platform in April 2007. This will enable the Telescope Control Console, Instrument Status Displays, and the Sequence Executor to be used by the faster Linux-based workstations planned for integration in late 2007/early 2008.

**Aspen instrument support:** HLDG provided builder and instrument group support for the Gemini Instrument Application Programmer Interface (GIAPI).

Real-Time Development Group (RTDG) Achievements:

**Adaptive Optics:** Work on the Adaptive Optics (AO) system for Gemini South was continued for the whole of 2007 and the Software Group contributed significantly by integrating the following modules:

- **Real-Time Controller (RTC):** The real-time controller is the heart of the AO system and was received by Gemini during the month of July. After three-weeks of integration work in the lab with the hardware, the AO team was able to close all the critical correction loops in the system. This was a major milestone towards delivering the Gemini South AO system.
- **Beam Transfer Optics (BTO):** BTO, the component that steers the laser (for generating the artificial guide star), in the laser system – from where it is generated to the sky, has been upgraded to use a new controller that drives the motor. This new controller also needed an upgrade to the associated software support.
- **Safe Aircraft Localization and Satellite Avoidance (SALSA):** SALSA exists to protect commercial aircraft and satellites from colliding with the Gemini beamed lasers. The All-Sky camera (ASCAM), an upgrade to SALSA, which automatically detects commercial aircraft and satellite in the sky, eliminates the need for human watchers.
- **Adaptive Optics Module (AOM):** The AOM is the heart of any AO system. It contains all of the hardware to measure the effects of the atmosphere on guide stars and remove the effects from the final science image. Some of the additional software integration work was done in addition to the aforementioned updates; this included remote power access and motion controller improvements.

Software Support for NICI Commissioning:

- An upgrade of the Data Handling System to transfer the image data from the instrument to the hard-drives for use by astronomers.
- Upgrade to the Acquisition & Guiding system and its interface, the Telescope Control Console, to use NICI for observations.
- Simulator work that allows the Software Team to test the interfaces of the instrument was completed during this period.

Table E.9. Engineering team Band-1 tasks list for 2007.

| TASK TITLE | TASK DESCRIPTION | PERCENT COMPLETE |
|---|---|---|
| GN Laser Guide Star Facility Commissioning | Operational readiness for science use and high reliability. Complete remaining technical commissioning tasks and list of improvements to achieve acceptable operational reliability and science performance. Develop engineering support system for laser, ALTAIR, BTO, BTOOB and LLT systems to enable efficient maintenance and troubleshooting. | 100% |
| LGS/ALTAIR Readiness for Queue (*New) | ENG01 was declared done and a new set of tasks was put in place to have this facility ready for queue observing. Some tasks were identified to be done during 2007 and others during 2008 | 2% |
| MCAO Project | Finish the design phase of the MCAO project and start the integration and testing process. | 60% |
| ASCAM | ASCAM for both sites. Feasibility study, options, selection, verification, validation, implementation and deployment. | 69% |
| M2 System Preventive Maintenance and Improvement | Commissioning new uEs sensors for M2, since we have no spare for the old ones. M2 X-Y positioner drive system upgrade. Replace obsolete CEM DOS/PC with modern/maintainable h/w and s/w. Faulty translation system sensor to be replaced by rebuilt sensor during scheduled GS shutdown. | 50% |
| Telescope Operations and Maintenance Support | General telescope and instrument operations support improvements, including attendance at meetings, addressing telescope fault reports, telescope and instrument preventive and corrective maintenance. | Year-long task |
| NICI commissioning | Provide the necessary engineering support for the new instrument commissioning activities. This include some support during design and construction phases, FATs, on-site preparations prior to instrument arrival, on-site pre-installation support, instrument installation and instrument commissioning process. | 52% |
| F-2 Support | Provide the necessary engineering support to new instrument development activities. This includes, support during design and construction phases, FATs, on-site preparations prior instrument arrival, on-site pre-installation support, instrument installation and instrument commissioning process. | 23% |
| Complete Hiring Process | Fill engineering vacancies ASAP. Affected groups are: E&I, OAO South, Mechanical Engineering North, Software Group, Systems Group, MK site. Also the expectations are to be able to open at least five new positions before the end of 2007 | 60% |
| Focus on queue planning | Provide a "finished" tool for queue planning in 2007. The primary goal is to achieve automated planning. Secondary goal is to provide the on-site capability of providing the "best" observation based on present conditions. This is dependent on getting good site-monitoring equipment that generates appropriate real-time information at the sites. | 30% |
| Science-Eng Coordination and Communication | Continued development of the working relationship and communications between engineering and science operations. Encourage more direct contacts and follow-up on specific issues and good two-way communications on topics and issues of mutual interest. | Year-long task |

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| TIO Telescope CRCS shutdown | Replace leaking helium hoses at Gemini South. | 100% |
| A&G Upgrade and Preventive Maintenance | Initiate a more aggressive campaign to improve reliability and to remove of bugs in hardware, real-time software and firmware. Keep having two preventive maintenances per year per system. Duplicate with sci07-1 | 90% |
| GS Water Vapor Monitor | Gemini South water vapor monitor GPS commercial solution. Feasibility study, option, selection, verification, validation, implementation and deployment. | 31% |
| Spare Parts Procurement Project | A planned project based approach to the investigation, prioritization, selection and procurement of spare parts for all telescopes and instruments to support operations until at least 2010. | 10% |
| Guide Improvements | Improve telescope guiding capability when chopping. Includes MICHELLE/T-ReCS image elongation. PWFS realignment if needed, understanding centroiding algorithms if needed. | 20% |
| TIO Instruments | This activity is linked ENG08 and ENG38 activities. The purpose is to formalize a calendar with regular preventive/corrective maintenance on operational instruments to assure smooth operation throughout the year. | Year long task |
| TIO Telescope | This activity is linked to activities ENG08 and ENG37. The purpose is to formalize a calendar with regular preventive/corrective maintenance activities for telescope systems to assure smooth operation throughout the year | Year long task |
| Engineering Safety Projects | Initiatives taken by the engineering team to improve safety at the sites. This is our contribution to the observatory safety improvement goal. | 5% |
| Engineering Tools Corporate Approach | The Systems Group is tasked to define a strategy that will allow us to take corporate approach with respect to the software tools that the engineering team uses. This is a top-to-bottom definition that aims to make our team more efficient and better organized in dealing with these tools. This is a very similar approach to what is called “corporate identity.” | 20% |
| Engineering Staff Retention and Morale | Ensure that overall staff morale within engineering is maintained and increased. Lobby with Gemini management to ensure market competitiveness of engineering salaries. Organize workload and engineering support to ensure working conditions are improved. Improve the quality of office space for Engineers at Gemini South. | Year long task |
| Earthquake Readiness Initiative | Elaborate a plan at both sites that would allow us identify areas of the telescope support building, dome and telescope itself where we need to modify or improve current designs and implementations in order to be better prepared in case of a big earthquake. | 2% |
| GNIRS Repair (*New) | This is a new project that was included as Band 1 for 2007 to recover GNIRS after the April 2007 accident. The goal is to commission GNIRS at Gemini North during the third quarter of 2008. | 11% |
| Risk Awareness Initiative | Elaborate a plan that will raise among the members of the engineering team their awareness with respect to the need to perform proper risk analysis every time a change or upgrade is introduced to the telescope, instruments or support building. | 0% |

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| SCT Support | SCT is the mechanism that is currently in place to prioritize and execute software tasks requested by astronomers throughout the year. | Year long task |
| Pachón Control Room Redesign | New Polycom, network cabling etc. More workspace is required for MCAO, laser operator, visiting astronomer. Move to Band 1; likely resource issues | 100% |
| DATA Flow Data Reduction SW | Dataflow Systems and Products Project: User reduction software (Gemini IRAF/PyRAF package) | 20% |
| OT Improvements | OT improvements: automatic calibration definition; ability to undo more than one step; automatic inclusion of libraries; better skeletons; OT checking - move to engineering | 57% |
| Blind Offsetting | Improve guide probe mapping to support 0.1 arcsecond blind offsetting accuracy; Improve P2 guide probe mapping; finish GMOS-N OIWFS mapping work and test if the technique works; move to engineering | 0% |
| ALTAIR/LGS TT FOV | ALTAIR LGS: Larger FOV for TT with field lens - 1st stage is replace dichroic/field lens to get 35"; 2nd stage requires much more work to get FOV comparable to Keck; duplicated by DEV07-4; move to ENG. | 0% |
| GPI Support | Management oversights of GPI contracts, execute PDR, provide engineering support for software and design development, provide data on Gemini performance. | 37% |
| PRVS Support | Negotiate design and construction contract, management oversight, provide engineering support, software design guidance, and Gemini performance data. [Contract was not approved, so minimal engineering support was required.] | 3% |
| WFMOS support | Contract negotiation for conceptual design study contracts; conduct CDR and down-select, provide competing teams with systems engineering support, manage communications with Subaru. | 17% |
| New Instruments Spares Procurement | Order spare parts for new instruments (NICI and F-2 in particular) | 2% |
| TEXES Support | Management, science, and engineering support to bring TEXES back to Gemini for 2007B | 100% |
| NICI Campaign | Start executing NICI campaign observations | 15% |
| F2 Narrow band filters (F2T2 and UNB) | F2T2 is being built in Canada, but requires Gemini support to integrate into F-2, and later to install for operations. Ultra-narrowband filters just need to be ordered and installed. | 15% |

## E.1.5 Science Program

### E.1.5.1 Gemini Science Staff Mission

Science staff took the step in 2007 to define a clear mission for itself: “The Gemini Science Staff is committed to participating in and enabling a better understanding of the Universe. In addition: 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.1.5.2 Science Operations

The priorities for the science operations for the current year are set through the Observatory Planning process, which was initiated this year. The table below lists the high priority items resulting from the planning process for which the Science division is responsible. Note that many of the tasks originally defined by Science ended up being the responsibility of the Engineering division. This list of tasks does not include the research by the science staff as this was "taken off the top" to determine the available FTE resources available. About 75% of the science staff effort was needed to maintain science operations and the staff's astronomical research, while the remaining 25% was available for development tasks.

Table E.10. Science Group Band-1 tasks for 2007.

| TASK TITLE | TASK DESCRIPTION | PERCENT COMPLETE |
|---|---|---|
| Science Operations | Support Normal science operations | 75% |
| DATA FLOW User Data Reduction S/W | Dataflow Systems and Products Project: User reduction S/W (Gemini IRAF/PyRAF package) | 75% |
| External/Internal web pages | Improve external and internal web pages and move under 'configuration control'; split into external and internal web pages - internal pages need to be explored observatory wide | 40% |
| MICHELLE polarimetry | Resolve issues related to MICHELLE polarimetry mode. Most of this can be queue scheduled. New software effort | 0% |
| SCT List | Software Items from the SCT list. This effort is currently mixed with ENG08 but we want to split it out. | 75% |

### E.1.5.3 Dataflow

This year saw a rapid ramp up in effort of Gemini's dataflow project; in September 2006, our new dataflow project scientist (Paul Hirst) was hired. He leads the development of the dataflow project from the science perspective, bringing a substantial experience with data processing pipelines covering a diverse array of instrument systems at UKIRT, and a vision to develop a true next generation pipeline data processing system at Gemini. The project scientist works very closely with the Software Manager who leads the Dataflow Project and is responsible for delivering the "system".

In October 2006, a two-day meeting of the Gemini Data Reduction Working Group was held in Hilo. This group comprises experts from our user community (see Table E.11), and provides expert community input and guidance to the observatory on data reduction matters. The bulk of the discussion centered around what we should be aiming to achieve both in the log and short term, with respect to automatic pipeline data processing at Gemini. The membership of the

working group was selected such that all major areas of observational astronomy that Gemini does were represented, along with a representative from ESO.

Table E.11. Gemini Data Reduction Working Group Members

| | |
|---|---|
| Tom Matheson (Chair), NOAO/NGSC | Optical Astronomy |
| Mark Swinbank, Durham University, UK | Integral Field Unit Astronomy |
| Dave Harker, UC San Diego | Mid-IR Astronomy |
| Tim Davidge, HIA / NGO Canada | Adaptive Optics |
| John Rayner, UH IfA | Near-IR Astronomy |
| Martino Romaniello, ESO | ESO |

The DRWG provided clear guidance to the observatory on the future development of both the pipeline processing and user's interactive toolkit aspects of Gemini's dataflow efforts. The DRWG presented to the Gemini Director a report with a set of recommendations, notably that a good data reduction toolkit should be the foundation for Gemini's future data reduction efforts and should be called from both the pipeline processing and interactive user environments.

On the interactive data reduction side, a major milestone has been achieved on our migration from traditional IRAF to the PyRAF environment in that all the Gemini data reduction tasks now run properly under PyRAF as well as IRAF. This clears the way for both migrating summit operations to PyRAF and for driving our existing data reduction tasks from Python. 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 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. Whilst a couple of last minute glitches, not least the weather during our test night, have delayed the full transition of summit operations to PyRAF, we expect this transition to happen at both Gemini telescopes soon. PyRAF is maintained by STScI that is under contract to provide support to Gemini during the transition.

We recognize that the actual data reduction toolkit is the foundation of Gemini's data processing systems, and that transitioning the toolkit to Python is an essential part of the project, especially in facilitating pipeline processing. Therefore we have seen a corresponding ramp up of effort within the data reduction group. In addition, we are currently actively recruiting two more Data Process Developers, to be based at Gemini South, to bring extra effort into the group and to ensure that our data reduction development effort is balanced equally between our two operations centers.

In the final stages of this year, we are preparing for a dataflow project Conceptual Design Review, to be held in December 2007 with an external review committee including NSF representation. Throughout the year, we have been examining various options and technologies, and we are now in the process of finalizing and documenting our designs and planning to present them for review.

## E.1.6 Directorate Program

*"We commit to make Gemini a transformational discovery machine…"*

Gemini's Directorate is focused on the future while remaining grounded in a deep appreciation of the past. We understand Gemini Observatory in the context of today's complement of ground and space based astronomy research assets. We also understand the potential for discovery when a remarkable machine like Gemini is unleashed on the sky, capable of providing unique observations of objects across the universe.

A basic goal of Gemini is to take what is learned through such observations and help teach humanity about the universe. This overarching aspiration – *to give humanity a new awareness of the universe and therefore of ourselves* – is why we pursue with relentless passion the support and operation of the Gemini twins. This admittedly unorthodox motive is not about promoting Gemini or aspiring to be the best in some sort of global astronomy competition. We are leaving behind such archaic doctrines of the past through our vision of the future – a future in which observatories pursue scientific research as a common quest for discovery. A future in which the end-game is not about sustaining the professional careers of astronomers – it is about providing the rest of the world's populous with knowledge they could not hope to acquire otherwise. Focused on this much larger vision, our Directorate is dedicated to making Gemini a transformational discovery machine that rightfully leads on many fronts. We recognize that for an observatory that will outlive all of us, many of the discoveries made at Gemini will not occur during our tenure here. Nonetheless we take great pride in the knowledge that our contributions to Gemini, when it is in its "adolescent" years, forged the glass, steel, copper, and staff that made such discoveries possible in the first place.

Figure E.14. The Flammarion woodcut is shown. This classic representation of man's notion of a mysterious universe that lies beyond the realm of the stars captures the spirit of discovery we enjoy at Gemini Observatory.

In the pages that follow progress reports from two key groups at Gemini are summarized, namely the Public Information and Outreach (PIO) group and the Safety Group. PIO plays a crucial role in fulfilling our mission to teach humanity about the universe. They have a central function in connecting astronomers with literally thousands of school children each year in the Hilo and La Serena areas. As described in our "Working Culture" summary, the safety program is key to

instilling health, occupational safety, and professional management themes within the staff. Gemini's safety program has impact at home as well, by enhancing a safety awareness that permeates the staff and is ultimately taken home each day from work.

### E.1.7 Public Information and Outreach (PIO) Program

The mission of the Gemini PIO effort is to execute the observatory's core mission (under development), "…to teach humanity…" and effectively support the communication needs of the observatory while fostering a thriving legacy that will sustain the observatory and our host communities into the future.

During the period of this report the Gemini PIO department accomplished this by maintaining multiple ongoing programs as well as implementing a wide variety of new initiatives that are represented in the band-one projects listed in the table at the end of this section.

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

**Local Outreach:** Among the most significant activities in this area included the Journey through the Universe program, AstroDay Chile, StarLab portable planetarium programs, FamilyAstro and partnerships with the 'Imiloa Astronomy Education Center in Hilo and the CADIAS center outside of La Serena in Chile. Collectively these programs impacted over 20,000 students, teachers and the public. In addition to these programs, the Gemini Virtual Tour saw almost 80,000 users in kiosks in Hawai'i and Chile and facility tours, classroom and public presentations reached an additional 12,000 individuals.

**Media Relations:** Media communications has continued to represent a large portion of the overall PIO effort at Gemini and has resulted in a total of 6 press releases during the period of this report and over half-a-million web hits generated by these releases on the Gemini webpage. Significant progress was also made in expanding the overall PIO staff responsibilities needed to support our media relation efforts locally and internationally.

**Partnership Support:** During the period of this report, the Gemini Public Information and Outreach office participated in multiple national and international conferences including exhibiting at the National Astronomy Meeting in the UK, two meetings of the American Astronomical Society, the Gemini Science Meeting in Brazil and several national education meetings in the US and Chile. In addition, several "Live from Gemini" videocasts were held for US audiences and plans are in place for future programs with other Gemini partners.

**Staff/User Support:** Major functions in the area of publications (the twice-annual GeminiFocus and this Annual Report) continued to be a significant part of the PIO effort over the past year. GeminiFocus has continued to expand and become graphically and editorially more complex while content has evolved into a more science-centric mode. Other operational support functions have 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.

**Current-year (Band-one) PIO Initiatives:** In addition to the core PIO categories described above (and in sections C.2 and C.3), the following new initiatives were executed during the period of this report. Due to the cycle of planning/execution these projects are all scheduled to be completed by the end of calendar year 2007 rather than the writing of this report. The Table E.12 lists these initiatives and the current percentage of completion (as of the end of August 2007).

Table E.12. PIO Group Band-1 tasks for 2007.

| TASK TITLE | TASK DESCRIPTION | PERCENT COMPLETE |
|---|---|---|
| Partner and Professional Meetings | Participate and Exhibit at NAM and AAS meetings - MK AAS Tour Planning | 100% |
| Publications | GeminiFocus and annual Program Plan and Progress Report | 50% |
| Improve Partnership PIO communications | Facilitate regular PIO Liaison meetings and facilitate international outreach programming | 15% |
| Image/Prints Production | Produce Gemini 8.5x11" Image sheets | 50% |
| Live from Gemini Programs | Expand delivery of "Live from Gemini to entire Gemini partnership | 45% |
| Web Content Support | Facilitate production/coordination of homepage "websplash" updates | 75% |
| Lobby Displays | Lobby Display(s) Implementation | 100% |
| Local Outreach Programming (Hilo) | Sustain annual commitment to the Journey through the Universe (JTTU) program in East Hawai‘i and maintain healthy partnerships, specifically with the Department of Education (DOE) and all currently participating community organizations. | 90% |
| Local Outreach Programming (Chile) | Evaluate partnership with the CADIAS center in Chile and provide appropriate funding/resources for Gemini sponsored activities at the center. | 50% |
| Local (Host Community) Outreach | Sustain and explore possible expansion of programming partnerships with the 'Imiloa Astronomy Education Center in Hilo | 65% |
| Career Awareness | Develop observatory "Career Awareness" K-12 educational materials and integrate them into local host community schools. | 70% |
| Press Release Partnerships | Encourage university press offices to lead in 50% of Gemini releases. | 20% |
| Media Contact Database | Expand active media contacts and resources for partner office media relations. | 50% |
| Mauna Kea Conference Tours | Facilitate and assist in hosting media tour of Gemini/Mauna Kea for May 2007 AAS Honolulu meeting | 100% |
| Website Redesign | Web homepage and secondary page template development and image gallery redesign. | 70% |

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| PIO Science Staff Expansion | Implement addition of 0.25 FTE Science staff person at GS | 95% |
| PIO Staff Exchange GN/GS | PIO Staff Location Exchange(s) (project based) | 60% |
| International Year of Astronomy | Assess possibility of chairing IYA working group on Planetaria and Informal Science Education. | 35% |

**Issues:** The greatest area of concern for completion of the PIO band-one projects for 2007 are related to the engagement of Gemini's partner offices in the participation in Gemini programming and the generation of press releases. This is partially due to key changes in several of the partner office PIO representation and an intention to address many of these issues later in the year. The production of partner office press releases is also very dependent upon partner country resources for press release development and scientific results from each partner country. Another related issue is the initiative to participate in the International Year of Astronomy (IYA) planning activities in 2008 (to be executed in 2009). IYA participation will profoundly impact participation of partner countries in Gemini initiatives but will not be resolved until the 2008 planning process when the issue will be addressed as part of a new band-one initiative.

Other initiatives (i.e. 8.5" × 11" image production) are essentially all on track for completion in 2007. There is a possibility that the final implementation of some of the "Career Awareness" products (CD duplication and poster printing) will require a delay into 2008 due to budget limitations but are all on track for content completion in 2007.

### E.1.8 Safety Program

Shortly after being appointed, the Gemini Director undertook an extensive employee interview campaign. In all, 74 employees were interviewed and one of their main concerns was that of safety. This led to the decision to formulate a structured safety and health management system at Gemini. The guidelines used were based on a base line safety review.

As a result of the employee interviews a comprehensive safety review was undertaken which consisted of site visits, staff presentations and interviews with Gemini staff.
The review was conducted from August 21 – 24, by a well-experience team lead by Chuck Gessner (Safety Manager, NOAO, Tucson Arizona) and which included Mark Grushka (Bio safety Manager, University of Arizona), Joe Kane (Consultant, Thunder Road Consulting, Oracle Arizona), and Steve Shimko (Safety Manager, W.M. Keck Observatory).

The review committee made a number of recommendations including:

- Prepare a Gemini Safety Policy that reflects your commitment;
- Recruit a Safety Manager reporting to Director and consider interim support;
- Be the champion for the revitalization of the safety system;
- Require safety leadership training for all managers;
- Support full implementation of the Gemini Driver Safety Initiative;

- Hold personnel accountable for completing currently identified safety issues;
- Develop a formalized procedure using a Job Hazard Analysis model;
- Establish regular, high visibility contacts with all levels of organization to reinforce your safety values;
- Establish the inclusion of a relevant safety element within the daily coordination meeting;
- Consider adopting an internationally recognized safety management system that can be measured.

**Restructure of the Safety Department:** The safety department has been restructured with the appointment of Ron McKinnon as the Gemini Safety Manager, reporting directly to the Director, the appointment of Alejandra Cortes as the Gemini South Safety Coordinator and Peti Singletary, previously Safety Officer, as the Gemini North Safety Coordinator.

**Formation of the Safety Leadership Team (SLT):** The Safety Leadership Team, consisting of the Director, Deputy Director and Associate Directors, was formed on the 21 June, 2007 and the agreed objective of the Safety Leadership Team is: *"The SLT is the leadership for the Gemini safety drive and shows commitment and involvement in safety and is the forum for setting safety objectives and approving the Gemini Safety System and Standards."*

**AURA - Gemini Health and Safety Policy:** One of the first tasks the Safety Leadership Team embarked on was the drafting and circulation of the *AURA –Gemini Health and Safety Policy* that spells out the safety commitment of the organization. It also clearly defines management and individual safety roles and responsibilities.

**The Gemini Safety and Health Management System:** During the first Safety Leadership Team meeting the team agreed to adopt the Gemini Safety and Health Management System, (the Gemini Safety System) that consists of 5 Main Sections, which contain 73 Safety elements, that form the core of the system.

These elements are key measurable safety management performance criteria that can be measured by an audit process. The system is based on world's best practice and is risk-based and audit driven.

Once fully implemented the system will comply with the internationally recognized standard for safety and health system accreditation, namely, OHSAS 18,001 (Occupational Health and Safety Assessment Series).

**Safety and Health Standards:** The Gemini Safety System requires the development and implementation of some 73 health and safety standards and policies. As part of the implementation of the system, a number of new safety standards and policies have been introduced and are currently being implemented. Some of the new or revised safety standards include, *Written Safe Work Procedures, Visitors Guide to the North, Good Housekeeping Practices and Driver's Requirements.*

**Safety Training:** During the year some 90 Gemini employees attended the 8-hour *Modern Safety Management* training course. Fifteen more attended an intensive program on *Critical Task Risk Assessment* and the analysis and drafting of procedures.

**Driver Safety Training Project:** In an all-out effort to reduce vehicle accidents and to skill drivers in safe driving techniques, a major safe driving program was embarked on at Gemini South during which all Gemini vehicle drivers were exposed to a full-day practical driving lesson.

- After successfully completing the driver safety-training project at Gemini South the project was launched at Hilo in July and will continue until all employees have completed the course.

- GPS systems have been fitted to all vehicles in an effort to monitor driving patterns and take necessary steps to correct unsafe driving before such behavior leads to vehicle accidents.

**Safety Planning:** Safety has now been included in the Gemini Observatory Plan and several safety system objectives have been planned over the course of the next 5 years.

Table E.13. Safety Program Band-1 tasks for 2007.

| TASK TITLE | TASK DESCRIPTION | PERCENT COMPLETE |
|---|---|---|
| Formation of Safety Leadership Team | Form a Safety Leadership Team consisting of top management and arrange for monthly meeting. | 100% |
| Implement Modern Safety Management Training | Present eight 1-day Modern Safety Management courses per 12 months. | 20% |
| New Role of Safety and Health | Revise the role that the safety department and personnel play in Gemini. Correct titles, write a Standard for their job functions. | 5% |
| Implementation of the Gemini S & H System (See Attached) | Implement the safety system by writing the Standards, having them reviewed, cascaded and by holding technical briefing sessions to explain their contents and ramifications. See attached measure under "System". | 38% |
| Safety Department Training and Team Building | Build the team. Hold weekly meetings. Draw up self develop programs, membership of professional bodies, conference attendances etc. | 5% |
| Appointment of Safety Reps. | Get nominations - appoint and train Safety Representatives | 0% |
| Revamp S & H Website | Assist in revamp/update/maintenance of the New safety portion of the internal web. Post all Standards and update as required. | 20% |
| Review evacuation drills (Fire Wardens) | Demarcate fire exit routes. Erect assembly sign. Train Wardens. Do annual drill. | 50% |
| Reconstitute Safety Committee | Assist in the formation of the 2nd level Safety Leadership Committees. | 10% |
| Meet with other Observatory Safety Personnel | Host frequent meetings with other observatory and organization's safety personnel. | 4% |

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|---|---|---|
| Participate in MK Safety Committee | Join and participate in the MK safety committee. | 11% |
| Complete SWOT Analysis | Complete the Gemini Safety and Health SWOT analysis. | 100% |
| OSHA / Chilean Standards | Review compliance with all regulations and standards/ Purchase of books and membership to compliance bulletins or software. | 50% |
| Accountability Process | Written policy / Accountability process needs to be in place. Incorporate safe hours worked and some type of employee recognition into program/ policy. | 20% |
| Driver Policy and Procedure | Write policy regarding use of GSA vehicles and driver qualifications. | 75% |
| Rescue Procedures for dome to include fall protection rescue | Written procedure/ cost involves equipment to be purchased at GN and GS and training time. | 30% |
| Rescue Procedures for Mirror Cell | Written procedure/ cost involves equipment to be purchased at GN and GS and training time. | 50% |
| Confined Space Rescue Procedures | Written procedure/ cost involves equipment to be purchased at GN and GS and training time. | 20% |
| Updating of all current safety Polices and Procedures | Refer to System (attached) for progress on 73 Elements | 38% |
| First Responder / First Aid CPR | First Responder / First Aid CPR courses for GN employees | 50% |
| Applied Laser Safety Course | Applied Laser Safety Course for GN and GS employees (if laser will be up and running in GS this year) | 10% |
| Safety Orientation / Briefing | Update Safety Orientation / Briefing. Translate. Conduct at GN and GS | 20% |
| Semi Annual Audit | Semi Annual Audit currently conducted at GS - Cerro Pachon, but needed at GN - Mauna Kea | 50% |
| Safety Manager | Hire Safety Manager to cover GN and GS locations. (in progress) | 100% |
| Safety Technician | Hire Safety Technician for GS. | 100% |
| MCAO Risk Assessment Safety Plan/ Report | Draft the safety plan NEW | 80% |

# Section F

# 2008
# Program Plans

# F 2008 Program Plans

The following section highlights the highest priority tasks developed for each operational unit at the 2008 planning meeting held in October of 2007 in Santiago Chile.

## F.1.1 Administrative Program

In the section relating to our current year program (E.1.2), we stated the mission of the Administrative Program. This mission statement describes what is true today and what will be true in the future. The Administrative Program has been quite good at fulfilling their mission of providing administrative services and facility, fleet and electronic infrastructure for the observatory, but there is a shared feeling among the members of the group that we have been in a continual state of playing catch-up or running to keep up with daily demands, a shared feeling that we can even do better.

The Administrative Program is ready to move into a new era, and we have a vision for this new era. The 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.
- We are able to deliver what our customers need.

These elements of our vision project a compelling view of our future. While those elements may not state what is completely true now, they describe our vision for what we desire to become. Attaining the Administrative Program vision will be a process. We believe that it will take a matter of years for us to attain the vision. Yet, we believe that improvement can begin immediately and continue indefinitely.

For the first element, “We are a service group that knows exactly what our customers want,” we have identified the following steps:

- Members of the Administrative Program developed an on-line survey of Gemini staff to identify areas of unmet customer needs. The survey was launched on September 26, 2007. As of the writing of this report, we have conducted a preliminary review of the results and are determining our next plan of action.
- We will undertake a systematic review of documents and procedures that seek information on customer requirements and we will work to make improvements. This review will also identify areas where requirements documents are actually lacking.
- We will engage in an ongoing dialog with our customers, now and in the future.

For the second element, “Our customers know what to expect from us”, we have identified the following steps:

- We will identify and publish service standards and will track our success in meeting them.
- We will plan an ongoing internal education program regarding services and infrastructure.
- We will plan and produce a comprehensive and easy to use web presence.

The focus of the total approach to achieving our vision is excellent communication and, through excellent communication, the convergence of expectations and understanding. The result we are striving for is the third element, "*We are able to deliver what our customers need*."

What will we undertake to do in 2008 to move toward our vision? Our top priority, of course, is to keep the observatory running: hiring people, procuring goods and services, paying bills, keeping the networks running, the vehicles operating, making sure that the buildings are cared for and comfortable, reporting to authorities, overseeing compliance with rules and regulations and keeping up with other essential tasks. Our next priority is to carefully plan for a better future. Our third priority is to undertake as many improvements as we have time to address, focusing first on those that will create the greatest improvements in productivity.

In our effort to carefully plan for a better future, all groups within the Administrative Program will participate in five planning tasks. These are located at the top of the Table F.1 and clearly echo our planned steps for elements one and two of our vision.

Each group has also identified projects that they feel will certainly fit into the vision and that can be undertaken in addition to their participation in the overall planning of our pathway to the vision. These projects are listed under the headings for each group within the Administrative Program.

In addition, our planning tasks will generate a list of projects that must be undertaken in the future. The annual prioritization process allows for quarterly review and revision of the 2008 tasks. If, once we have our plan in hand, we feel that additional tasks could be undertaken with the resources available, or if we feel that newly identified tasks should take precedence over the tasks currently on the 2008 list, we will make changes in the 2008 plan as allowed by the process.

Table F.1. Administration program plans for 2008.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| ALL ADMINSTRATION PROGRAM GROUPS | |
| Unified planning system | Set up on-going planning process; ensure that projects are managed uniformly across the Services & Admin group via dot project or a similar program. |
| Requirements Documents | Systematic review of forms, documents or procedures that seek information on customer requirements. |
| Internal Education Program | Design an internal education program for our customers so they know how to obtain services or perform certain administrative tasks. |
| Plan Web Presence | Plan administrative web presence, creating a high quality, unified Administration website. |
| Service Standards | Identify and publish our service standards so our customers know what to expect. |
| ADMINSTRATION AND FACILITIES (AFG) | |
| HBF-X & HBF move in | Ensure smooth move in once HBF-X is complete |

| | |
|---|---|
| HBF redecoration (including lobby) | Specify, quote and execute the redecoration of the HBF including lobby. |
| In-house travel ticketing | Eliminate travel agency use by performing travel booking both North & South in house |
| SBF-X planning | Review GS people plan and engage architects for schematic plans for minor remodeling or remodeling or extending the SBF (obtain designs, ballpark costs and timescales) |
| Internal efficiencies | Consider means whereby staff can share information in simpler, more efficient ways (non-IT and IT opportunities). Consider flexibility-matrix planning (who can do what and to what standard?) |
| CONTROLLER | |
| Research Viability of Ultipro | Continue investigation of this program with the goal to replace inefficient HR/Payroll/Timecard system w/Integrated State of the Art Software that also contains Employee Self Service Abilities. |
| Set up Ultipro or research other programs | If Ultipro proves viable, work on conversion of data and structural set-up of program for use in 2009. If not, research other programs. |
| Managerial Access to Financial Reporting | This would allow budget managers to access up to date financial reporting, with access to detail expenses. |
| Research Viability of Electronic Travel Expense Reports | Research viability of electronic submittal/approval/processing of travel Expense Reports. |
| HUMAN RESOURCES | |
| Arrange Managerial Training Courses for GS | Conduct needs assessment; research qualified instructor; create training plan based on assessment; research costs; implement; follow-up |
| Create Webpage for Services & Infrastructure Group (HR side) | Create admin task force for web development; determine needs; work on design; determine relevant information with HR Staff; meet with IS, followup meetings. |
| Create Standards for HR Procedures | Determine which procedures to transform; develop standards; educate staff on standards; implement; evaluate |
| Improve Employee/Community Relations | Participation in local community events that "Geminarians" could engage in, ie replanting native flora, cleanup, adopt-a-school, charity walks/runs. Doing things = happy people=happy workers=higher retention |
| New Software for HR & Payroll | Determine feasibility of Ultipro software; if selected, plan and implement program for use by January 2009; if not selected, research other software programs |
| Implement Employee Assistance Program | Finalize selection of EAP programs for GN & GS; solicit bids; education managers and staff in benefits of program; implement; evaluate |
| Implement standardized merit review for GS & GN | Develop consistent, reasonable merit system based on performance reviews; education managers and staff about system; implement; evaluate |
| PROCUREMENT | |
| Reqless Upgrades | Streamline buyer and requisitioner interfaces and workflow, investigate adopting a travel request module, check request module, signature authority delegation module and implement those modules that seem viable. |
| Cooperative Agreement Compliance System | Develop system to assign compliance with Cooperative Agreement provisions or other legal requirements to responsible individuals. |

| | |
|---|---|
| Hazmat Shipping/Handling | Identify and train person responsible for hazardous material shipping and handling. |
| Streamline Workflow for Electronic Filing in Purchasing | Streamline workflow for electronic filing in purchasing. |
| Revise Shipping Procedures | Reduce money spent on shipping and processing shipments. |
| PO Browser Upgrades | Improve web-browsing capabilities so that requisitioners and others can easily access information relating to purchases. |
| INFORMATION SYSTEMS GROUP (ISG) | |
| Day-to-Day Customer Service | Help desk, customer complaints, system crashes, etc. |
| Upgrade Core SUN Servers | DHS, real-time & boot servers etc. Most are at least six years old, slow and high risk of failure resulting in potentially long periods of downtime and lost science. |
| GS Network Redundancy | Purchase, Install & Configure 6509 switch for SBF & Pachon |
| Replace SSA & Astronomer Summit Workstations | Linux-based solution. |
| Deploy Certificate Services – NSF | Hardware ready. Required also for HR/admin to comply with data privacy issues. We cannot deploy without minimum security policies in place. |
| Deploy Single-Sign-on Solution - NSF | Hardware ready. Required also for HR/admin to comply with data privacy issues. We cannot deploy without minimum security policies in place. |
| 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. |
| IS Security Polices – NSF | Write IS Polices, email, backup, passwords, EAR/ITAR etc ... Related to above certificate services. |
| Network and Computing Standards - NSF | Despite our efforts to standardize we constantly face divergence such as users installing whatever flavor of Linux takes their fancy. |
| Sea-level Ops Room Workstation Upgrades | Must ultimately reflect the Linux-based solution deployed at the summit, again these machines are very old and slow. |
| WinInstall | Deploy automatic Windows installation server and clients |
| 20-Units' Dorm Network/Phone | Install network & phones into the '20 Units' accommodation |
| Internal Web Redesign | New website design and organization of the Gemini Intrarnet |
| HBF-X Network & Phones | Network & phone infrastructure for HBF-X |
| Site-wide MS Office Upgrade | Some Office versions are 3 releases behind. This is increasingly problematic for groups that share documents with third parties (e.g. admin/HR) |
| Increase Base Storage | Expand storage space for Science data, home accounts etc … |
| Increase Summit Storage | Expand Storage space for GEA, DFSP, Instrument Integration data etc.. |
| RedHat Proxy | Purchase, Install & Configure Proxy RedHat update server to provide efficient, controlled release of patches and software updates |
| Leave Request Web App | Web based, paperless leave approval system |

| | |
|---|---|
| Consolidate HBF WEB Servers | Virtualization of HBF web servers and upgrade to Solaris 10 |
| External Web Redesign | Continue design changes for Science & PIO |
| Phone Service Cost Savings | Phone services enhancements and cost savings initiatives. I.e Phone Billing, technologies to reduce cell phone charges |
| Implement IDS | Deploy Intrusion Detection System based on Cisco/SNORT |
| Dynamic Phone Directory | Gemini wide dynamic IP telephone directory |
| MS SMS | Deploy MS SMS server to track software licensing |
| Inventory Webapp | Web tool to interface with Gemini's Inventory system |
| MS Vista Upgrade | Perform compatibility tests and write migration plan |
| Support MCAO | Exact requirements are unclear, but of-course includes providing network & computing infrastructure. |
| Data Flow Products & Services ISG support | Exact requirements unclear, but include fast, reliable storage systems and computing infrastructure |

## F.1.2 Instrument and Facilities Development

The table below details the development tasks planned for 2008. Note that many of the tasks associated with new instrumentation, such as the NICI campaign, MCAO testing, GNIRS repair and FLAMINGOS-2 commissioning, are "owned" by the engineering or science groups. Please refer to the tables in those sections for more details.

Table F.2. Instrumentation and Development Tasks 2008

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| GPI support | Management oversight of GPI contracts, execute CDR, provide engineering support for software and design development, provide data on Gemini performance. |
| WFMOS design study support | Contract management for conceptual design study contracts. Provide competing teams with systems engineering support, and manage communications with Subaru. |
| 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. |
| GLAO modeling | Modeling effort to understand the implications of the Mauna Kea Site Monitoring results in the context of the GLAO feasibility study. |
| 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. |

Table F.2 clearly shows the emphasis in 2008 on the Aspen instrument development activities. The WFMOS design work to be done in 2008 will lead to a key decision point for WFMOS and GLAO in early 2009.

The tasks in the table are *only* those that can be scheduled and completed in 2008 without identifying additional resources. There are some tasks currently listed in the long-range plan in the next section below that may be possible to complete in 2008, either by reprioritizing or by

contracting to external institutions. There are also three new FTEs in the development group in 2008, and these individuals will help bring some tasks forward from the long-range plan into 2008. Note that much of the work on this list is contracted to other institutions, including almost all the work related to F2T2 and GLAO modeling.

### F.1.3 Engineering

The engineering team prepared a comprehensive list of tasks for the 2008 planning process, which were presented at the Santiago October 2007 planning retreat. The outcome is a list of 28 tasks with 13 mission-critical tasks that require 74.6 FTEs. Total engineering FTEs that will be available in 2008 is 75.

During the execution of the 2007 plan we identified a number of issues that we are determined to address in 2008. We hope these will help us achieve a better task completion rate by the end of next year.

**2007 Lessons Learned:**

- The new planning concept requires a cultural change within engineering and also within science. This change did not take place at the expected speed.
- We did not define our tasks in detail.
- Engineering managers are not used to managing their groups in the way that this new concept requires.
- It was almost impossible to get progress reports from managers.
- We were heavily overloaded; 38 tasks is NOT a realistic number.
- We did not have a good progress reporting tool, which made the process even more difficult.
- We were still learning about the whole process.
- Within the observatory we haven’t implemented a good system on how to deal with new tasks.
- Lack of communication did not help us when promoting the concept to the rest of the people in the team.
- We didn't track the tasks that other groups had responsibility for that required engineering support.

**2008 Issues:**

- Group staffing issues.
- The Electronic and Instrumentation Group is heavily overloaded with work.
- The Optics and AO group is still trying to recruit an optical engineer for Gemini North
- The Software Group still needs to hire three more engineers.
- We need to review the current list of Band 1 tasks to make sure we include those that allow us to better distribute the work among groups.
- We need to check the level of details the critical tasks already have, and to add more, if necessary.
- We need to introduce accountability.
- We need to improve internal communications.

- We need to improve tasks progress tracking system.
- We have to continue working on our hiring process.
- We need to keep MCAO resources demand, balanced compared to the rest of the engineering tasks for 2008.

**Planned Corrective Actions to Address 2008 Issues:**

- A committee was created to approve the tasks list and the task resource figures.
- The tasks will be put in MS Project so they can be distributed over the year.
- The 2008 overall definitive set of tasks will be communicated to the engineers and technicians in engineering staff meetings.
- Managers also will have separate meetings with their staff members to go over the tasks in detail.
- There will be engineers, technicians and managers accountable for each task to be executed during 2008.
- There will be biweekly engineering managers meetings to go over the task list. This will allow us to identify areas that need more attention.
- The Electronic and Instrumentation Group will boost the already ongoing hiring process.
- The Software Group has initiated the hiring process of additional staff.
- The Optics Group is almost done recruiting for the new optical engineer for Gemini North.
- We will contact companies that specialize in recruitment to evaluate what could we gain in our recruiting process by working with them.
- We are actively working on expediting a prompt decision with respect to the planning tool to be used during 2008.
- We have contacted universities in Chile to recruit students for summer internships to work on MCAO.
- We are analyzing the alternatives we have to outsource part of the work for 2008.

**Plans for 2008**

**Telescope Earthquake Readiness:** The Mechanical Group intends to retain the services of a structural engineering consultant to inspect and audit the condition of the two facilities for earthquake readiness and then lead the engineering effort to implement the recommendations.

**Safety Projects:** With the support of a structural engineering consultant, the group intends to improve facility and personnel safety by completing the design and installation of an Instrument Platform Lift (IPL) guard rail and a M1 cell guard rail, creating an enclosure shutter drive work platform for servicing the drive motors, improving access to the dome and to the top of the coating chamber. The Mechanical Group working with our Safety Team intends to review and improve our hazardous chemical handling procedures and emergency response necessary for stripping the M1.

**Gemini North Coating Shutdown:** Gemini intends to coat the Gemini North M1 this year and the Mechanical Group will be heavily involved in the planning for, and execution of, the shutdown.

**Gemini South MCAO:** The Mechanical Group intends to successfully complete the engineering, fabrication, integration and testing of the MCAO system at GS.

**Software Engineering Goals for 2008**

MCAO integration in the lab and commissioning mid 2008

- Complete NICI technical commissioning
- GSAOI Phase-I commissioning
- FLAMINGOS-2 commissioning
- Client apps Linux to Solaris upgrade
- Linux DHS clients, QlTool upgrade
- M2 upgrades
- Linux RT build environment
- Data Flow Systems and Products Project:

HLDG is part of the planning and development group working on the DFSP project, which will enter the implementation phase during 2008.

- Phase 1 Tool, OT, and OCS Releases for 2008B and 2009A
- Phase 1 Tool and OT must be released twice/year to support the telescope allocation process. Tasks for these releases are not yet specified.

**MK Site Group Plans for 2008**

**Telescope Earthquake Readiness:** The group will implement modifications to improve safety to personnel from falling objects (lighting fixtures, for example), and to secure equipment.

**Safety Projects:** The group will install various upgrades to our equipment to improve personnel safety. The projects include improvements to the Instrument Platform Lift (IPL) guardrail system, the primary mirror guardrail system, access platforms to the enclosure shutter drives, and enclosure snow/ice accumulation mitigation.

**Enclosure Shutter and Vent Gate Seals:** The group will repair/replace seals to keep air conditioning in and inclement weather out.

**Gemini North Coating Shutdown:** The group will help with the necessary steps to remove the primary mirror and relocate it to the coating area, strip the existing silver coating, and after coating reinstall the primary mirror onto the telescope.

**Hilo Base Expansion Construction:** The group will continue to provide technical assistance through the end of construction in mid-2008.

**CP Site Group Plans for 2008**

- Support MCAO project during its integration and testing phase.
- Assisting on the logistics for equipment transportation.
- Laser service enclosure construction
- Construction of a change room for the technicians
- Improvement of the parking area in order to minimize dust contamination.

Table F.3. Engineering tasks for 2008.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| Execute operations & maintenance program (A tasks) | O&M tasks that are absolutely necessary for normal operations support. |
| Telescope earthquake readiness | Seismic retrofit, safety planning, sensor installation. |
| Spares procurement | Develop a long-term equipment renewal plan, spares inventory based upon risk, use of Maintscape for inventory management, spares storage and spares purchasing. |
| Engineering staff hiring process | Hire engineers for remaining unfilled engineering positions. |
| A&G preventive maintenance | Annual A&G preventative maintenance. |
| GS instruments maintenance | Annual GS Instrument maintenance and upgrades. Includes - NICI software completed, documentation completed, AO performance evaluated, array controller problems fixed, characterized on the sky, and ready for call for science. |
| GN instruments maintenance | Annual GN Instrument maintenance and upgrades. |
| Implement new operations scheme | Implement new Operations scheme. Training. |
| MK Site Emergency Electrical Power Upgrade (ENG05) | Procure equipment for 2008 upgrade (plans finalized in 2007). |
| Engineering Safety Projects | Safety reviews, dome access ladder, wash tank room improvements, dome crane wire rope repair. |
| GN mirror coating preps (A Tasks) | Coating preparation tasks that absolutely must be completed prior to coating. |
| GN mirror coating | GN Mirror coating. |
| GNIRS repair and enhancements (2008 portion) | GNIRS repair through commissioning and SV. |
| MCAO (phase 1 & 2) | |
| Data Flow project | Data Flow PDR, CDR, execution phase I, execution phase II. Includes - Automatic quality assurance reduction of common instrument/mode data in near real time at the telescopes to help avoid losing telescope time by taking data that does not meet PI requirements and to help queue observers evaluate the quality of the data they are taking. |
| Linux migration | Linux DHS, 24-bit Skycat, Improve Reliability and performance. |
| Observing software maintenance | HLDG support to Observing SW Maintenance. Regular PIT/OT Updates. |
| Engineering tools corporate approach | Sitescape, JIRA improvements. Corporate approach to engineering documents. |
| GPI support | Management oversight of GPI contracts, execute CDR, provide engineering support for software and design development, provide data on Gemini performance. |

| | |
|---|---|
| WFMOS design study support | Contract negotiation for conceptual design study contracts, conduct CoDR and down-select, provide competing teams with systems engineering support, manage communications with Subaru. |
| New M2 control hardware/software project | SW/HW/Mechanical upgrades to M2 control. |
| NICI operations | Complete commissioning APD protection, Start Operations. |
| GN LGS facility improvements | Completion of ALTAIR LGS tasks for full LGS Queue operations. |
| Chopping improvements | M2/WFS synchronization, Remove image elongation issue in mid-IR. |
| Chopping upgrades | HW/SW upgrades to improve chopping off mid-IR detector. |
| Water vapor monitor upgrade | Complete installation and test. |
| FLAMINGOS 2 (AT and on-sky AT support) | Support acceptance test and shipping. |

### F.1.4 Science

The three core activities of the science group in 2008 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 PhD science staff members. The effort directed towards the development of data reduction software and automated reduction pipelines will increase in 2008 as we hire new Data Process Developers.

The key tasks for the Science division in 2008 were developed as part of the Observatory Planning process. As this was the second year of this process at Gemini, the Science division was able to develop a more detailed and fleshed out program than in 2007. The FTE effort required to support various aspects of science operations were explicitly unrolled in this year's plan and the numbers fine-tuned to more closely represent the actual effort required.

The majority of the effort from the science staff in 2008 is required for the support of nightly science operations. This effort is approximately the same as last year. One of the goals of the 2008 tasks defined by the Science division is to enhance the tools that are used for queue planning to reduce the time required for this activity. These tasks are 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 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 request from the Gemini Board to provide more user-friendly, pipeline-based data reduction tools for both data quality assessment

and producing *science-ready* data. To fulfill this demand, the observatory will complete 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 and so called "science ready" data.

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 starting the planet-search campaign with the Near-Infrared Coronagraphic Imager (NICI) on Gemini South. Science effort will also be directed towards the commissioning of the Flamingos-2 near-IR Multi-Object Spectrograph and Canopus, Gemini South multi-conjugate adaptive optics (MCAO) system. Smaller effort will be directed towards improvement in documentation, both internally and externally, as well as improved monitoring of the status and performance of the instruments.

Our goal for 2008 is to bring the technical time loss to 4 to 5 %. It is achievable if we improve in areas that we have been able to identify after several years of operations. To introduce these improvements, we will take the following actions: Promote the concept of having at least one preventive maintenance shutdown per site per year for implementing well-designed upgrades to telescope or instrument systems.

We will dedicate more support software engineers to operations in order to fix several bugs that at the moment generate a large amount of minor faults. Our new software manager is elaborating a coherent plan and the hiring of several new software engineers makes this approach feasible in 2008.

By consolidating our approach of year-round tasks, plan, and priorities, we will aggressively improve our current O&M model. Acquiring a good maintenance tracking tool, formalization of the Telescope Technical Managers concept, and the development of a more formal on-call policy should allow us to gain a few percent more on-sky time.

Finally, Gemini Ph.D. science staff plans to carry out forefront research in 2008 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, and of other communities such as the Subaru, European Southern Observatory and Keck communities. Several Gemini staff programs will also be done in conjunction with Hubble Space Telescope and Spitzer Space Telescope observations. Some of the most active areas of investigations are listed below:

- Primordial solar system ices
- Gamma Ray Bursts: their progenitors and as probes of the distant intergalactic medium
- Exploring the dust created and ejected from evolved star envelopes
- The coolest brown dwarfs: the frontier to super-Jovians
- The origin and nature of the strangest stars: hydrogen-deficient carbon stars
- Reconstructing the Jovian proto-satellite disk
- Characterization of dusty torus in active galactic nuclei
- Brown dwarf binaries: nature and origin

- Merging galaxies and cyclic bursting star formation
- Origin of young massive stars at the center of the Milky Way Galaxy
- Evolution of massive galaxy clusters in the last half of the universe's history
- Multi-conjugate adaptive optics
- The origin of nucleated dwarf galaxies and link to massive globular clusters
- The interplay between gaseous inflow and outflow at the center of active galaxies
- The origin of fossil groups of galaxies
- Jets and outflow from young stars

Table F.4. Science division priorities 2008.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| Nighttime Summit Support | Active collection of science data |
| Queue planning & daily preparation | Efficient queue execution: QC, daytime SSA, masks etc |
| Long term queue planning (core QC, ITAC/TAC) | Maintain effective long-term queue management and QC training |
| Data quality assessment and distribution | High quality and timely science product. |
| Phase II Support | Produce error-free observations ready for execution, all CS duties |
| Instrument Scientist and Team Duties | Ensure reliable, efficient operations of Gemini instruments |
| Science staff recruiting | Keep science staff positions filled |
| Science staff training | Better trained observers, SSAs and DAS for improved efficiency at night and better scientific product |
| Lead SSA Duties | Time required by Leads SSAs at both Sites |
| Lead DAS Duties | Time required by Head of the DAS at both sites |
| Lead DPD Duties | Time required by Head of the DPDs |
| Research Productivity | Produce science |
| Science mentoring | Increased scientific productivity and job satisfaction |
| 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 |
| Development and maintenance of the data reduction user package | Provide new and improved data reduction tools within the interactive Gemini Data Reduction Package |
| 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 |
| Data reduction support for NICI | Provide the PIs with the essential data reduction tools fo NICI |
| NICI Campaign and Operations | Realize collection of science data for the community. |
| Instrument performance monitoring | Regularly measure the total throughputs of all instrument to monitor system health |
| Improvement of the internal sciops web pages | Improve staff access to information necessary to perform observatory support work. |

| | |
|---|---|
| Improvements to external sciops web pages | Improve user and staff access to information necessary to plan, perform and publish Gemini observations/data |
| Career Development and training | Staff development and improved productivity |
| SSA and Data analyst development projects (well-defined fillers) | Help with science or observatory projects |
| Science staff travel between sites | GN/GS interactions and consistent operations, travel time only |
| Improve Performance Evaluation process for Science group | Improve feedback to science staff, job satisfaction. Staff load minimal, management task |

### F.1.5 Safety

Table F.5 includes all of the highest (band 1) priorities for the Safety program at Gemini in 2008.

Table F.5. Safety priorities for 2008.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| 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% |
| Applied laser training | Arrange Laser training for Gemini South |
| Critical Task training | Arrange and conduct 2 critical task identification and analysis/JSP 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. |
| Risk Assessments | Present 1 Risk assessment course at each site and train 10 employees in the technique. |
| Ergonomic training | Arrange office ergonomic training for both observatories |
| Action Plans | Compile and circulate action plans for the implementation of the new standards and update master control sheet monthly. |
| Employee handbook | Write the employee safety handbook, obtain approval and manage circulation and translation thereof. |
| Team development plan | Draft the safety team self development program and implement it. |
| HK Inspection | Facilitate the 6 monthly housekeeping inspections and competitions. Arrange presentation function and delivery of trophies. |
| Safety Seminar | Arrange the "Gemini Observatory" 1-day safety seminar and invite local industry to participate. Arrange exhibitions etc. |
| 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. |

| | |
|---|---|
| Briefing sessions | Hold briefing session on the contents and implementation of safety system Standards that have been approved. |
| Visit to other plants | As part of staff development, arrange visits to other observatories and industries. |
| Off-the-job safety | Hold a 'children's safety poster competition'. Arrange displays, judging and presentation function. |

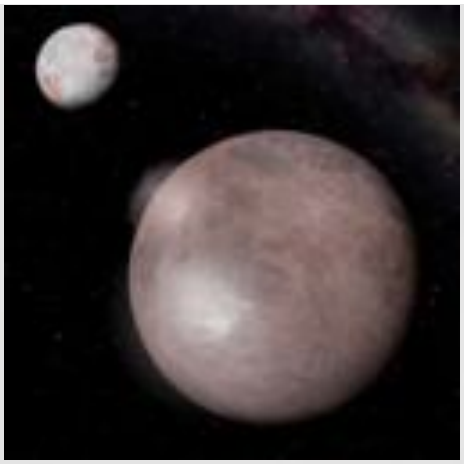
## F.1.6 PIO

The following priorities represent the ongoing evolution of the PIO department's scope of work and programmatic elements for 2008.

In addition to the considerable number of ongoing (baseline) operational programs and functions, 2008 will see the addition of several new elements that will improve our media relations, internal communications and partnerships with internal and external entities.

Table F.6. PIO priorities for 2008.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| Base Operations | Staff Support, Outreach Programs, Publications, Media Relations, Project Management, Library Operations, Images, Travel, etc. |
| Media Relations "Upgrade" | Improve process and implementation of Gemini's media relations to increase innovativeness, timeliness and relevance. |
| Annual Report - "Public" version | Produce full-color "glossy" version of Gemini Annual Report (note printing expenses to come from Directorate account) |
| IYA Programmatic Planning (for 2009) | Complete planning of 3rd astronomy newspaper tabloid for publication for IYA in 2009 and 2009 StarTeachers program. |
| 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. |
| Integrate new PIO Assistant Position at GS | Hire and train new expanded PIO Assistant position to assist in expanded outreach and media relations at GS. |
| GoogleSky Legacy Image Integration | Develop process for "ingesting" Gemini Legacy Images into GoogleSky. |
| 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. |
| 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 |
| ʻImiloa Mauna Kea Programming | Serve as "consultant" in the development of Imiloa "Mauna Kea updates" program feature current science from MK observatories |
| CADIAS Gemini Classroom Completion | Complete Gemini Classroom at CADIAS to include posters, text signs and exhibits to complement the console and Virtual Tour exhibits. |



# Section G

# Long Range Program Plans

# G Long Range Program Plans

Observatory planning for 2009 and beyond is continually addressed in the Gemini planning process by prioritizing tasks that go beyond the staffing and funding resources available in the current year's planning process. Each year these tasks are re-assessed for inclusion in future year planning. The following represent those tasks identified in the 2008 planning process but where insufficient resources and prioritization moved them into the long-range category.

## G.1 Administration

The Administration Program's 2008 top priority to plan for a better future will lead naturally into a very specific long range plan. The planning process we will undertake in 2008 will provide a detailed list of projects for 2009 and beyond. The list below has placeholders for these yet-to-be-defined tasks in the "All Administration Program Groups" categories. The other tasks under specific group headings address known tasks for 2009 and 2010.

Table G.1. All administration groups tasks 2009 and beyond.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| BAND 2 | |
| ALL ADMINSTRATION PROGRAM GROUPS | |
| Requirements Documents | Update requirement documents. |
| Service Standards | Keep track of service statistics and publish results on the web on a regular basis. |
| Internal Education Program | Develop educational materials and training sessions. |
| Plan Web Presence | Implement web presence plan. |
| HUMAN RESOURCES | |
| AURA Suggestion Program | Promote AURA suggestion program; develop recognition program for those whose suggestions are implemented |
| Create Retention Program for Current Employees | Research retention best practices; evaluate exit inteview data; addition of benefits that are added value to staff; implement succession plan program; evaluate |
| Third Party Administrator for Retirement Plans | Utilize third party administrator for the Retirement plans to ensure that Gemini is offering the best in investment options to the Staff and to provide staff with education regarding their retirement |
| Internal Audit | Complete internal audit to ensure consistency and fairness within and between departments and locations |
| Recruitment | Research different relocation providers; conduct survey of needs met of recently relocated staff; implement different options for those relocating |

| | |
|---|---|
| Communication | Implement monthly staff news bulletin highlighting employee events, achievements, etc at GN & GS. Not a public newsletter |
| Continue Webpage for Services & Infrastructure Group (HR side) | Continue development of website, updates, additions |
| INFORMATION SYSTEMS GROUP (ISG) | |
| Network Configuration | Implement depository - procedure/change control. Creation of an automated backup system (in progress). |
| External Web Redesign | Continue design changes for Science & PIO |
| Improve Monitoring Tools | Improve Network & systems monitoring tools to improve reliability (Zenoss). |
| Data Flow Products & Services ISG support | Exact requirements unclear, but include fast, reliable storage systems and computing infrastructure |
| Personal computer audit | Perform audit of all staff laptops & desktop machines; make recommendations for replacement/upgrade |
| Global Load Balancing | Deploy global load balancing technology for Gemini web services |
| BAND 3 | |
| ALL ADMINSTRATION PROGRAM GROUPS | |
| Internal Education Program | Develop educational materials and training sessions. |
| Plan Web Presence | Continue implementation of web presence plan. |
| HUMAN RESOURCES | |
| Continue Webpage for Services & Infrastructure Group (HR side) | Continue development of website, updates, additions |
| INFORMATION SYSTEMS GROUP (ISG) | |
| EPICS Proxy Gateway | EPICS proxy gateway |
| Satellite-based Internet Backup Link | Alternative Internet access for GS/GN, as backup for external fiber/equipment failure. |
| Deploy Unified Messaging services | Deploy Unified Messaging services |
| Upgrade to MS Vista | Upgrade to MS Vista |
| Server Room Upgrades | Computer room upgrades (racks, cabling, aircon) |
| Grid computing/High performance clusters for data reduction | No formal requirements received, but is on the radar. |

## G.2 Instrument and Facilities Development

Table G.2 contains a number of tasks that were proposed for 2008, but sufficient resources have not yet been identified to complete them in 2008. We have also included tasks that were considered lower priority, and therefore not scheduled for 2008. Finally, we have also included the high priority tasks that will not begin until 2009 for various reasons (including follow-on tasks such as GPI support). A task's rank on this list approximately indicates its priority.

Table G.2. Instrumentation and Development tasks 2009 and beyond.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| BAND 2 | |
| NIRI and GNIRS array controller replacement | Replace existing GNAAC controller with new systems (e.g., SDSU-3 system from ATC, as per UIST or MICHELLE). |
| MICHELLE detector upgrade | Replace aging EDICT controller with a SDSU-3 system, upgrade software. |
| GMOS-N CCD replacement | Replace CCDs with more red-sensitive devices (with input from GSC and sci staff). A compromise between red and blue sensitivity is needed unless we choose to wait a couple of years for better devices to become available. |
| GMOS-S CCD replacement | Replace CCDs with more red-sensitive devices (with input from GSC and sci staff). A compromise between red and blue sensitivity is needed unless we choose to wait a couple of years for better devices to become available. |
| TEXES support | Management, science and engineering support to bring TEXES back to Gemini for runs in 2008, if desired. |
| GLAO concept design study preparations | Issue RfP, assess proposals, select team, and negotiate contracts. |
| Instrument Decommissioning plan | Need to plan for future with more instruments than we can support, and give community very long lead time to plan ahead. |
| Mid-IR filters | Order additional mid-IR filters for MICHELLE and T-ReCS. |
| GMOS-N Filters | Procure a new u and other NB filters to match GMOS-S. |
| F2T2 Commissioning | Commission F2T2 and begin sci ops. |
| GPI support | Management oversight of GPI contracts, provide engineering support for software and design development, provide data on Gemini performance. |
| WFMOS support | Contract negotiation for phase 2 construction contracts, conduct CoDR and down-select, provide teams with systems engineering support, manage communications with Subaru. |
| Increase ALTAIR LGS sky coverage: ALTAIR field lens replacement | Replace the ALTAIR field lens and modify SFO as appropriate to enable wider tip/tilt field coverage using GNIRS or NIRI OIWFS. |
| BAND 3 | |

| | |
|---|---|
| IR WFS procurement | We are part of a consortium trying to procure high-speed near-IR WFS detectors fro the new A&G. |
| 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 would normally hold the next community meeting in 2008 to cover instrument development in the 2011 to 2015 window. The Gemini partnership renegotiation may complicate this. |
| New optical WFS CCDs | Replace the CCDs in all optical PWFS, HRWFS, OIWFS to improve sensitivity. |
| GPI support | Management oversight of GPI contracts, provide engineering support for software and design development, provide data on Gemini performance |
| WFMOS support | Contract negotiation for phase 2 construction contracts, conduct CoDR and down-select, provide teams with systems engineering support, manage communications with Subaru |
| GLAO concept design study support | Provide support to teams conducting conceptual design studies, conduct down-select, negotiate contracts for next phase |

A couple of tasks on this list deserve comment. First, the NIRI and GNIRS array controllers have had persistent problems, and the task of solving those issues may need to be moved up to 2008 if they continue to deteriorate, particularly when GNIRS is repaired. The GNIRS repair project may allow a natural time for additional testing and debugging. We will explore contracting out much of this work.

Replacement of the GMOS CCDs has been highly ranked by the GSC for several years. There are finally some acceptable CCDs available for purchase now, so this project may move forward if funding and then FTE support & expertise can be identified. Much of the work may also be contracted to other institutions.

TEXES support will be provided if the Observatory brings TEXES back for additional runs. A decision will be taken after reviewing the results from the current run and assessing its scientific impact and consulting with the Gemini Science Committee.

## G.3 Science

The period 2009 – 2011 will see improvements in the efficiency of science operations, which will be achieved mostly through the implementation of new software tools and systems. Early during this period a complete data quality pipeline will be implemented for night-time operations. At the end of 2011, a science quality pipeline will be available for most instrument modes. This pipeline will run at the GSA and deliver processed data to PIs and archival researchers.

**2009**

The current (non-research) task list for 2009 is focused on further refinement of our science operations, finishing the commissioning of new instruments delivered in 2008 and further development of data reduction tools and the pipeline infrastructure. This task list is not completely defined and further tasks will be added during the 2009 Observatory planning

process. In 2009, a full data quality assessment pipeline will run at both sites and provide near *real-time* assessment of the data acquired during each observation. Problems will be flagged for the immediate attention of the observer who can confirm if the problem requires a repeat of the observation. This will save time in obviating the need for another target acquisition, as is often the case currently.

The Observing Tool will be improved to perform more thorough error checking of each observation. Better support for the ITAC process and the merging of accepted programs in the queue schedule will also be developed in 2009.

**2010**

All of the pre-Aspen instruments will be in normal science operations by the end of 2009 and the first Aspen instrument (GPI) will not be delivered until late 2010 or early 2011. The gap between the pre-Aspen and Aspen instruments provides an opportunity to significantly improve the efficiency and effectiveness of science operations. Certainly operating MCAO will present new operational challenges but this will be a good window to deal with issues and make improvements. The definition and planning for this work will take place during 2009. Many of the defined tasks will likely require significant effort from the Observatory's software group and should end up in Band 1 for 2010.

For example, the tool used for queue planning will likely see significant improvements during this science operations upgrade. The queue-planning tool will be able to generate an optimized plan automatically in less than 5 minutes with only minor modifications required by the queue coordinator.

In 2010 Gemini will also complete the work necessary to properly support GPI in nightly science operations.

**2011**

While IRAF has been a standard for over 20 years, its various limitations have led to a need in the astronomical community for a new Open Source data processing environment. The approach that Gemini, in collaboration with STScI, has taken with its Dataflow Project is a model for such an environment, and NOAO, who currently support IRAF, agree with this approach. At the moment the three AURA Centers, STScI, Gemini and NOAO, are discussing the possibility of an Open Source replacement for IRAF.

If these discussions develop into concrete plans, Gemini will be in a position to play a significant role in the development of this data reduction environment as Gemini is one of the premier state-of-the-art observing facilities and has a responsibility to provide leadership for the astronomical community.

This will be a long-term effort that will begin in 2008 but continue through the current planning horizon.

Table G.3. Science tasks for 2009 and beyond.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| BAND 2 | |
| Data reduction support for MCAO/GSAOI | Provide the PIs with the essential data reduction tools for MCAO/GSAOI |
| Data reduction support for F-2 | Provide the PIs with the essential data reduction tools for Flamingos-2 |
| Proposal and TAC Support | Make the TAC process more efficient |
| Validate and Improve ITCs | Improve users ability to properly (and easily) predict required telescope time |
| Update current GMMPS to support F2 | Allow mask design creation for F-2 |
| Data Reduction and User Support tasks for GMOS | Improve the user support and science use of GMOS data |
| Data Reduction and User Support Tasks for NIFS | Improve user support for NIFS |
| Data Reduction and User Support Tasks for T-ReCS | Improve user support for T-ReCS (place holder task, need description) |
| Data Reduction and User support tasks for NIRI | Increase science usability of both previously obtained NIRI science data as well as future science data |
| Remove GN dependencies from GS web site mirrors | Make GS mirrors more useful, simplify off-site access. |
| MICHELLE Spectroscopy Issues | Reliably center and keep objects in the slit, as essential for efficient use of the MICHELLE spectroscopic mode |
| Understanding the beam imbalance in MICHELLE spectroscopic observations | Increase efficiency of MICHELLE observations |
| Data Reduction and User Support Tasks for MICHELLE | Improve user support for MICHELLE |
| Data Reduction and User support tasks for NIRI | Increase science usability of both previously obtained NIRI science data as well as future science data |
| Various MICHELLE Internal Calibration Issues | Optimize MICHELLE science use |
| Science Software Servers and Maintenance | Increase commonality and reduce scistaff work as sysadmins. |
| Image Quality Performance Monitoring | Science image quality monitoring tasks. |
| Data Reduction and User Support Tasks for MICHELLE | Improve user support for MICHELLE. |

| | |
|---|---|
| Various MICHELLE Internal Calibration Issues | Optimize MICHELLE science use. |
| Science Software Servers and Maintenance | Increase commonality and reduce scistaff work as sysadmins. |
| Image Quality Performance Monitoring | Science image quality monitoring tasks. |
| PIO support | Outreach, education, dark sky protection. |
| T-ReCS array controller repair | Improve T-ReCS data quality, by improving the noise. |
| All-sky camera upgrades | Reliable all-sky monitoring, cloud detection, extinction estimates. |
| Systems use in-position flags | Improve telescope efficiency and reliability. |
| Determine and implement flexure model for P2-instrument flexure | Improve spectroscopic throughput and eliminate re-centering overheads. |
| Block the leaks in the MICHELLE narrow-band filters | Make the MICHELLE narrow-band filters useful for science. |
| Improvements needed to GMOS DC and Seqexec for smooth Nod&Shuffle operations | To bring the Nod&Shuffle implementation of the GMOS DCs into compliance with Gemini Standards. |
| Calibration Management | Improve tracking of Gemini Calibration data to make it easy to determine the existence and identity of the best available calibration data for a given science frame. |
| Improve mid-IR on-sky calibrators | Access and improve the accuracy of the mid-IR calibrator stars used with the science observations done by T-ReCS and MICHELLE |
| Establish P2 limiting magnitude | Provide correct information on performance to users |
| Complete NGO Visit web form | Improve visit organization |
| Improved long-range queue planning | Provide tools for making better long-range queue plans. |
| Data Display System – new “do-it-all” Quick-Look-Tool | Visualization of both raw and reduced Gemini Data to enable higher observing efficiency. |
| Procedure and requirements for data reduction software provided by Aspen instrument teams | Enable implementation and integration of reduction software for the Aspen instruments, essential for the science productivity of these instruments |
| Full Integration of Phoenix into Gemini Queue system | Reduce work and errors while observing, improve queue planning and meta-data handling. |
| Extract more information from WFS streams | Additional IQ and CC information. |
| Gemini Science Archive Enhancements | Improve accessibility and usability of Gemini data to both our PIs and to the public user community |
| Gemini Acquisition (gacq) as a standalone task | Improve observing efficiency, reliability and ease maintainability |

| | |
|---|---|
| Replace NIRI f/32 4-pixel slit | Cut & install new f/32 4-pix slit that is usable for science. |
| Speedup NIRI controller "Housekeeping" so detector status is accurately reflected | Eliminate time-loss due to incorrect reported status, which confuses the observer and the users of the data. |
| MICHELLE Spectropolarimetry Commissioning | Make the spectropolarimetry mode available to the community. This is a unique mode for a mid-IR instrument |
| NIRI Y-filter | Install & characterize Y-filter. |
| Improve near-IR OIWFS Performance for GNIRS | The GNIRS OIWFS provides either useful fast tip-tilt OR slow focus/flexure correction for spectroscopy observations. |
| Data Reduction Pipeline phase 2 | Support more instruments / modes in the pipeline by making use of the next generation data reduction toolkit. |
| Improved/rewritten mask design software, possibly integrated with the OT | Improve the user support for MOS modes for GMOS and Flamingos-2. |
| Improve near-IR OIWFS Software Performance | Correct the functionality of the near-IR OIWFS software, with particular and immediate benefit to existing NIFS performance. |
| NIRI fast mode | Enable high temporal resolution astrophysics. |
| BAND 3 | |
| Data Manager Phase II | Improve handling of auxiliary files, reduce workload, improve data products. |
| Improve near-IR OIWFS Performance for NIRI | The NIRI OIWFS provides either useful fast tip-tilt OR slow focus/flexure correction for spectroscopy observations. |
| Developing a MICHELLE Spectroscopic "Scan mode" similar to that used with TEXES | Make MICHELLE capable of producing spectroscopy data cubes, useful for observations of extended objects |
| Investigate and (possibly) Procure and Install long-pass filter for PWFS2, PWFS1 | Improve the guide performance, in particular the limiting magnitude, of the peripheral wavefront sensors. |

## G.4 Engineering

Table G.4. Engineering tasks for 2009 and beyond.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| BAND 2 | |
| MCAO (Phase 3) | |
| MCAO (Phase 4) | |
| NIRI Pattern Noise | NIRI Pattern Noise |
| Dataflow project phase II | Continue developing dataflow concept to achieve science quality on line reduction capabilities |

| | |
|---|---|
| ASCAM | SW integration for new Apogee camera, Summit integration at MK |
| SALSA (ENG03) | ASCAM & BOCAD integration, FAA approval of camera systems, SOP for laser use |
| GNIRS recommissioning | Install GNIRS on the GN telescope and perform instrument recommissioning. |
| NIRI and GNIRS array controller replacement | Replace existing GNAAC controller with new systems (e.g., SDSU-3 system from ATC, as per UIST or MICHELLE) |
| Execute Operations & Maintenance Program (B Tasks) | O&M tasks that are improvements to subsystem performance and reduction of risk |
| EPICS Software Upgrade | VxWorks upgrade and EPICS conversion to 3.14 |
| In-Situ Wash | Hardware upgrades at GN and GS + Washes as required |
| GS Mirror Coating Preparations (A Tasks) | Coating preparation tasks that absolutely must be completed prior to coating |
| GS Mirror Coating | GS Mirror coating |
| SOAR M1 Coating | Coat SOAR M1 mirror - |
| New A&G Project | New A&G Conceptual design through CDR |
| Flamingos 2 Commissioning | SW upgrades & commissioning |
| M2-3 Commissioning | M2-3 installation and performance characterization, contract closure |
| Implement Maintenance Software | Complete the integration of Maintscape as our software tool for maintenance management |
| Engineering Training Program | Safety and technical training |
| Organize Engineering Documentation | Organize drawings, ICD's, documentation |
| Seeing Monitor Upgrade | SW/HW upgrades |
| Mount Control Improvements (check mount control review report) | Complete Mount tuning engineering, CRCS improvement (software -> random park position) |
| M2 hardware &software upgrades phase II | Implement design approved in 2008. Commission in lab, preliminary testing on telescope |
| GSAOI Commissioning Phase II | |
| Non-Sidereal Targets | Deploy new TCS version from OSL (features ready), Update TCC accordingly |
| BAND 3 | |
| M2 hardware &software upgrades phase III | System commissioning on the telescope |
| New A&G Project | Implement design approved in 2009. |
| EMS Implementation | Sensor installation, subsystem performance monitoring, data logging enhancements |
| Active optics improvements | Crosstalk between both astigmatism, field astigmatism model (Zernike model in TCS), P2 astigmatism model with decenter of M1 from the optical axis, TCS LUT synchronization/restore, statistics Z8 when parking/unparking, |
| Weather Tower Upgrade | Includes: Keep basic weather information reliable, e.g. wind dir and humidity for GS. |

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|---|---|
| Web Based System Monitoring Tools | Need web-based monitoring system for non-EPICS systems and GEA improvements. |
| GEA Functionality Improvements | IQ pages upgrades, Instrument/AO calibration upgrade, MCAO integration |
| GN Dome Sealing | Engineer Dome Seal Solution |
| GN Dome Painting | Paint Dome, contracted |
| GN Vent Gates | Repair Vent Gates and Skirts |
| Equipment and Technology Improvements | Investigate mv167/mv2700 upgrade/replacement + uniformity among system, Investigate RTEMS as replacement for vxWorks, Cross compiling RT systems from Linux platform, Investigate VDCT as replacement for capfast |
| Sky Photometry Monitor | Properly implement our site monitoring system at both sites - split into separate monitors at each site to allow prioritization across monitors |
| HLDG Build/Tools Machine Update N&S | HW updates |
| Seqexec Refactoring | Prototype/test; Improve observing efficiency and reduce observer errors. |
| HRWFS reduction software | Write software like P1 reduction, TCC interface, automate sky, data logging in GEA |
| IQ model studies | Centroiding algorithms optimization, coma correction closed-loop, |
| PCS calibrations | PCS regular calibrations, rework PCS maintenance long-term |
| aO upgrades | Test PCS scaled C matrix, aO parameters parametrization vs conditions, PCS 6 zones |
| Dome-mirror seeing | M1 thermal control, automate vent gates to optimize M1 flushing |
| GN Mirror Coating Preparations (B Tasks) | Coating preparation tasks that improve subsystem performance, permanently and properly install components, reduce risk, would save time during the coating process and are upgrades |
| GS Mirror Coating Preparations (B Tasks) | Coating preparation tasks that improve subsystem performance, permanently and properly install components, reduce risk, would save time during the coating process and are upgrades |
| Guiding Improvements | Improve deficiencies in guiding performance in current systems: astigmatism converence, non-chopped image elongation, dynamic skyframe, actuators out of range, centroiding algorithms |
| Change uEs at GS | Hardware procurement and engineering shutdown for uE change |
| Guiding Upgrades | Reengineer hardware & software to improve guiding. |

## G.5 Public Information and Outreach

Table G.5. PIO tasks for 2009 and beyond.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| Library Image Catalogue | Establish on-line catalogue of key Gemini images. Possible Graphic Arts/Library intern Band 2 |
| Civic Organization Support | Increase participation in community civic organizations. Band 2 |
| ProjectAstro - Chile | Begin limited pilot ProjectAstro site in La Serena Chile Band 2 |

## G.6 Safety

Table G.4. Safety Program tasks for 2009 and beyond.

| TASK TITLE | TASK DESCRIPTION |
|---|---|
| BAND 2 | |
| Safety System Standards | Write third set of 20 Safety System Standards, circulate for comment and table at SLT for approval. Have approved Standards posted on safety web page. Achieve 55% |
| Near miss training | Arrange and conduct 1 near miss course at each site. |
| Implement near-miss reporting | Implement an across-the-board near miss reporting and investigation system. |
| Internal Audit team | Present the 40-hour Internal Accredited Auditor's Course and approve 10 internal auditors. Invite external people to attend. |
| OHSAS 18,001 Audit | Plan and arrange the OHSAS 18,001 audits at both sites. Arrange presentation of findings and circulate reports. Table at SLT. Draft action plans. |
| Legally compliance survey | Do a legal compliance survey and highlight non conformances to both Chilean and US legislation. |
| Implement incident reporting system | Develop and implement an incident (initial report) reporting system. |
| Safety Representatives Seminar | Host a Safety Representatives seminar |
| Audit Protocol | Draft an audit protocol. |
| Outside audits | Have safety staff audit other organization's safety systems |
| Employee office safety handbook | Produce an office safety handbook. |
| Visit to other plants | Arrange one visit to a different plant or industry for 2 staff members. |
| Safety Day | Arrange a Gemini Safety Day and invite local industry to participate. Arrange exhibitions, talks etc. |
| Ergonomic survey | Facilitate ergonomic risk assessment and survey |
| Supervisor's Safety Training (SSTC) | Present 2 SSTC training courses |
| Safety Suggestion Scheme | Design and implement a safety suggestion scheme |
| On-line safety orientation | Revise safety orientation for new employees and make this an online learning program. |
| BAND 3 | |
| Annual audit (Internal) | Facilitate the first internal audit audit |
| Audit action plan | Implement a post-audit action plan |
| Risk Assessments | Facilitate 4 site specific risk assessments |
| Safety System Standards | Write fourth set of 20 Safety System Standards, circulate for comment and table at SLT for approval. Have approved Standards posted on safety web page. Achieve 75% |
| Security survey | Conduct a security survey in line with Section 3 requirements |
| Accident Investigation training | Present 2 courses on Effective Accident Investigation. |
| Safety Circles | Select and train a safety circle (small group activity) |
| Fire safety survey | Arrange for a fire risk assessment of both sites |
| OHSAS Training | Have team trained as OHSAS Accredited autiors |

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|---|---|
| Draft a Supervisor's Safety manual handbook | Research and write a supervisor's safety handbook |
| Host BISA | Host the Big Island Safety Association at Gemini |
| Implement OTJ safety program | Implement a comprehensive off-the-job safety system involving spouses and children |
| Emergency plan | Write the emergency plan |
| Safety System Courses | Present 2 Gemini Safety System Element courses |
| On-line safety orientation | Revise safety orientation for new employees and make this an online learning program. |

# Section H

# Advisory Committee Reports

# H Advisory Committee Reports

The Gemini Observatory and AURA have several oversight committees that 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 users 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 user's issues. The Gemini Science Committee held two meetings during the last year, first a special meeting to review the Aspen instrument priorities at the request of the Gemini Board, on April 23-24, 2007 in Tucson, AZ, and its regular meeting on October 18-19, 2007.

At its November 2006 meeting, the Gemini Board asked the GSC to recommend a "*decision tree for optimizing the scientific return from the available budget for Aspen instrumentation incorporating key decision points in the next few years."* At its special April meeting, the GSC endorsed all prior decisions regarding the Gemini Planet Imager and pushed for construction to proceed as swiftly as possible to enable timely deployment of the instrument. In the order of highest priority, the GSC endorsed the Wide-Field Multi-Object Spectrograph (WFMOS), the Precision Radial Velocity Spectrograph (PRVS) and Ground-Layer Adaptive Optics (GLAO), in this respective order, and encouraged the Board to expedite the WFMOS effort. The GSC re-stated that the primary science goal of searching for planets in the habitable zones of M dwarfs to be very timely and of wide interest. The GSC renewed its support for the Aspen vision and strongly urged the rapid pursuit of the Aspen instruments through the execution of their associated contracts during its October 2007 meeting.

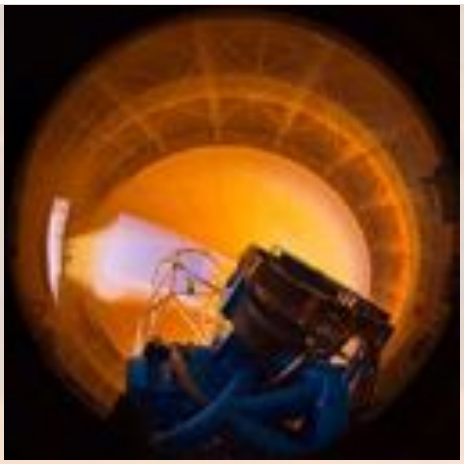
For near-term planning and effort deployment on instrument capabilities, the GSC re-iterated obtaining and installing red-sensitive CCDs on both GMOS instruments (north and south). For Gemini North, the recommended priorities were: the GNIRS repair, increasing the tip-tilt star field of view for ALTAIR LGS AO as well as greater reliability of the whole LGS system, optimization of telescope systems to optimize the performance of the mid infrared facility MICHELLE. For Gemini South, the priorities are completion of NICI commissioning and start of science with NICI, FLAMINGOS-2 and MCAO commissioning.

The GSC reviewed several Users' issues: divergent oversubscription rates among partners, Phase II proposal tool improvement, up-to-date maintenance of web pages with latest information on instruments and telescope systems and ways to provide useful guidance to the observatory on a range of support issues.

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, in Hawaii on March 29-30, 2007, and in Chile, October 19-20, 2007.

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 recognized the management challenges in developing a collaborative effort for the development of the Wide Field Multi-Object Spectrograph (WFMOS) and made useful and practical suggestions for working with Subaru to put into place the best work frame and tools. It urges enhanced communication at all levels with the Japanese community.
- The AOC-G endorsed a carefully phased approach to move forward with the Precision Radial Velocity Spectrometer (PRVS) as funding and cash commitments allow.
- The Council applauded the yearly planning process for the Gemini Observatory newly instituted in 2007, an encouraged the production of a five-year plan to frame the yearly exercise more robustly. It also suggested that more representatives from the Observatory's "customer base" be included, e.g. members from the Gemini Board, the Gemini Science Committee or other heavy users of the telescopes.
- The AOC-G continued to express its concerns regarding software management at the observatory and notes the crucial importance of having a strong Software Manager to ensure the success of the Dataflow Project and close coordination between engineering and science.
- While noting a number of significant milestones in the MCAO project, the council expressed disappointment with the slip in the schedule for this key observatory program. It also recognized the challenge of finding the appropriate balance between MCAO development efforts and operational priorities. It re-emphasized the timely implementation of the MCAO system for the competitiveness of the observatory.
- The council encouraged the Director to manage expectations of the Gemini user community with regard to when FLAMINGOS-2 and MCAO might be commissioned and released for general scientific use.
- The AOC-G strongly encouraged the observatory to be extremely aggressive in the hiring process until the several open positions are filled, and to use any unallocated salary funds to out-source as many tasks as possible.



# Section I

# Gemini's Future and Key Strategic Issues

# I Gemini's Future & Key Strategic Issues

## I.1 Recruitment Challenges

The remote location of Hilo has proven to be a large obstacle in Gemini's recruiting efforts. In contrast, the recent recruitment of positions based in La Serena has been easier than in the past. This year, two individuals turned down offers for Hilo but accepted offers for La Serena.

The high cost of living in Hilo and lack of quality medical service have been a deterrent to attracting individuals to work in Hilo. Uncompetitive salaries offered to administrative and engineering staff have also hampered the recruitment in these areas. This is an area that is currently under review

Two factors are internal to Gemini in creating recruitment challenges. Gemini has the reputation of not providing quality research time for staff astronomers. Several offers of employment have been rejected by applicants who wish to pursue their research and know that Gemini requires that the scientist must spend more time in supporting operations.

Also, Gemini is too slow in making offers. Many applicants have accepted other offers due to Gemini's failure to respond in a timely fashion. Human Resources is working with the managers to develop a standard for the turnaround time from the posting of a job to the offer of the job.

## I.2 The Aspen Program

Gemini's long-range science-driven strategic plan remains substantially pinned to its Aspen development program. Borne of diverse input from across the Gemini partnership, the Aspen instruments are being designed and built to answer key questions in astronomy. Together they represent a bold step forward in Gemini's young life. Far more than just upgrades to existing capabilities, the Aspen instruments each represent pathways to deeper understanding through new technologies and operational paradigms which will require broader community collaboration through larger scale programs than have been attempted in astronomy. Such is the nature of making meaningful progress in answering some of the profound questions facing astronomy. While PI science will be preserved during this revolution (to support the diverse and creative spirit of Gemini's community), campaigns requiring hundreds of nights of observations using Gemini and other 8-10 m class telescopes will substantially pave our path forward.

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:** Key components like the micro-machined deformable mirror needed by GPI, the fiber positioner needed by WFMOS, and the adaptive secondary needed by GLAO all require invention of new technologies.

**Funding:** Aspen is being financed in an extremely competitive environment across the Partnership and our ability to sustain Aspen is at risk. It is important to recognize that we depend upon instrument builders that have choices and are typically funded through "soft" money, so

funding uncertainty at Gemini has significant knock-on effects in our entire development program.

**Inter-observatory Collaboration:** Instruments of the size, cost, and complexity of WFMOS cannot realistically be pursued by single observatories and are compelling Gemini to forge new strategic relationships with Subaru, who are in parallel developing the HyperSuprime Camera. 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 simply too high for a single observatory to bear hence drives 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 whole area through the Mauna Kea network of major observatories – a system we intend to expand to other observatories in the future.

**New Contracting and Risk Management Models:** This is arguable the least understood and appreciated among the risks to the Aspen program. This is a complex issue and Gemini has had to lead/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.

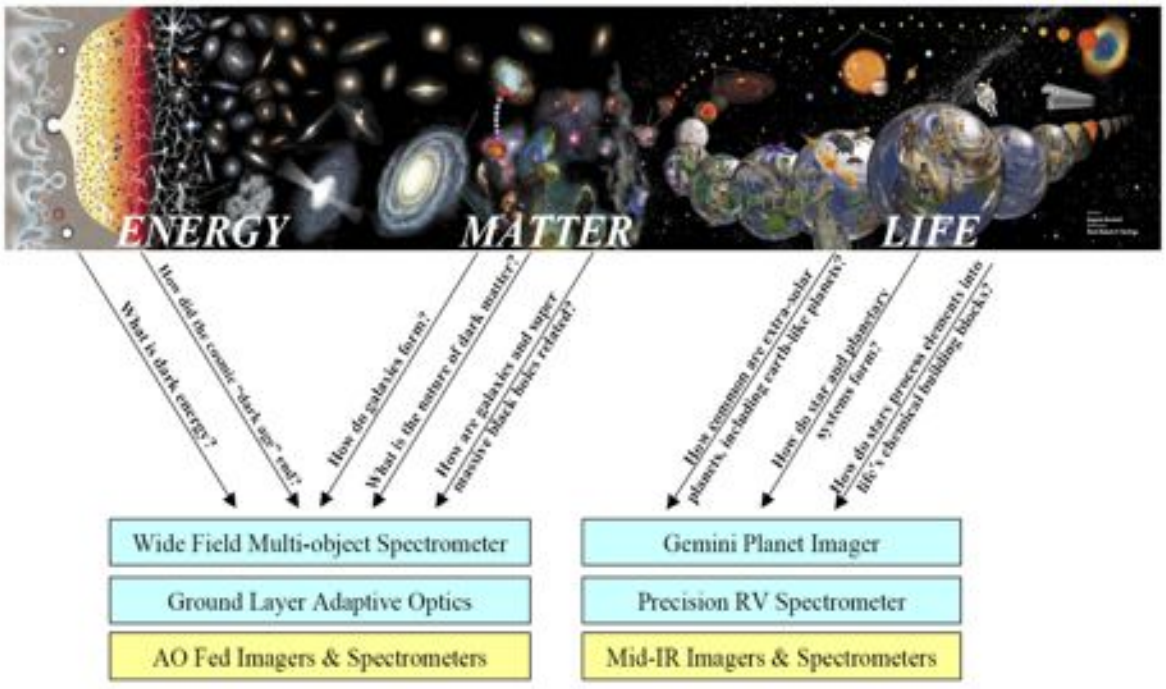



Figure I.1. The questions identified through the Aspen process have been mapped onto a combination of existing (yellow) and new (blue) instruments that together stand to make significant progress toward answering some of the most profound questions about nature before society.

## I.3 Science initiatives

Gemini, W.M. Keck and Subaru Observatories have been conducting a limited exchange of observing nights for several semesters. The purpose of the exchange is to favor collaborations and to give members of each community access to facilities not available at *their* facility. In semesters 2006B and 2007B, the Gemini community had access to five nights of SuprimeCam (wide field optical imager) or MOIRCS (multi-object near infrared spectrograph) on the Subaru Telescope, in exchange for five nights of the Gemini Multi-Object Spectrographs (GMOS-North or South) and the Near Infrared Integral Field Spectrograph (NIFS) on Gemini for the Japanese community. The observing time exchange with Keck was five nights of MICHELLE (mid-infrared imaging and spectroscopy) for five nights of HIRES (high resolution optical spectrograph). This trade is still quite limited in terms of the number of nights exchanged and the three observatory directors are exploring ways to expand this exchange in ways that are beneficial for all communities.

## I.4 Base and Dorm Facilities

### I.4.1 Hilo Base Facility (HBF)

In order to address the continuing space shortage at the Hilo Base Facility, the Gemini Board approved the design and construction of a two-story base facility extension in the space behind the existing HBF building. The detailed architectural designs and construction documents were completed in fiscal 2006, and the procurement for a contractor proceeded in the first quarter of fiscal 2007. The Board approved the construction contract in early 2007. Also early in 2007, the staff housed in the relocatable buildings behind the HBF was moved into the main building so that site excavation could begin in early April. 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 earnest again in late August 2007 and is proceeding apace. The current estimate for completion of construction of the two-story 13,507 square foot building is May 2008. Upon completion, the building will be readied for occupancy along with a nearly simultaneous "freshening-up" of the now ten-year-old original building. Staff currently housed in the 3,000 square foot leased facility about a mile down the road will be recalled to the main base facility and all Gemini North based staff will be redistributed in the total available space. The construction project also includes a commensurate increase in parking space. We project that all moving activities will be completed by July 2008.

### I.4.2 Cerro Pachón Dormitory Facility

An AURA Corporate (not Gemini) infrastructure project to undertake the construction of a Dormitory on Cerro Pachón was begun in July 2007. 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 in the vicinity of the AURA 20-Unit Dorm about 3.5km from the Gemini South telescope. This project has developed in response to the reduced requirement for Cerro Tololo facilities and increased possible future requirement for infrastructure on Cerro Pachón following the decision by the LSST (Large Aperture Synoptic Survey Telescope) to join Gemini

and SOAR on Pachón. Construction documents were completed in April 2007, and the project has been planned so that it can proceed in phases. AURA Corporate began Phase One building (costing ~$250K) in July 2007 and is expected to be completed in early 2008. The intent is for this dormitory to support ongoing nighttime operations. The current (AURA) 20 unit building on Cerro Pachón will continue to be used for peaks in demand such as instrument commissioning, engineering shutdowns and some initial LSST work. This initial phase includes 6 dormitory rooms, a small common area and the Paramedic office. The source of the funding for this initial phase is a no interest loan to AURA-O from the AURA Corporate office, which will be repaid over approximately five years from room occupancy charges per night.

## I.5 The Working Culture at Gemini

Before starting as Gemini's new Director in 2006 an extensive set of interviews was conducted across the entire organization which, in the end, included about half the staff. These were intended to provide the incoming Directorate with a clear perspective of Gemini, *through the eyes of the staff*. A core philosophy behind these interviews is that if any organization is going to reach its potential, the "brutal facts" about the organization must be recognized as the first step in a process of improvement. Gemini is no different from other organizations in that our greatest asset exists in our staff, for therein lies the skills, energy, and ambition needed to operate two of the most complex and powerful telescopes ever built. Nurturing the human element at Gemini is therefore crucial if we are to achieve our goals as one of the world's truly great observatories.

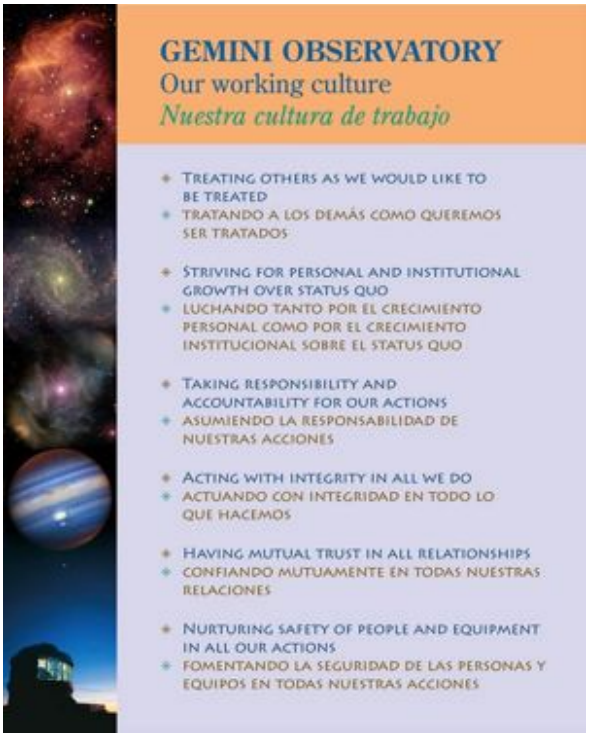



Figure I.2. The Working culture at Gemini is summarized in this poster, which has been replicated across all of the Observatory work sites in the past

The working culture at Gemini is summarized in the illustration shown to the right. This poster has been reproduced all over the many sites which comprise Gemini Observatory, including the summits of Cerro Pachón and Mauna Kea and our distributed offices in La Serena and Hilo. This working culture poster encapsulates core values that we aspire collectively to bring to the Gemini work experience. The first element is simply the "golden rule" – a concept taught to us as children which has roots thousands of years old in the history of civilization. It is a key foundational element in our working culture which spans the 20+ nationalities we have on our staff. Next is a challenge to never settle for the *status quo* – when this happens we are essentially adrift, working toward no particular goal, waiting for a reason to find ourselves in a sea of false confidence.

Pushing to always improve, no matter how good we become at running Gemini, means we will never actually reach our "destination." Such is the nature of organizations that value journeys of improvement more than reaching destinations that represent a status quo. The next two elements include such key concepts as personal responsibility and accountability which together support our organizational integrity. Building a sense of professional integrity into our culture is key to instilling pride and a sense of teamwork as we work toward common goals. Next, the importance of building mutual trust in our relationships is stressed. Trust is essentially a sacred component of our working culture. It can only be earned, over time, between coworkers. Once established, if it is ever lost, trust can be almost impossible to recover. Functioning without a baseline sense of mutual trust across the observatory leads to a multitude of inefficiencies and complications which tax our staff and would prevent Gemini from reaching its potential. Finally, we stress the need to remember safety in all of our actions. Nothing we do at Gemini Observatory should put our staff at significant risk of personal injury because the health and well being of our most precious resource can never be compromised.

Together, these core values represent the working culture we are striving to achieve at Gemini Observatory. They are a foundational element in a cultural transformation intended to take our staff from a construction era sprint to a sustainable operations era marathon.