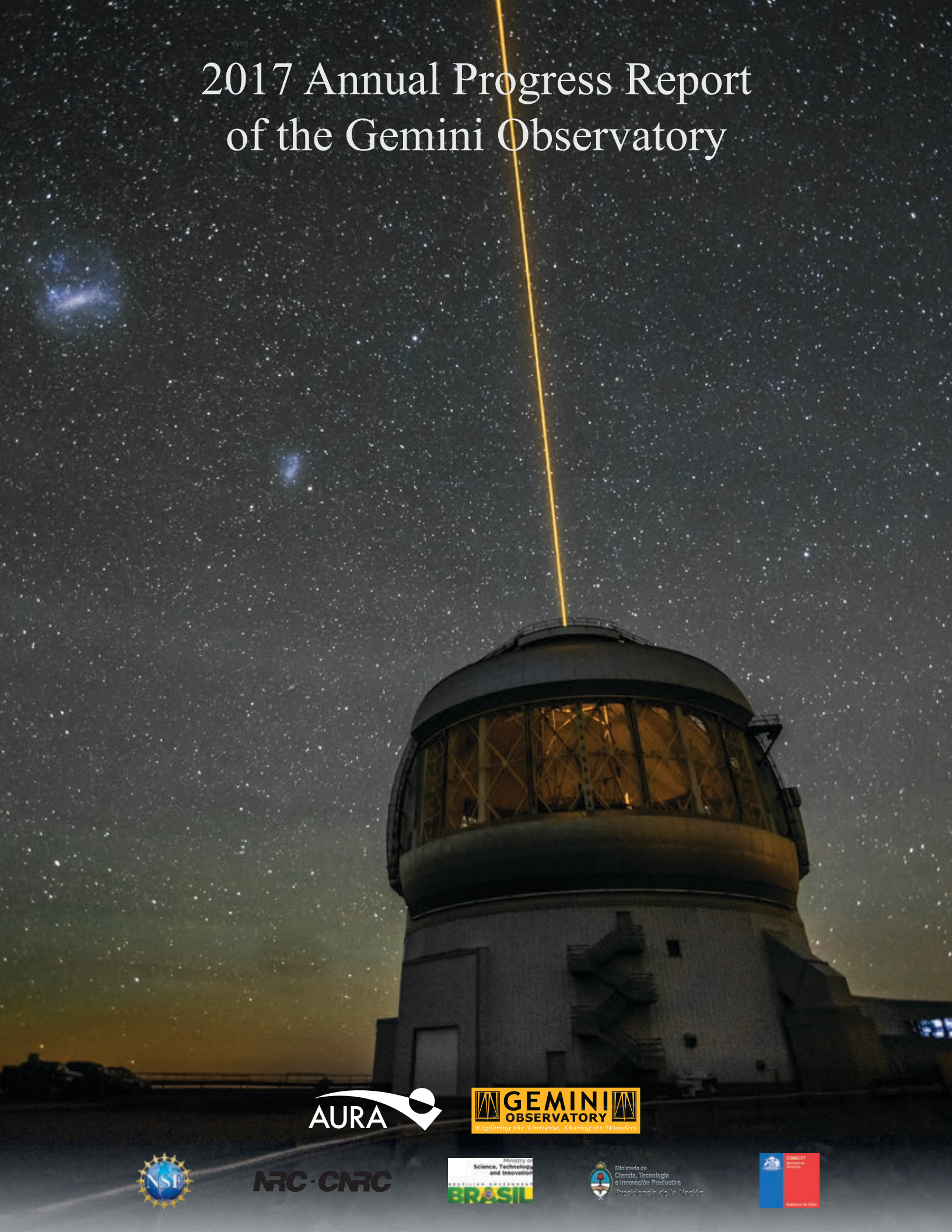
2017 Annual Progress Report of the Gemini Observatory



AURA

GEMINI OBSERVATORY
Exploring the Universe, Sharing its Wonders

NSF

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Ministry of Science, Technology, and Innovation
BRASIL

Ministerio de Ciencia, Tecnología e Innovación Productiva
Presidencia de la Nación

CONICYT

Table of Contents

1 Executive Summary

Gemini Observatory is an international partnership operating twin 8-meter diameter optical/infrared telescopes located on two of the best observing sites on Earth. Locations in the northern and southern hemispheres (Hawai‘i and Chile) provide access to the entire sky. A range of instrumentation enables visual and infrared imaging and spectroscopy, with enhancements from adaptive optics and specialized instrumentation.

Gemini’s International Participants include Argentina (Ministerio de Ciencia); Brazil (Ministério da Ciência); Canada (National Research Council, NRC); Chile (Comisión Nacional de Investigación Científica y Tecnológica, CONICYT); the United States (National Science Foundation, NSF); and the University of Hawai‘i (site host). Additionally, Gemini worked with three Limited-Term Collaborators: Korea (Korea Astronomy and Space Science Institute, KASI); Australia (Astronomy Australia, Ltd.); and Weizmann Institute of Science. The operations and maintenance of the Observatory are managed by the Association of Universities for Research in Astronomy, Inc. (AURA) through a cooperative agreement with the National Science Foundation (NSF). The NSF acts as the Executive Agency on behalf of the International Participants.

Two primary activities dominate the work of the Observatory. The first is maintaining and supporting operations on behalf of the international scientific community of the Gemini Partnership. The Observatory’s goal is to enable our users’ scientific progress by being an efficient, nimble, and responsive observatory. We offer a variety of observing and proposing modes to suit the varying needs of our individual Principal Investigators (PIs). Astronomers may visit and conduct their own observations, or have staff execute their observations in a “queue” mode. The queue matches observing conditions to science programs and provides access to the time domain. Now well-established, the Fast Turnaround program allows monthly proposals, combined with rapid peer review by other PIs. Successful proposers can obtain data as early as a month after having their scientific idea.

Gemini’s second primary activity is the development of instrumentation and facilities. Development projects provide novel capabilities to users through new facility instruments, upgrades to existing facility instruments, and visitor instruments. The construction of GHOST continues on track for delivery in late 2018. Gemini signed a contract with the Southwest Research Institute (SwRI) to build Gen4#3 (OCTOCAM) that is destined for Gemini South and will play a key role in supporting LSST follow-up. Gemini also welcomed back several previous visiting instruments and worked with teams for several new visiting instruments. The new visiting instrument ‘Alopeke, a speckle imaging camera, was commissioned at Gemini North.

As a result of these Gemini activities, users of Gemini continue to produce a steady stream of important and impactful scientific results. Gemini South acquired a time-critical sequence of observations of the first-ever detected electromagnetic counterpart to a gravitational wave event (GW170817). These Gemini data enabled researchers to form a complete picture of the aftermath associated with the merger of a binary neutron star system. Closer to home, Gemini observed the first interstellar object ever discovered within our solar system (1I; ‘Oumuamua) and helped show that ‘Oumuamua is a tumbling, elongated object about the length of a football field.

In mid-2017, Gemini successfully completed a major repair to the Gemini North dome shutter. Gemini also made significant progress on upgrading the Cerro Pachón network link and phase 1

of the longevity program, designed to ensure the Observatory remains scientifically relevant beyond 2025 by renewing and upgrading the facilities. Base Facility Operations (BFO), in which the telescope and facility are operated entirely from their respective sea-level offices with no personnel on the summits at night, continued in 2017 with no significant losses of observing time.

Fund	2017 Actual
Operations and Maintenance (O&M)	$32,260
Instrument Development Fund (IDF)	$4,296

Table 1-1: 2017 spending by fund, values in US$1,000

We continue to manage the Gemini budget and hit targets as set by the Observatory Governance. The 2017 budget is expected to be spent within the target tolerance range. *Table 1-1* and *Table 1-2* summarize the spending and FTE levels of Gemini Observatory in 2017. Gemini's staffing remains at the post-transition level, with approximately 168 FTEs distributed evenly between the two sites. The principal sources of budget variance were a reduction of 2017 labor costs due to unplanned FTEs reductions and unplanned leavers, increased relocation costs for both departures and new hires, changes in AURA F&A, AURA CAS & HR fees, and increased facility expenses.

Division	FTE
Administration	17
Development	15
Operations	115
Deputy Director	14
Directorate	7

Table 1-2: 2017 Staffing

2 Introduction

Gemini Observatory's mission is:

To advance our knowledge of the Universe by providing the international Gemini Community with forefront access to the entire sky.

Gemini's foundation is the twin 8.1-meter telescopes on Maunakea, Hawai'i, and Cerro Pachón, Chile, with their complement of instrumentation that provides a range of broad and specialized capability across the optical–infrared bandpass, including adaptive optics. That foundation supports our multi-national astronomical user community, which includes Gemini's own scientific staff. Our users are directly responsible for Gemini's scientific achievements, pursuing interests that range from the Solar System to the most distant galaxies and structure of the Universe. Gemini's users continue to publish a steady stream of scientific results. Gemini Observatory provides the flexible, responsive platform that enables these advancements.

In addition to its nightly observing operations, Gemini continues to position itself for the future, with work on new instrumentation and maintenance and upgrades to the telescopes and facilities. Additionally, Gemini continues to develop its Strategic Plan for the coming decade of 2021-2030.

In this 2017 Annual Report we present an overview of the activities and scientific output of Gemini Observatory. *Section 3* presents some of the scientific highlights of 2017. *Section 4* reports on operations, including demand, usage and productivity. We also present summaries of user interactions, proposing and observing modes, and Observatory metrics. *Section 5* discusses accomplishments in instrumentation and facility development, including progress on new facility-class instrumentation and upgrades of existing instruments. In *Section 6,* we review our educational programs, our efforts toward broadening participation, and our communications for users and the general public. *Section 7* summarizes administration and finance. Appendices

list acronyms used in this report, approved science programs in the most recent two completed semesters (2016B/2017A), publications in 2017 using Gemini data, a report on progress against the 2017 Program Plan, and staff accomplishments.

3 Science Highlights

3.1 The Gravitational Wave E-M Counterpart Follow-up Campaign

The biggest story in astronomy in 2017, and Gemini's most intense observational effort, involved the first-ever detection of an electromagnetic counterpart to a gravitational wave event. Soon after event GW170817 was localized by LIGO, Virgo, and *Fermi* on August 17, the discovery of an optical counterpart initiated a time-critical sequence of observations at Gemini South. The flexibility of Gemini's operations and queue scheduling was essential for this effort, which involved triggering of observations in rapid ToO programs as well as fast approval and activation of Director's Discretionary Time (DDT) requests. Gemini's "eavesdropping" mode enabled PIs to assess the quality of the data and adjust the observations in real time, while operating from the base facility in La Serena allowed the queue coordinators to be present and facilitated dynamic adjustments to the observing plan. Gemini's ability to switch quickly from one instrument to another made it possible to obtain both optical data with GMOS and near-infrared data with FLAMINGOS-2 during the limited time the object was visible in a given night.

In conjunction with observations from telescopes around the world, the Gemini data allowed researchers to form a complete picture of the aftermath associated with the merger of a binary neutron star system. The first Gemini South observations of GW170817 were taken as part of a DDT proposal and were obtained on the same night that the proposal was received, demonstrating that the Observatory can respond extremely quickly to incoming requests. The Gemini observations involved multiple teams and spanned a period of 25 nights while the object's light gradually faded.

At least five refereed publications have already resulted from the Gemini imaging and spectroscopic observations of the GW170817 counterpart. The *Astrophysical Journal Letters* paper[1] based on the Gemini F-2 near-infrared spectra concludes that the data provide direct evidence that binary neutron star mergers produce even the heaviest of the r-process elements. Edo Berger, a coauthor on the paper and a presenter at the press conference on October 16 in Washington, D.C., described the Gemini observations as, "collectively the longest-running, and finest, infrared imaging and spectroscopy of this object that we have available. [This] solves the decades-long mystery of the origin of the heaviest elements in the periodic table." As reported in *Nature*[2], Gemini/GMOS spectra from a DDT program by another team prompted that team to trigger observations from their joint *HST*/*Chandra* ToO program, which led to the first detection of the event in X-rays, and subsequent X-ray follow-up.

[1] http://iopscience.iop.org/article/10.3847/2041-8213/aa905c

[2] http://www.nature.com/nature/journal/vaop/ncurrent/full/nature24290.html

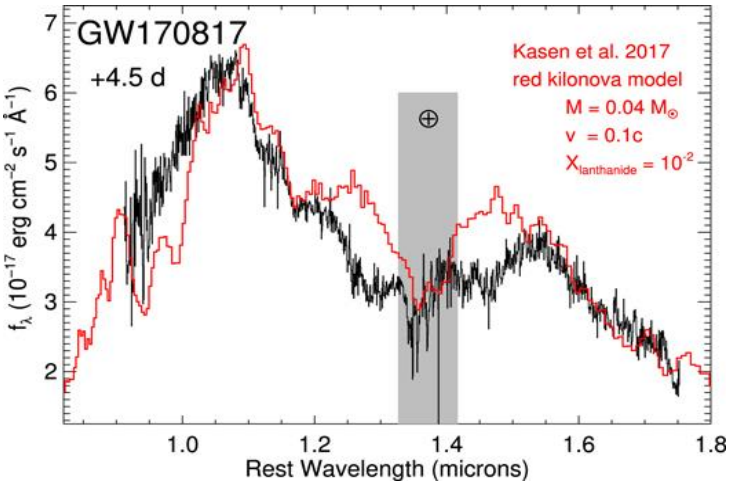

Figure 3-1: FLAMINGOS-2 spectrum (black) of the GW counterpart taken 4.5 days after the merger, compared to a theoretical model (red). This is the 3rd epoch; the first Gemini F-2 spectrum was taken 1.5 days after the GW event. The large spectral peaks near 1.07 and 1.55 μm are associated with a high concentration of lanthanides (or "rare earth elements") and are seen in both the data and model. Resolving the obvious differences between the predicted and observed spectra will advance our understanding of the detailed physics of binary neutron star mergers. (Figure reproduced from Chornock, Berger,Kasen et al. 2017.)

3.2 On the Trail of the First Interstellar Asteroid

In October, Gemini Observatory provided key observations in characterizing the first interstellar object ever discovered within our Solar System. The object was originally given a provisional cometary designation, but later received the permanent designation 1I (to indicate its status as the first interstellar object) and the name 'Oumuamua, a Hawaiian word that connotes the idea of an advance scout, or a messenger from a great distance. When discovered in mid-October by Pan-STARRS1 on Haleakalā, 'Oumuamua was about 85 times the Earth-Moon distance away, and on its way out of the solar system. Soon afterwards, Gemini Observatory received a Director's Discretionary Time proposal from the discovery team, followed by two additional DDT proposals from other teams. Both Gemini telescopes observed 'Oumuamua over the course of three nights as it quickly dimmed from view.

"What we found was a rapidly rotating object, at least the length of a football field, that changed in brightness quite dramatically," said Karen Meech of the University of Hawai'i's Institute for Astronomy, the leader of the discovery team who were the first to obtain Gemini observations of the object. "This change in brightness hints that 'Oumuamua could be ten times longer than it is wide – something which has never been seen in our own solar system," according to Meech. The research led by Meech is published in *Nature*[3]. The other two teams that obtained Gemini observations have also produced publications, showing that the optical and infrared colors of 'Oumuamua are not as red as had been expected, and that it appears to be "tumbling," meaning that its rotational axis is not aligned with a principal axis, as it travels through space.

[3] https://www.nature.com/articles/nature25020

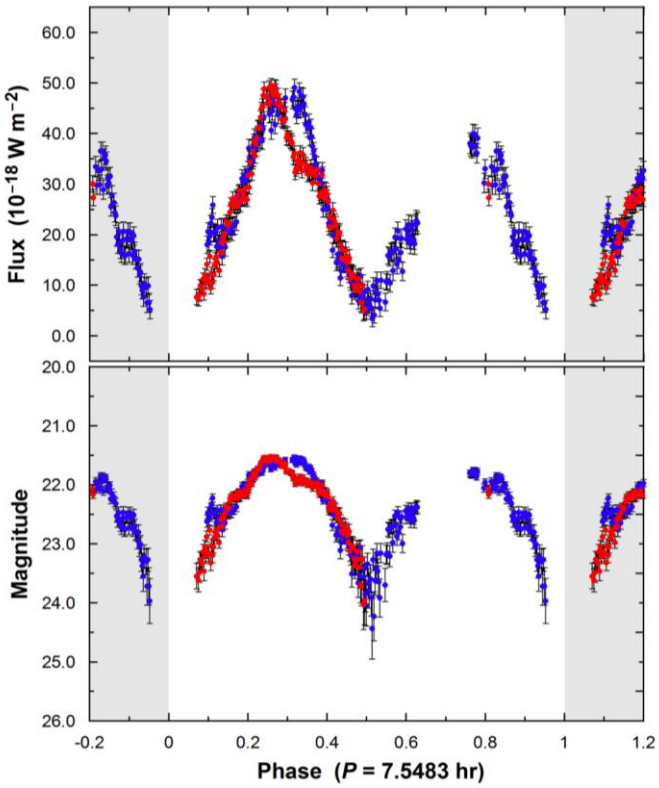

Figure 3-2: Variations in the brightness (top) and magnitude (bottom) of 'Oumuamua as measured in the r-band filter with GMOS on Gemini North over the course of two successive nights (indicated by the blue and red points) in late October. The exceptional quality of the GMOS photometric data allows the rotational period to be determined with high precision. Interestingly, the light curve does not repeat itself exactly from one rotation to the next. This indicates the object is "tumbling" in its trajectory through space. (Figure reproduced from Drahus et al.[4])

3.3 Blue Binaries in the Cold Classical Kuiper Belt

The "Colours of the Outer Solar System Origins Survey" (Col-OSSOS) project is a Gemini Large Program that is measuring the colors and constraining the binarity of KBOs found in the OSSOS survey, a Large Program with the Canada-France- Hawai'i Telescope. The combination of these two large programs is a superb example of synergy on Maunakea, exploiting both the wide-field survey capability of MegaCam on CFHT and the large aperture and excellent image quality of Gemini. To maximize efficiency, follow-up r-band tracking observations with CFHT/MegaCam are often scheduled simultaneously with the Gemini GMOS g-band imaging. In a publication in *Nature Astronomy*[5], the OSSOS/Col-OSSOS team reports the detection of a new population of relatively blue, tenuously bound binaries in the cold, classical Kuiper Belt (CCKB). The team's interpretation is that the blue binaries formed at smaller distances and survived "push out" into the CCKB region (where the objects tend to be much redder) during the early phases of Neptune's migration from 20 au (where it's believed to have formed) to its current 30 au. The blue binaries would therefore provide a unique probe of the formative conditions in the region cleared out by Neptune; if this is the case, then the planetesimals in this originally high-density region must have formed predominantly as multiples.

[4] https://arxiv.org/abs/1712.00437

[5] https://www.nature.com/articles/s41550-017-0088

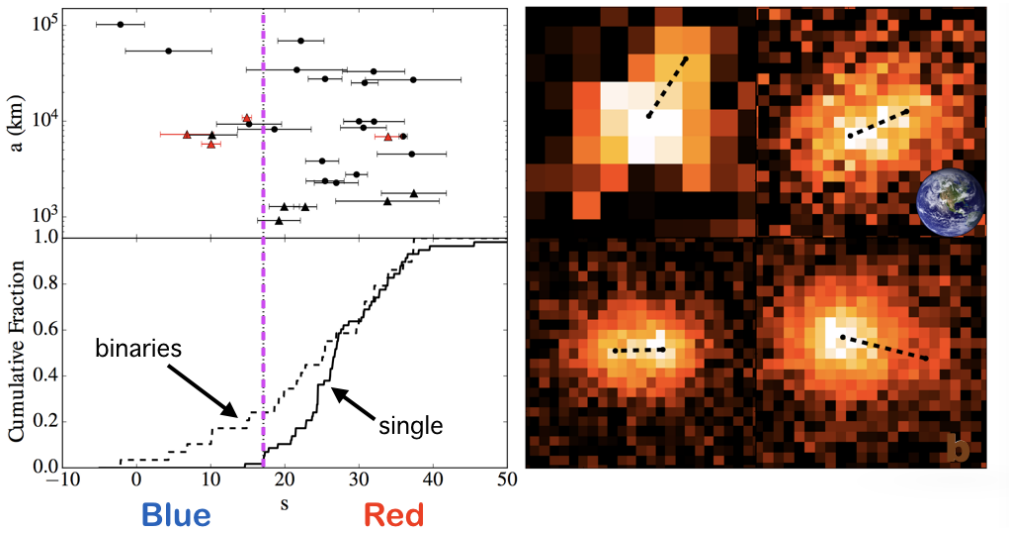

Figure 3-3: Left, top: Binary semi-major axis a (top) versus optical spectral slope s of known cold classical Kuiper belt (CCKB) binary objects with well determined colors. The spectral slope is based on color and is defined as percent increase in reflectance per 100 nm in wavelength. Left, bottom: Cumulative spectral slope distribution of single (58 objects, solid line) and binary (29 objects, dashed line) cold classical objects. The vertical dotted line divides the blue and red classes of the dynamically excited KBOs. Right: Gemini/GMOS Col-OSSOS images of four new binaries (those plotted in red at top-left). Black lines indicate the fitted binary separations as compared to the scaled version of the Earth shown in the figure. (Figures adapted from Fraser et al. 2017.)

3.4 First Determination of the Host Galaxy of a Fast Radio Burst

Fast Radio Bursts (FRBs), typically lasting only a few milliseconds, have remained enigmatic since their discovery in 2007. Outstanding questions include what powers these bursts, their distance, and what their host galaxies might be. The repeating burst source FRB 121102 was discovered in November 2012 at Arecibo, and offers the opportunity to follow up bursts quickly to identify the source. A campaign at the VLA in 2016 detected nine bursts from this object, permitting a precise position to be determined. Gemini North GMOS observations were then used to characterize the host galaxy, which turns out to be a low-mass star-forming dwarf (stellar mass ~ (4–7) × 10^7 $M_\odot$), at a redshift of 0.19. The galaxy has a high star formation rate for its mass, about 0.4 $M_\odot$ yr^{-1}, which may suggest that FRBs are linked to younger neutron stars. These results also hint at links between FRBs and long duration gamma-ray bursts and superluminous supernovae, both of which are also prevalent in star-forming dwarf galaxies. The work was published in *ApJ Letters*[6].

[6] http://iopscience.iop.org/article/10.3847/2041-8213/834/2/L7/pdf

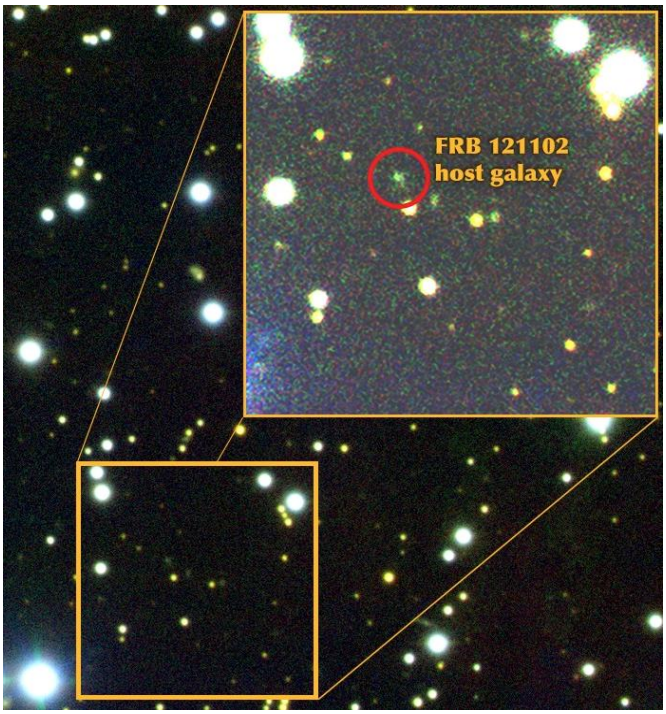

Figure 3-4: Gemini composite color image of the field around the host galaxy of the repeating fast radio burst FRB 121102 (indicated). The dwarf host was imaged, and spectroscopy performed, using GMOS-North. This provided the first ever redshift for a fast radio burst, proving that at least some of them are extragalactic in origin, and likely associated with young stellar populations.

3.5 A Quasar in the Epoch of Reionization

A team of astronomers have discovered a new record-breaking quasar at a redshift of 7.54, corresponding to a light-travel time of 13 billion years. The object, known as J1342+0928, was discovered in observations from the Dark Energy Camera on the Blanco 4-m telescope at Cerro Tololo. The quasar is powered by a supermassive black hole with an estimated mass 800 million times greater than that of our Sun. At this distance, the universe was only about 5% of its current age, or about 690 million years old, a very short time to build up such a large mass. Data from the Gemini Near-InfraRed Spectrometer (GNIRS) were key in determining the mass for the supermassive black hole. Among the instruments used in the study, only GNIRS was able to probe the highly redshifted Mg II lines, emitted in the rest-frame UV. The study also concludes that J1342+0928 existed at a time when the universe was still emerging from the cosmic "dark ages" and entering the epoch of reionization, when neutral gas in intergalactic space became ionized by luminous young stars and the onset of quasar activity. It is unknown precisely how many quasars as distant as this one exist over the whole sky. The discovery team plan to continue searching for similar quasars using Gemini and other large telescopes around the world. These results are published in *Nature*[7].

[7] https://www.nature.com/articles/nature25180

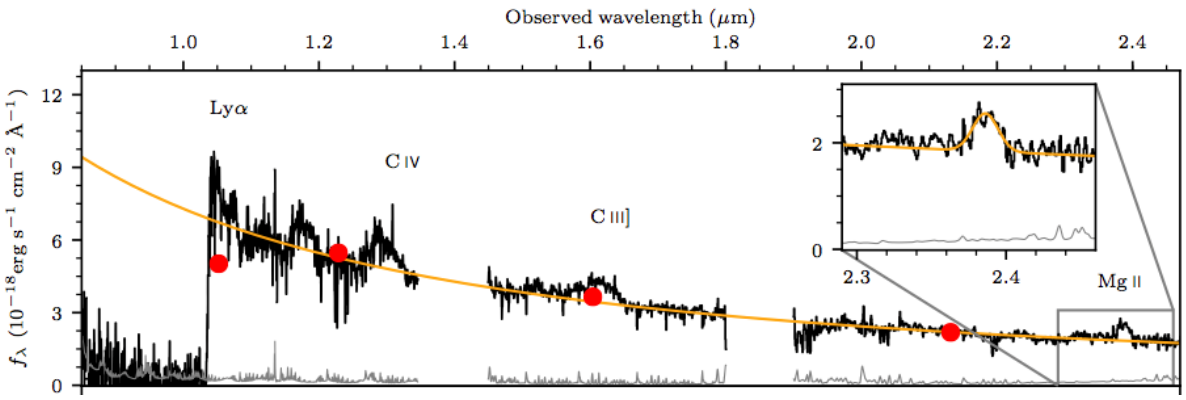

Figure 3-5: Combined Magellan/FIRE and Gemini/GNIRS near-infrared spectrum of the quasar J1342+0928 at redshift z=7.54, the highest redshift of any known quasar. The inset shows the Mg II line, which was only probed by Gemini/GNIRS and played a crucial role in determining the unexpectedly large mass of the supermassive black hole that powers the quasar. (Figure reproduced from Bañados et al., Nature.)

3.6 Proposal and Publication Statistics

Gemini offers a variety of different program types and observing modes and serves hundreds of Principal Investigators (PIs) each year. We list the total numbers of approved programs by proposal mode for semesters 2016B and 2017A in Table 3-1. National Time Allocation Committees evaluate "Semester" programs which, once accepted, may be executed in queue or classical mode. Project titles and PIs in these completed semesters are listed in Appendix D.

Overall, the publication rate based on Gemini observations continues to be strong. As shown in the Figure below, a total of 211 refereed papers were based on Gemini data this year. This is the second highest yearly total, exceeded only in 2014. Of these, 107 (51%) resulted from observations with Gemini North; 81 (38%) from Gemini South, and 23 (11%) from observations with both telescopes. In the previous two years, more publications resulted from Gemini South than from Gemini North, but the reverse is true in 2017. It is noteworthy that the publication rates from the two telescopes have tracked each other reasonably well.

The GMOS instruments are involved in roughly half of all publications (52% in 2016, 54% in 2017). The publication count for instruments involving adaptive optics also remains strong: 30% of publications thus far in 2017 utilize Gemini's AO capabilities, and 20% of these (i.e., 6% overall) involve GPI. Early indications are that the GPI publications tend to have above-average impacts. FLAMINGOS-2 was especially instrumental in the follow-up effort for the August 2017 gravitational wave counterpart. Several of the Large and Long Programs (LLPs) have produced their first refereed publications this year and have more in preparation. Of the total 2017 publications, 8% have a Gemini Observatory staff member as lead or co-author. All Gemini staff publications are listed in Appendix B, and all publications based on Gemini data are listed in Appendix C.

Proposal Mode	N
2016B	
Semester	170
Large and Long	14
Fast Turnaround	56
Discretionary	13
2017A	
Semester	165
Large and Long	15
Fast Turnaround	44
Discretionary	15

Table 3-1: Number of proposals per proposal mode for completed semesters

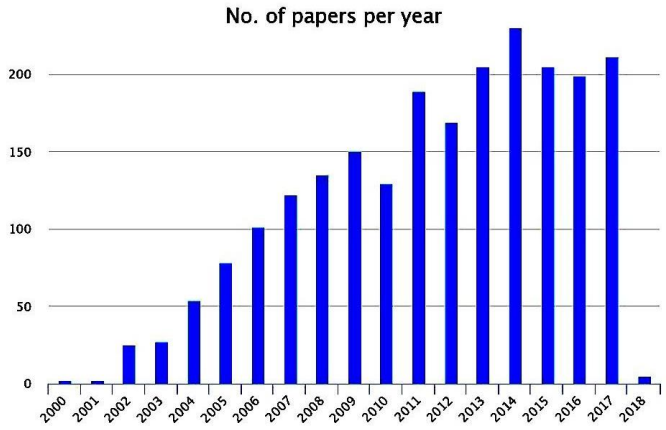

Figure 3-6: Publications by year, to date

4 Operations

4.1 Operations Summary

The 2017 program plan provided a list of "regular operations" activities and tabulated specific additional major tasks scheduled for 2017. *Table 4-1* shows those major items; the main tasks are all more than 90% complete at the time of writing. Throughout this section we describe progress with these activities, list changes and decisions taken within the year, and give highlights of the regular operations activities.

Title	Completion	Section
Implement first round of work on Observatory-wide Obsolescence Mitigation Plan	80%	4.8
Real-time Software Upgrades	90%	4.8
Replace the Gemini North dome shutter drive chains and gearboxes	100%	4.6
Science Operations Model Upgrade	50%	4.8
Upgrade the Cerro Pachón Network Link	90%	4.8

Table 4-1: Major Operations Activities in 2017

4.2 Instrumentation

Here we summarize operational performance of facility instrumentation over the last two complete semesters (2016B and 2017A). See Instrument Upgrades *Section 5.5* for information on instrument upgrades.

4.2.1 Gemini North

GNIRS

GNIRS, the workhorse Gemini North near-IR spectrometer, suffered an increasing fault rate in both semesters 2016B and 2017A; the main causes of lost time were detector controller crashes and shifts in the cross-dispersing prism. A total in excess of 15 hours were lost in both semesters, mostly to these two problems. Replacement of the detector controller is the subject of a Development project, as reported elsewhere in this document. Other required remedial work includes assessment of the internal focus mechanism as a means to improve image

quality, and to improve the acquisition mirror mechanism - which frequently loses position and requires re-indexing (costing a few minutes per instance).

GRACES
The demand for GRACES remained high. In spite of poor weather we completed all but one Band 1 program. Very little time was lost to faults. Employing intern effort, we optimized the input parameters for the Opera data reduction software to work with as many different datasets as possible. In addition to Opera, an IDL GRACES data processing script, written mainly by Gemini staff, has been made available to Users via the DR User Forum. A strong correlation was found between instrument temperature and focus, which has since been calibrated out - a significant time saver at night.

GMOS-N
We commissioned the new R150 grating for GMOS-N in December 2016. This grating replaces the old R150 grating, which had developed a throughput degradation due to an issue with the coating. The new Hamamatsu detector array was installed in early 2017. We obtained the first queue observations with the new detector array in late March. The main CCD commissioning phase was concluded with the release of the Gemini IRAF package v1.14 in July 2017; a few remaining commissioning tasks and webpage updates will be finalized shortly. Some shutter faults encountered since the installation were traced to faulty sensors, and fixed. Finally, during the telescope shutdown period in mid-2017, we implemented a new active temperature control scheme for the science CCD controller. The new temperature regulation has improved temperature and bias level stability.

NIRI
NIRI's capabilities remain in adaptive optics and seeing-limited imaging mode with all three cameras. In 2016B, two in-cryostat mechanism sensors failed; no significant observing time was lost in either case, and NIRI continues to operate nominally using the two backup sensors. The instrument has continued to suffer cooling problems. In September 2016, NIRI's cold heads, and their controller board and power supply, were replaced. However at the end of 2017A, the cryocoolers showed early signs of failure. To ensure no interruption of on-sky observations in 2017B, the cold heads were replaced during the July-August 2017 shutdown. NIRI went back on sky at the end of the Gemini North shutdown. With no laser capabilities available on Gemini-North, only NGS AO and seeing-limited observations were executed during 2017A.

NIFS
NIFS, the facility Near-IR Integral-Field Spectrometer, performed flawlessly throughout Semester 2016B. Due to the lack of Laser AO, it was not in sufficient demand in 2017A and was not installed on the telescope.

Gemini North AO and Laser Guide Star
We are developing a new procedure to measure and compensate for the ALTAIR Non-Common Path Aberrations (NCPA), as part of an SOS Masters' thesis in optics. The procedure will allow us to create instrument-specific NCPA calibrations in the daytime using ALTAIR's calibration source, saving time at night. The new procedure has been demonstrated to increase ALTAIR's Strehl on a calibration source from 47% to 55% in the K-band. The goal is to have NCPA measurements for each of the instruments used with ALTAIR. Due to the laser failure at the end of 2016 the LGS mode was not offered for 2017A, 2017B or 2018A. We are currently in the process of acquiring and installing a new laser, similar to that in the South. The goal is to complete commissioning towards the end of 2018A.

4.2.2 Gemini South

GMOS-S

The bias structure that first developed in October 2016 disappeared in February 2017, after an unscheduled thermal cycle caused by a failure in a Helium compressor. Only the known bad columns persist (located in amps #3, #5, #8 and #11). The instrument performed at full capability in 2017A. The On-Instrument Wavefront Sensor (OIWFS) was serviced during a shutdown, and noise levels were reduced. As a result the sensitivity is higher and efficiency is improved, resulting in better sky coverage.

FLAMINGOS-2 (F-2)

FLAMINGOS-2 (F-2) operated in imaging and long slit modes without major faults, throughout 2016B and 2017A. F-2 imaging and spectroscopy plus the rapid ToO capability were crucial in the NIR imaging and spectroscopy follow-up of the LIGO transient source GW170817. F-2 observations spanned a period of 25 nights and, according to the PI's in press conference, were "... collectively the longest-running, and finest, infrared imaging and spectroscopy of this object that we have available." By contrast, the OIWFS mechanism, which is a prerequisite for successful operation in the MOS mode, was not reliable at all, suffering failures in Nov 2016, February 2017 and June 2017. A planned shutdown to troubleshoot the problem in early September was postponed in order to support the LIGO follow-up campaign. Work continued on the OIWFS mechanism in November 2017. Detailed analysis and microscopy of the bearings suggested excessive axial loading as the root cause of the many problems. After some adjustments, the instrument returned to the telescope in December 2017.

GPI

Active cancellation of vibrations arising in GPI's cold heads has been working very well on sky. With the practically full removal of these vibrations at source, it became possible to test the High Order Wavefront Sensor (HOWFS). This revealed a strong vibration at 100 Hz, originating in FLAMINGOS-2. We are analyzing ongoing internal GPI and external vibration sensor measurements to determine possible remedial actions. The HOWFS is not a standard deliverable and is not currently used in observations, any changes would most likely be implemented when GPI moves to Gemini North.

Optomechanically, the instrument has worked well. The last major repair was made in July 2016 when the rotator arm of the Pupil Plane Mask wheel was successfully replaced. There is a concern about the Tip/Tilt stage for the Spatial filter, for which it has been found that movement along one of the axes is impeded. This has been determined to affect the pupil seen by the AOWFS to the order of a few percent.

Secondly the pointing and centering mirrors for the Calibration system and the Integral Field Spectrograph alignment are somewhat nonlinear. This has been the case for the last two years and we have operational procedures to remove this effect. Both of the previous concerns are planned to be addressed at the stage GPI is shipped to Gemini North, as the impact on performance is minimal compared to the effort to remediate these concerns.

We have had two major events related to hardware. The first was a complete failure of the SSD disk in the AO computer. The second was due to a combined commercial power failure and generator failure that caused the instrument to warm up uncontrolled. We estimate that this caused a 4 week downtime for GPI, two of which fortunately fell during the planned telescope shutdown.

GeMS/GSAOI
GSAOI operated very reliably during the past year; most issues related to the laser and the AO Bench, CANOPUS. During 2016B, laser runs were scheduled in November 2016 and another in January 2017. The November run was severely affected by unusually bad weather, and both runs were affected by problems with CANOPUS and the laser. We completed one science program and obtained a small amount of data for other programs. In 2017A, two laser runs were scheduled (9 nights each), one in March 2017 and another in May 2017.

The March run was affected by the weather and by a technical issue with the Laser Launch Telescope focus motor. We nonetheless managed to obtain data with good image quality, and completed one GeMS/GSAOI program during the March run. The May 2017 run again suffered poor weather, which limited the observing opportunity. However, some data with good image quality were obtained, and we completed one further program. Preparations were completed for the replacement of the LMCT laser with a Toptica, which promises much greater reliability and ease of use. Commissioning was completed in October 2017, and the first science observing with the new laser was carried out in December 2017. The laser operated reliably, and good image quality was achieved.

4.3 Science User Support

The Science User Support Department (SUSD) is tasked with creating a collaborative community of users and staff and consolidating post-observing support. Areas of attention include data archiving and reduction, interactions with the National Gemini Offices (NGOs), and oversight of the HelpDesk and Data Reduction User Forum systems.

With the completion of the Quality Assessment Pipeline (QAP) Project, as defined for Gemini's Transition Program, we have turned our primary focus to development of data reduction software for our users. IRAF is growing obsolete and we are thus working to extend the Python infrastructure developed for QAP to meet the requirements of science quality data reduction for our users. We expect to release our first Python science quality data reduction software for facility imagers in 2018. The final updates to Gemini_iraf will also occur in 2018 upon commissioning of the FLAMINGOS-2 MOS mode. The penultimate Gemini_iraf release to support the new Hamamatsu detectors in GMOS-N occurred in July.

Additionally, we are collaborating with STScI to repackage the STScI and Gemini developed software within Ureka using Anaconda[8]. Use of Conda[9] will allow the user to stay more up-to-date with third-party Python packages such as numpy and matplotlib (among hundreds of others) and decrease effort to release and maintain subsequent versions of our software. The first Gemini Conda release occurred in May. In addition to improving our data reduction tools, users also request improved data reduction documentation. A FLAMINGOS-2 imaging and long-slit cookbook is currently under development.

We have begun to collect trackable and actionable feedback from Gemini users through the use of regular surveys. The short survey format (2-3 questions) makes it easy for our users and motivates a higher level of participation. The questions are permanent so that answers can be compared over time. The surveys are timed to coincide with the four phases of the science program lifecycle (Proposal preparation, Observation preparation, Program completion, and Post-observing) and repeated each semester. Requests to participate are sent by email and

[8]Open-source Python collection and package management system: https://docs.continuum.io/anaconda/
[9] The package and environment-management part of Anaconda: http://conda.pydata.org/docs/

direct users to web-based surveys. The results will be analyzed every semester, and monitored long term.

We have launched the first three surveys with response rates between 30% and 50% so far. For proposal preparation roughly, ~65% of respondents either liked or really liked the system; of these, ~20% had suggestions for improvements. Some 11% were strongly dissatisfied, and shared very useful comments about what they felt should be different. Observation preparation is generally less appreciated than proposal preparation; only ~42% of respondents either liked or really liked working on their Phase II, and ~25% of them were significantly unsatisfied. Although PIs are unhappy with both the tools and documentation, they commended the support they received.

In both cases comments received about the PIT and OT will be used in setting requirements for the OCS upgrade project. Additionally, we were able to provide new tutorials and to reorganize the web page to address the most common proposal issues before the 18A Call for Proposals. Better observation preparation instructions and tutorials are being prepared for the 18A semester. The 17A program completion survey demonstrates that about 73% of the respondents whose programs got data evaluate that their data meet, or exceed in some ways, their expectations. Those that didn't get data were more likely to feel unfairly treated and were mostly GSAOI and GPI users affected by bad weather or instrument issues or both.

4.4 Storage and Archiving

The Gemini Observatory Archive (GOA) continues to operate with essentially zero unplanned downtime since its release December 2, 2015. There have been two planned interruptions of service of approximately two hours each in August 2016 and 2017 to release new features and fix bugs.

Improvements in 2017 include additional programmatic information returned with queries (e.g. the program abstract, Co-I list, and publications if they are known in the database maintained by the Gemini librarian) and the ability to search by PI name and Program title. As of October 2017, we have 750 registered users (it is not necessary to register to access non-proprietary data). With site hits up to almost 30 million for 2017 so far, typical usage is approximately 800 searches and 5GB of data downloaded per day.

Quarter	Queries	Site Hits	Downloads (GB)	Files ingested
Oct-Dec 2016	135,879	5,535,737	381	142,259
Jan-Mar 2016	1,488,777	14,137,458	403	267,824
Apr-Jun 2016	3,086,744	7,349,974	513	325,895
Jul-Sep 2016	2,580,086	6,630,286	562	115,041

Table 4-2: Statistics for the Gemini Archive in 2017

4.5 Special Observing Modes

4.5.1 Fast Turnaround

Fast Turnaround (FT) was active throughout 2017 with both sites participating all months. All partners are utilizing the FT proposal cycles. FT is in particular used by grad students and is a good way for them to be exposed to the peer review process at an early stage in their career.

The inclusion of MOS observations continues to be popular. The FT program is also popular as part of the exchange time program with Subaru.

The proposal load varied in 2017. From 15 per month in the first semester, to an average of 6 over the northern summer back to 10 proposals in the last few months of the year. The oversubscription has stayed above one for all months except August and peaked at 2.4. Note that not all the 20 hours per telescope per month available are allocated in a given month due to weather requirements by the PIs. Thus the effective oversubscription is higher.

The publication rate using data from FT programs increased from 7 publications in 2016 to 14 in 2017, as of end of November.

4.5.2 Large and Long Programs

Three new Large and Long Programs (LLPs) were added via the 2017 call for proposals, covering topics from supernovae progenitor science to high-redshift quasars and galaxies. In total 10 LLPs remain active through Semester 2018A. The oversubscription rate for observations requested by LLPs in 2017B was ~2.2, below the ~6.1 rate in 2016B.

All active LLPs submitted annual reports to the LLP time allocation committee (LPTAC) in late April. The LPTAC recommended that two programs be granted extensions through 2018A; these were accepted by the Gemini Director. Through semester 2017A, 90% of the time of the allocated LLP at Gemini North has been executed, excluding ToO programs. Completion rates for semester's 2016B-2017A were 80-85% of the allocated time. At Gemini South, only 51% of the allocated LLP time has been allocated through 2017A. Completion rates for 2016B-2017A remained low, ~40% of the allocated time was observed, consistent with the overall low completion rates for all programs at Gemini South.

In consultation with the STAC and GBOD, two significant modifications to the LLP call for proposals were made. These will be implemented with the 2018 call for proposals. First, all programs will be required to submit processed data within 1 year of program completion and submit a data management plan as part of their proposal. The processed data will be hosted by the Gemini Observatory Archive. Second, Gemini will commit to reaching an 80% completion rate for all new Band 1 large programs.

4.6 Telescopes and Enclosures

Gemini's domes both have two shutter panels: the larger, upper panel which covers the majority of the dome slit when closed, and the smaller, lower panel which covers the lower part and pulls up the wind blind when moved upwards. As reported in the 2016 Annual Report, failure of a drive box bearing on the lower shutter at Gemini North, and premature wear on the opposite side of the same shutter was a clear indication that the drive chains and drive boxes needed replacement and refurbishment/replacement, respectively, and installation of the redesigned drive-box torque arms which have been trialled over the past year at Gemini South. In a seven-week shutdown at Gemini North in mid-2017, this major work was successfully completed. The top shutter is now working smoothly and drive currents are 30-40% lower than previously. Although the lower shutter function was similarly improved, some issues with its behavior (in particular the function of the limit switches) were not understood at the end of the shutdown, and we have delayed returning it to full operations pending investigation. There has been thorough communication between North and South on the progress and nature of the repair work, which will likely need to be repeated at Gemini South at some future point.

4.7 Operations Metrics

The statistics in this section refer to demand and performance in the last two complete semesters: 2016B and 2017A, given in some cases in context of recent years. First, Figure 6-1 shows program completion rates in the regular semester queue. We show the “80% completion” statistic approved for discussion by the STAC and Board, and exclude Target of Opportunity (ToO) programs and those observed in blocked schedule (as we have much less control over completion rates of such programs). Recent Semesters at both sites have suffered from greater than usual losses of time to weather (particularly at Gemini South). Band 2 completion at Gemini South has rebounded well from a low point in 2015.

Figure 4-1: Completion statistics for GN and GS. 2016B and 2017A are represented by the bars at the right of each group. Bars represent the fraction of programs achieving 80% completeness; white dots represent the fraction achieving 100%. Band 1 completion rates in the final two semesters will increase as some Band 1 programs have rollover status.

4.7.1 Telescope Time Usage

Table 4-3 and *Table 4-4* show top-level time and fault distributions and science usage in the most recent two complete semesters.

Semester	Site	Science	Engineering & Commissioning	Weather loss	Fault Loss	Shutdown
2016B	North	49%	1%	38%	2%	10%
	South	56%	4%	29%	6%	4%
2017A	North	58%	3%	24%	3%	12%[b]
	South	56%	3%	36%	6%[a]	0%

[a] This number may be artificially low due to the cancellation and weathering-out of observing with more recent and more challenging instrumentation

[b] The A semester share of the major shutdown for shutter repair

Table 4-3: Overall operational statistics, semesters 2016B and 2017A

Semester	Category	North		South
2016B	Computer/Software	6%		15%
	Instruments & AO Facilities	68%		39%
	Telescope and enclosure	27%		46%
2017A	Computer/Software	11%		10%
	Instruments & AO Facilities	53%		39%
	Telescope and enclosure	36%		51%

Table 4-4: Categorized fault distribution, semesters 2016B and 2017A

4.7.2 Regular Semester: Oversubscription and Demand

Oversubscription rates in the regular Semester process are shown by partner in *Figure 4-2*. These rates are calculated as the ratio of the total time PIs request to the total available science time, which is 80% of the calendar time because we make allowance for weather losses in filling the queue. The distribution of time requested by instrument is shown in *Figure 4-3*. As usual, GMOS (as the workhorse visual-wavelength imager/spectrometer) took the largest single share of the time at each site; with the addition of GRACES and DSSI, visual-wavelength programs somewhat exceeded infrared in these two semesters.

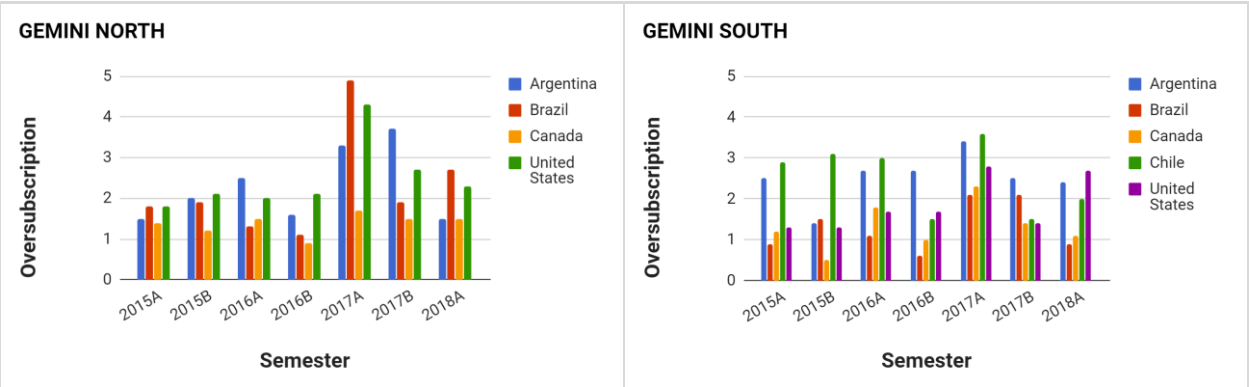

Figure 4-2: Oversubscription by partner over the last three years. 2018A values are provisional as submissions have only just been made. Note that Chile has access only to the South.

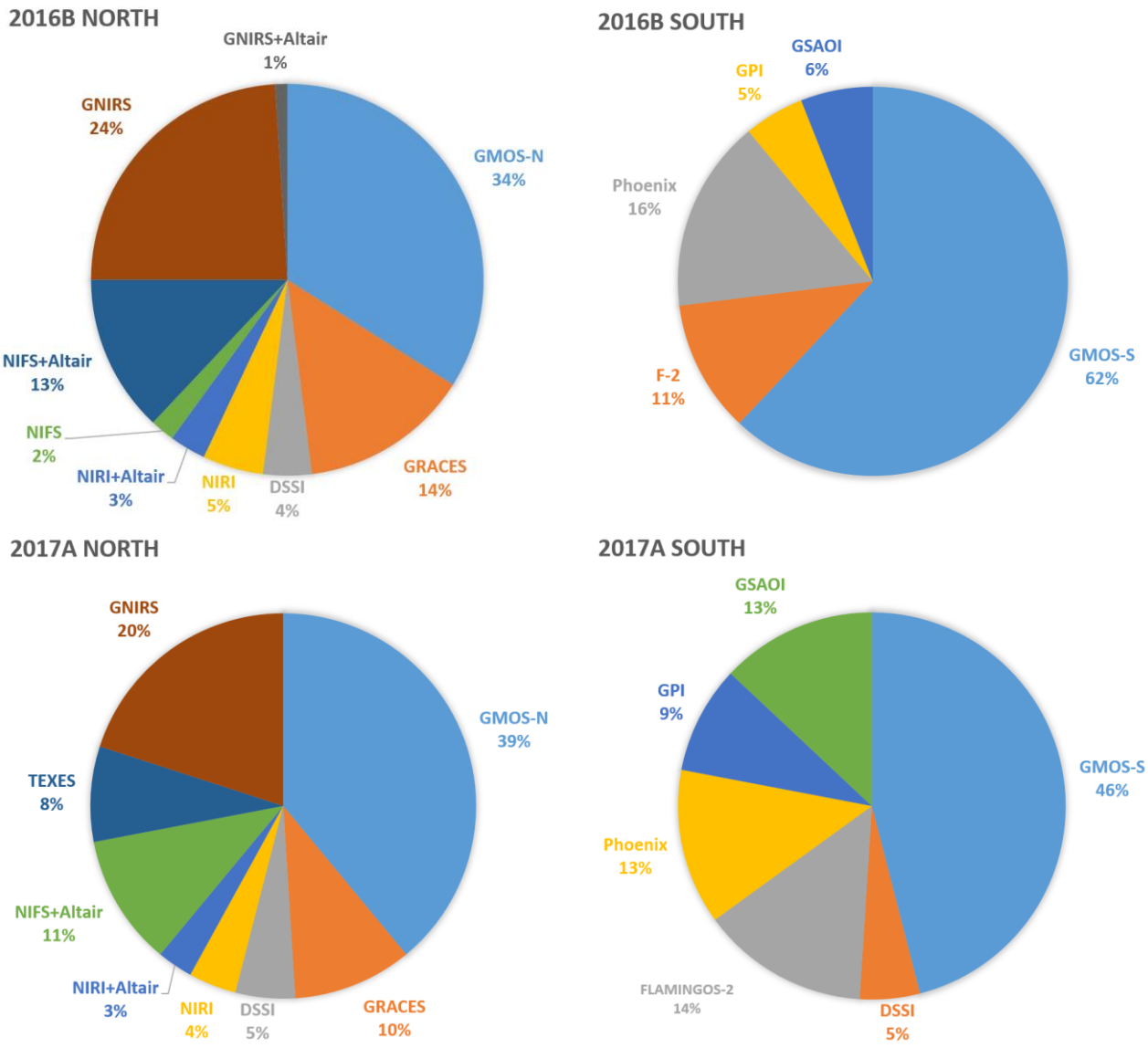

Figure 4-3: Distribution of demand by instrument, for Semester 2016B (upper) and 2017A (lower). Roughly speaking, visual-wavelength instrumentation is at the right of each chart; infrared to the left.

4.8 Other Operations Activities

Visiting Instruments

The Visiting Instrument Program continues to be popular both with instrument teams and with observers. TEXES visited Gemini North, GRACES was used in several observing runs at Gemini North, DSSI visited Gemini South, and Phoenix made three visits to Gemini South. In addition to these return visitors, a new instrument named ‘Alopeke, (an upgraded version of the DSSI instrument, which has made several visits), was installed and commissioned on Gemini North, and preparations were made for the IGRINS deployment at Gemini South in 2018A. We are working on long-term plans to host more ambitious Visiting Instruments, some of which may be suited to staying at Gemini indefinitely.

Base Facility Operations

Operations from the bases in Hilo and La Serena continued throughout 2017; by November, we had operated from the base for two years at Gemini North, and for one year at Gemini South. No significant time has been lost.

Visiting Observers

A total of about one month per semester has been carried out by visiting observers (either Large/Long program PIs in Priority Visitor - PV - mode, or visiting instrument teams) at each telescope. In PV mode there does not appear to be any significant difference in data quality between visiting observers and staff.

Longevity Program

The focus of the Infrastructure Sustainability and Scientific Longevity Program has been to organize and complete projects identified as being high risk in the 2016 “Obsolescence Plan” document. We were able to complete one hire in Real-time Computing, and have a shortlist of qualified candidates for Electronics. Purchases for the replacement of obsolete computing clusters at both sites were made, and spares for a set of potential single-point failures in electronics were procured or refurbished and tested. Options studies are underway to determine the optimal means of replacing or upgrading the following systems: the central electronics module on the secondary mirror, the Synchrobus (communications bus used by all instruments and wavefront sensors), the SDSU/VME interfaces and obsolete controllers on the peripheral wavefront sensors.

Real-time Software Upgrade

We are past the mid-point of a project to reduce long-term operational costs and simplify maintenance by upgrading and standardizing the real-time software, operating systems and development tools and processes for Gemini. The complete upgrade consists of replacing VxWorks (a commercial real-time operating system) with RTEMS, an open source alternative, upgrading EPICS (the software framework used at the core of the control systems) to a recent, common, stable version, and replacing obsolete development tools with modern well supported alternatives. As part of this work, we are also replacing the oldest real-time CPUs, and opening up possibilities to future upgrades. After the successful completion of an upgrade to our development tools and processes and a review and rationalization of all the software components and libraries in use, we started the process to upgrade the control systems in the last quarter of 2016. The first set of eight systems were successfully upgraded to a stable software version by October 2017. We are now in the process of upgrading the remaining five telescope systems and we expect this to be completed by the end of Q2/2018. Final documentation, procedures and standards will be finished in Q3/2018.

Cerro Pachon Network Link

We put in place a contract with TelcoNor to provide a redundant microwave link to Cerro Pachon from the AURA Recinto in La Serena. This link has been in use since early 2017 and provides for more reliable network connections to the summit in the event of downtime in the regular link provided via CTIO. The LSST fiber optic connection is approaching completion; the summit-base fibre is in place. Some additional fiber and network equipment is required both in La Serena and at the summit to enable the link, and we expect this to be in place within the first half of 2018.

Gemini North Energy Savings

The GN Energy Savings Project planned to (a) Upgrade the GN summit chilled water system with an air cooled fluid cooler and a high efficiency modular chiller and (b) Replace seven

existing HBF AC systems with eight new high efficiency AC systems. These two projects were part of the original Energy Savings Contract with Ameresco. In the best interest of all, Ameresco agreed to provide the summit equipment but not the HBF equipment or the installation effort for both projects. To complete the GN summit and HBF projects, Gemini would purchase the HBF equipment directly and repackage the installation work into four smaller contracts.

In 2017 Q1 Gemini released a request for proposals for the repackaged installation work. The selection of the low bidders was completed in 2017 Q2. Unfortunately the selected contractor was not able to secure the necessary construction bonds until 2017 Q4. With contractor's bonds now in-hand, we anticipates the installation work to take place during 2018 Q1 and Q2. We expect that the repackaging of the balance of the Ameresco work will reduce the overall project cost by over $400k.

Science Operations Model Upgrade
The following table lists status on the sciops review prioritized list of 9 items (together making up Stage 1).

Review item	Status	Numerical
Draft criteria for whether FT could be scaled to take on the whole queue	Complete	100%
Improve NTAC efficiency	Discussed at OpsWG, little actionable	100%
Balance allocated time, not executed time	Almost complete, requires one further report at Governance meetings in May 2018	90%
Develop adaptive queue software	Deferred into 2018; some initial thinking done on the scope of current QC processes	20%
Store all Threads on a Program	Deferred into 2018, as it may be better to consider this as part of the OCS upgrade project. Some initial options were developed.	10%
Prioritise Instrumentation Small Projects with a view to long term	Complete	100%
Enable extended visits by NGO staff members	Ongoing; some progress has been made and more visits have happened.	50%
Reorganize external web pages	Started with Digital Governance project that is almost complete. This project sets standards and policies for work on web site which will start in Q2 2018 and be a multi-year effort	30%
Replace Remedy for external users	Internal helpdesk replaced, provides a good model for the external version.	50%

Table 4-5: Status of Operations Review prioritized list

4.9 Administration and Facilities

The Administration and Facilities Group (AFG) in the North and South provides a wide range of administrative and facility support services to employees and telescope users. The Observatory achieved significant advances in diverse AFG categories in 2017. We cite several examples across both sites.

4.9.1 AFG-South

Gemini Southern Base (SBF) Office Extension Project
The AFG-S oversaw the internal construction of 15 new offices, a new clean lab, and bathroom extensions, done in order to house all Gemini South staff within the main building. Prior to this, Gemini staff were situated in three separate buildings. Significant sustainable savings have been achieved for Gemini because of the successful implementation of this project. Throughout 2017, office assignment relocations have taken place within the SBF, with considerable effort to renovate and modify offices to staff requirements.

SBF Control Room Modifications
The AFG-S modified the Gemini Southern Base Control Room as part of the Base Facilities Operations Project. Some examples of installed upgrades include: A new silent double HVAC cassette system, new desks, new chairs, new LED screen monitors, and new window blinds.

4.9.2 AFG-North

Preventive Maintenance Painting
This maintenance project was to prevent any rusting of the rooftop, as well as, mold control of the walls and soffit areas near the rooftop gutters. It was completed on the HBF-X Building rooftop, side-walls and soffits.

Preventive maintenance replacement of the HBF-X rooftop gutters
The old gutters were starting to encounter pinholes in the metal, the start of erosion, creating moldy areas under the soffits, needing to be treated.

Office Reassignment
Twenty-six Gemini North staff members were moved to different offices to accommodate a request for individual offices from the Science Operations Department. Most science staff members now have their own office space. This provides them with better “think-time”, quiet time to work on written publications, and space to work with their collaborators. Prior to these moves, most of the GN Scientists and Astronomers shared offices.

4.10 Safety

The Safety team worked closely with staff and supervisors during 2017 to implement a new safety platform that includes training, incidents, inspections and audits. Managers and employees have taken a more active role in Safety which has enabled our program to grow and be more successful. Gemini currently has 941 days without loss time due to injury. Gemini North completed a 7-week shutdown for shutter repair work with no incidents or injuries.

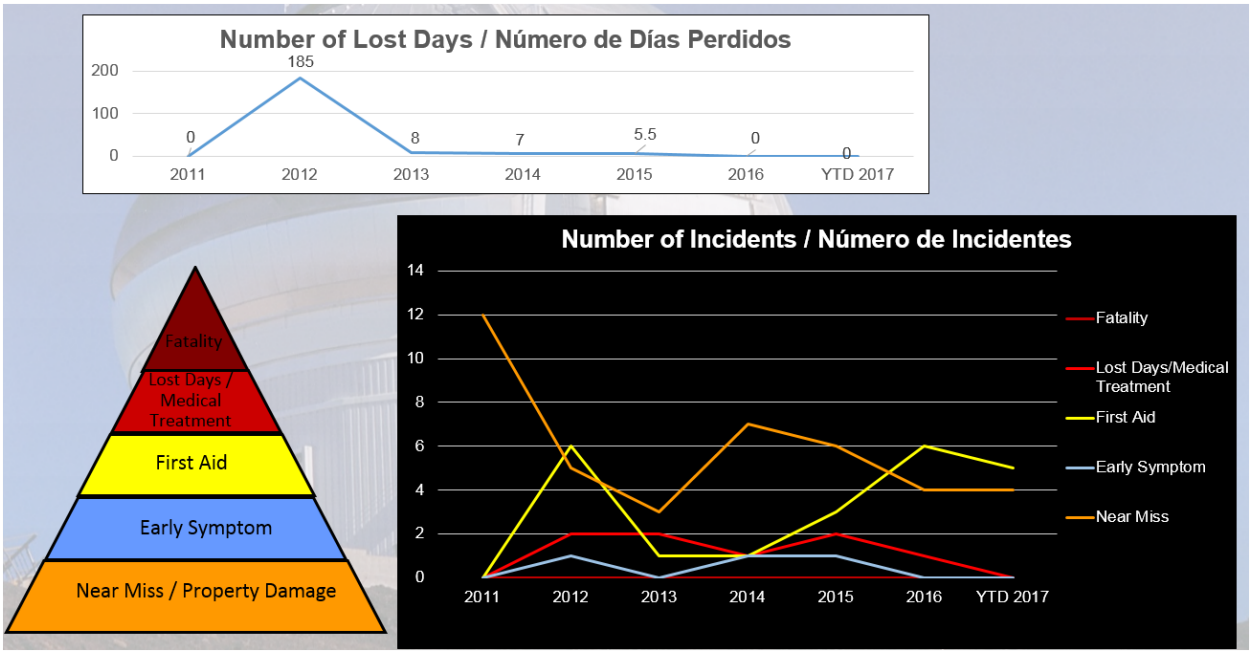

Figure 4-4: Historical trends in safety incidents and lost days

4.11 External Relations

Gemini Observatory remains committed to supporting our users with the broader goal of producing scientific results. We assist them throughout the scientific lifecycle, from initial idea through analysis, leading to final publication of results. As Gemini provides public access to diverse scientific users around the world, we aim to make the Observatory and its capabilities as accessible as possible. We describe here high-level activities between Gemini and our Users and Participant countries. We describe the regular communications program for Users and the general public in *Section 6.3*.

Members of Gemini's staff attended the XIV Annual Meeting of the Chilean Astronomical Society Astronomía (SOCHIAS) on January 23-26, 2017 and Laura Ferrarese, Gemini's Interim Director, attended the Annual Meeting of the Canadian Astronomical Society (CASCA) from May 30 to June 1, 2017.

Gemini worked closely with the Board on continuing to develop the Strategic Plan for 2021-2030.

Gemini signed two new Limited-Term Collaborator Memoranda of Understanding, one with Ben-Gurion University and one with the Weizmann Institute.

5 Instrumentation and Facility Development

The Development Division has three parts: the Project Support Department, the Technology Development Department and the Program Support Group. Together, they deliver new and upgraded scientific capabilities to the Observatory through our instrumentation, adaptive optics, and technology development programs and support Observatory operations and improvements through our telescope scientist, project managers, and systems engineers.

The Instrumentation program is able to support two large and two smaller efforts each year. Construction of Gemini High-resolution Optical SpecTrograph (GHOST) continued in 2017 and our next new instrument, Gen 4#3 (OCTOCAM), passed its Conceptual Design Review. We completed the Hamamatsu CCD upgrade project, providing increased capabilities on both GMOS-S and GMOS-N.

Our adaptive optics (AO) program works to stabilize and improve our adaptive optics facilities, making them accessible to all users, and also maintains telescope performance to deliver seeing improvements for all Gemini observations. This year we commissioned the new Toptica laser for GeMS at Gemini South and received its sibling Toptica laser on site at Gemini North.

5.1 GHOST

GHOST will provide simultaneous, high-resolution spectroscopy with R > 50,000 (for two objects plus sky) and R > 75,000 (for one object plus sky only) from 363 to 950 nm. We currently estimate GHOST will be available to the Gemini community for science use in 2019. We expect GHOST will have superb throughput, making it at least one of the most efficient instruments of its kind. The GHOST team — Australian Astronomical Observatory (AAO), National Research Council of Canada Herzberg (NRC-H), and the Australian National University (ANU) — completed its final design review in May, 2016, and the instrument is now in the build phase.

5.2 OCTOCAM

OCTOCAM, an 8-channel (g,r,i,z,Y,J,H, and K_s) optical to infrared imager and spectrograph, arose from the Gen 4#3 process. It successfully completed its Conceptual Design Review in August, 2017. The next major project milestone is the Preliminary Design Review scheduled for May, 2018. OCTOCAM will provide long slit (3') spectroscopy at R~4000 with simultaneous coverage from 0.37 to 2.35 microns.

5.3 GeMS

Improved Astrometry

We installed a pinhole mask in GeMS and took data to better calibrate the astrometry. We are analyzing these data and this system in the lab in 2016 and plan to test in GeMS in early 2017.

GeMS Laser

We purchased, installed, and commissioned a new laser for GeMS to provide increased availability and decreased support requirements so we can offer GeMS more routinely at Gemini South. We completed commissioning in October, 2017.

NGS2

Throughout 2017, we continued to work with ANU to deliver a new "Natural Guide Star Next Generation Sensor" (NGS2) to GeMS. The goal for the project is to improve our limiting guide star brightness to enable more sky coverage, while making the system easier to use and support. The ANU team is building a new system to meet these objectives using an EMCCD (electron multiplying charge coupled device) camera built by Nüvü Camēras. The team passed a hardware acceptance review in late 2016 and expects to deliver the complete system to Gemini for commissioning in 2018.

DM0

GeMS was designed to have three Deformable Mirrors (DMs), conjugated one each at 0, 4.5, and 9.0 km, but during the commissioning, DM0 failed. GeMS now operates with only two DMs (using the former DM4.5 to conjugate at ground level and become the current DM0). A failure of one of the remaining DMs would leave the system either inoperable or delivering very poor performance. In 2016, we completed and oversaw two related contracts to provide a new DM from Xinetics and electronics from Cambridge Innovations. In 2017, Xinetics completed the mirror and Cambridge Innovations expects to complete the electronics in early 2018, after which we do integrated testing at Xinetics prior to shipping to Gemini South.

5.4 GMOS CCDs

The GMOS CCD upgrade project replaced the detectors of both GMOS instruments (there is one at each Gemini telescope) with high-efficiency, fully-depleted CCDs from Hamamatsu. In 2017, we completed the project by commissioning the new detectors in GMOS-N, to complement the set previously installed in GMOS-S.

5.5 Instrument Upgrades

We completed our third annual call for proposal for community-sourced, science-driven upgrades to our existing facility instrument suite. We have made a selection for 2017 and are negotiating with the selected team now. We also completed the 2015 project to install new split K-band filters in Flamingos-2, started a 2016 project to install new narrow band filters in GMOS, and negotiated the work plan for an additional project arising from the 2016 RfP.

5.6 Altair

In November, 2017, we completed factory acceptance testing for a new Toptica laser for the Gemini North AO system, Altair. Identical to the laser purchased for GeMS in Gemini South, the new laser will replace the failed Altair laser with additional power that we may be able to harness later for better performance with future Altair upgrades.

We have started commissioning the new L+M band dichroic for use with NIRI and GNIRS and expect to offer it to the community in 2018. The GMOS-N dichroic commissioning will happen sometime after completing the new laser commissioning in 2018.

5.7 Additional Development Projects

The Acquisition and Guider (A&G) and GNIRS detector controller projects proceeded on a best efforts basis in 2017, with mostly some prototyping and test bench setup completed. With the GMOS CCD project now closed, the GNIRS detector controller project will see more effort in 2018. The A&G will become part of the Longevity Program in 2018.

6 Public Outreach and Broadening Participation

6.1 PIO Highlights for 2017

Gemini's Public Information and Outreach (PIO) efforts cover a wide gamut of activities including user, public, and staff communications, education, local outreach, and library operations. This diversity is reflected in the following selected highlights from 2017:

- Delivery of diverse public communications products including 11 press releases and 13 Webfeatures (as of mid-December), 318 social media posts, and a new, image-based news archive debuted for our growing legacy of press releases and Webfeatures (see: http://www.gemini.edu/sciops/releases);
- Development of framework and implementation plan for Digital Governance to provide oversight of all digital content production and delivery. This effort included absorbing one additional staff person (Web Architect) previously within the Information Technology Services department;
- Highly successful execution of annual *Journey Through the Universe* and *Viaje al Universo* programs in Hawai'i and Chile (respectively) with both programs undergoing considerable new elements and initiatives during the past 12 months *Figure 6-1*);
- Expanded engagement with the Gemini Science User Support Group to provide better communications with our user community. This effort included the development of a comprehensive Strategic Communications Plan as well as support of upcoming Science and Evolution of Gemini meeting in 2018 and facilitating active participation in annual AAS meetings;
- Support of broadening participation goals with further development of our local career awareness resources (brochures and staff profile inserts, (*Figure 6-2),* and successful continuation (third year) of our annual Outreach/Communications internship; and
- Extensive documentation of major dome repairs during the Gemini North shutdown.

Figure 6-1: Gemini Web Architect Jason Kalawe (standing, right) shares his career experiences with local students as part of a career panel during the 2017 Journey Through the Universe program.

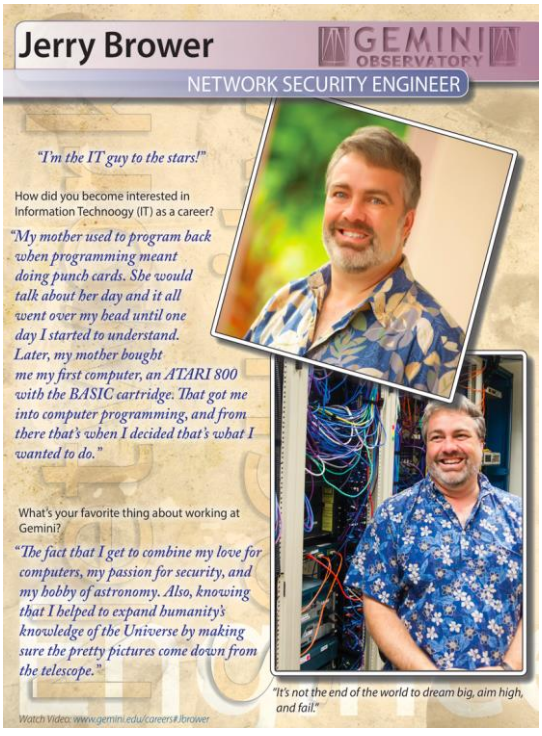

Figure 6-2: (Right) Sample front side of 8.5x11" career profile sheet used as inserts with the Gemini Career Brochure. These resources are developed primarily for host community schools to promote STEM careers with students and the opportunities available at Gemini. Currently we have 6 career profile sheets completed (or in production) and each is produced in both English and Spanish.

6.2 Local Outreach Programming

Local outreach in our host communities (Hawai'i and Chile) continues as a core commitment of Gemini and the PIO effort. Our ongoing long-standing programming includes *Journey Through the Universe* (*JTTU*, Hawai'i), the *StarLab* portable planetaria, *AstroDay* at both sites, and *Viaje al Univero* (*Viaje*, Chile) *(Figure 6-3*). All of these programs flourished and evolved significantly during 2017 while impacting thousands of students.

In March, 2017, the *JTTU* program in Hawai'i engaged dozens of Gemini and Maunakea staff in classroom visits, career panel events, and *StarLab* programs.

Figure 6-3: Highlights from the October 2017 version of the annual Viaje al Universo local outreach program at Gemini South

Throughout the remainder of 2017, expanded elements of the *JTTU* program included teacher telescope tours (*Figure 6-4),* and professional educational evaluation which measures the impact of *JTTU* career awareness programming on students and teachers (see *Table 6-1*).

Figure 6-4: (Left) A group of Hawai'i Island teachers tour the Gemini North telescope facilities in April 2017 as part of the Journey Through the Universe career awareness and workforce development programming.

Table 6-1: (Next page) Preliminary results of educational assessment work by outside contractor SMS Honolulu showing three local public school classes and how classroom programs impacted student's understanding and awareness of observatory careers. Different presenters (and content) reveal a range of impacts on students and these data are now being used to modify presentations and methodologies of presenters to better target student outcomes in alignment with programmatic goals. Data are still being collected and reduced for a report expected in Q1 of 2018.

Statements - Percent that strongly agree	Class #1			Class #2			Class #3		
	Pre	Post	Change	Pre	Post	Change	Pre	Post	Change
I want to take more science courses	11%	21%	11%	10%	5%	-5%	11%	0%	-11%
I want to learn more about astronomy	11%	16%	5%	29%	19%	-10%	5%	16%	11%
I want to learn more about what goes on at the observatories	11%	16%	5%	10%	29%	19%	5%	0%	-5%
Having a background in science, technology, engineering or math will enable me to have a lot of career options	32%	42%	11%	29%	33%	5%	5%	16%	11%
I would like to know more about the types of jobs available at observatories	5%	26%	21%	14%	24%	10%	0%	5%	5%
I would like to do an internship at one of the observatories when I'm older	5%	16%	11%	14%	14%	0%	0%	0%	0%
The most valuable skill for people who work at an observatory is a desire to solve mysteries	5%	21%	16%	10%	14%	5%	0%	11%	11%
Observatories hire many more people other than astronomers	5%	32%	26%	5%	29%	24%	0%	11%	11%
Studying the stars was important to Native Hawaiians	47%	63%	16%	43%	57%	14%	42%	53%	11%

The *Viaje* program engaged over 1,500 host community students and teachers in Chile during classroom visits in October, and other educational programs throughout the year. Both the *JTTU* and *Viaje* programs continued to grow in 2017 with new community partners that include businesses, observatory research facilities, and educational institutions.

In Hawai‘i, the Waimea-based Canada-France-Hawaii Telescope helped *JTTU* expand geographically by bringing the programs to schools beyond the reach of Hilo-based facilities. In Chile, CTIO and other area observatories are providing staff professionals for classroom visits and career panels.

A critical part of Gemini’s PIO program is our effort to engage staff from all disciplines at both sites. This not only makes our programming stronger, but supports our growing emphasis on fostering the future engagement of our local workforces in Hawai‘i and Chile in observatory STEM careers. Figure 2 shows a sample of an insert used with our popular observatory career brochure to highlight specific career options at Gemini. Additionally, our long-term commitment to our host communities positions us well strategically – especially as the Maunakea observatories collectively embark on securing a long-term lease once the current lease for the Maunakea Science Reserve expires in 2033.

Because of the uncertainties ahead for Maunakea, a sense of urgency has emerged and many of the Maunakea observatories are focusing on coordinated efforts toward a long-term strategic vision that includes a renewed Maunakea lease for decades beyond 2033. Gemini’s outreach program is critical to this vision, and we have seen considerably more engagement by all of the Maunakea observatories as indicated by programs like the monthly *Kama‘aina Observatory Experience* (KOE) tours exclusively for local Hawai‘i residents. Note: KOE was expanded in mid-2017 to double the monthly capacity from 24 to 48 and Gemini participates in these tours quarterly.

Additional local outreach highlights for 2017 include:

- Continuation of the PIO communications/outreach internship, now in its third year. We have already selected our 2018 intern who will begin in January 2018 and work concurrently with our 2017 intern who finishes in March 2018. We anticipate a synergy to develop by having two concurrent interns resulting in even more creativity and energy;

- Continued development of career awareness resources and events for local students, as well as recent support and participation in the Society of Women Engineers where our emphasis is on early-career female engineers;
- Gemini South PIO staff are engaged in work with AURA-Chile and other community partners in planning for the 2019 (and 2020) eclipses in Chile. This includes management of summit visitor capacity, eye safety, and general outreach and awareness;
- Support of first annual AstroDay Kona which attracted over 3,000 public visitors in November. It is anticipated that this program will continue in future years assuming that an appropriate venue is available in subsequent years.; and
- Initiation of first *Astronomy on Tap* (AoT) program in Hawai'i in early 2017 with second AoT event in December (*Figure 6-5*).

Figure 6-5: Gemini astronomer André-Nicolas Chené presents his scientific work to a diverse crowd at the Hilo Town Tavern as part of the Astronomy on Tap program held twice in 2017

6.3 User and Public Communications

6.3.1 User Communications

Figure 6-6: Cover of the 2016 printed Year-in-Review issue of GeminiFocus which compiles all content from the four quarterly issues published electron-ically during the year. Printed version available (upon request) in February of each year. [Note: this image to be updated with 2017 YiR cover once available]

Our ongoing commitment to supporting and improving user communications is expanding internally with increased inter-department coordination; especially involving the Gemini Science User Support Department (SUSD). Exemplifying this is our support of the annual winter meetings of the American Astronomical Society. Several new and updated publications were developed for this meeting, in concert with SUSD staff.

The Gemini's quarterly e-newsletter, Gemini*Focus,* (and annual Year-in-Review printed issue, see *Figure 6-6*), along with our monthly e-Newscast provide regular and timely updates to our users as well as to our staff and participant funding agencies. Additionally, user-centric content on social media (Facebook and Twitter) as well as homepage "Webfeatures" and press releases continue to highlight current science and technology milestones for our science user community

During the period of this report, considerable progress has been realized in defining and coordinating the PIO user communications roles in conjunction with the Gemini Science User Support Department (SUSD). This effort includes defining all of our primary audiences, products and resources across the PIO and SUSD groups. *Figure 6-7* shows our Communications Overview document which presents a structural overview of our user and public communications and conveys the essence of our plan to define and prioritize our user and public communications efforts.

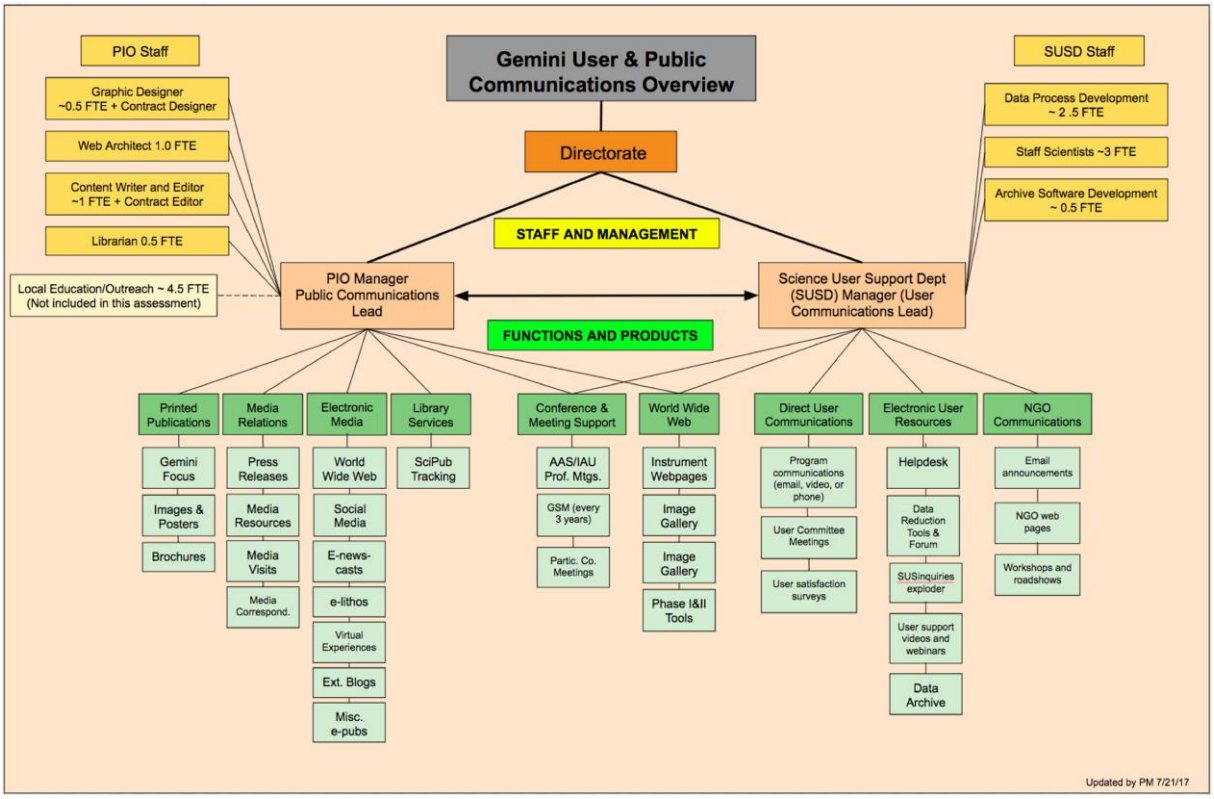

Figure 6-7: Organizational structure of communications resources and products to address the strategic needs of our users and public audiences.

Plans for the 2018 Gemini Science Meeting (titled the Science and Evolution of Gemini) began during the second half of 2017. The PIO group has been central to this planning effort, especially with regards to communications as demonstrated by their lead in the development of the conference website which can be found at: http://www.gemini.edu/seg2018.

6.3.2 Public Communications

Concurrently with our user communications efforts (described in the previous section), Gemini is committed to focused communications with public audiences that include our local host communities and the international scientifically engaged lay public. While traditional press releases continue to provide the foundation for our public communications, adaptations of press release content is constantly utilized as content for social and other digital media.

The traditional "press release" has evolved significantly in recent years due primarily to the influences of *social* and "*new" media (blogs, Youtube, etc.)*. Gemini's response is to adjust our emphasis on how traditional press releases and media resources (images, animations etc.) can not only serve *traditional media* but provide *social* and *new media* with compelling content and audio-visual resources.

Gemini's public communications focus on supporting the following key areas: *traditional media* (print), *social media* (Facebook, Twitter etc., see *Figure 6-8* below), and *digital media* (blogs, e-pubs etc.). In addition, our own digital media (webpages and e-pubs) serve as a primary "public face" and is elaborated on in Section 6.4, which includes our major initiative to implement Digital Governance.

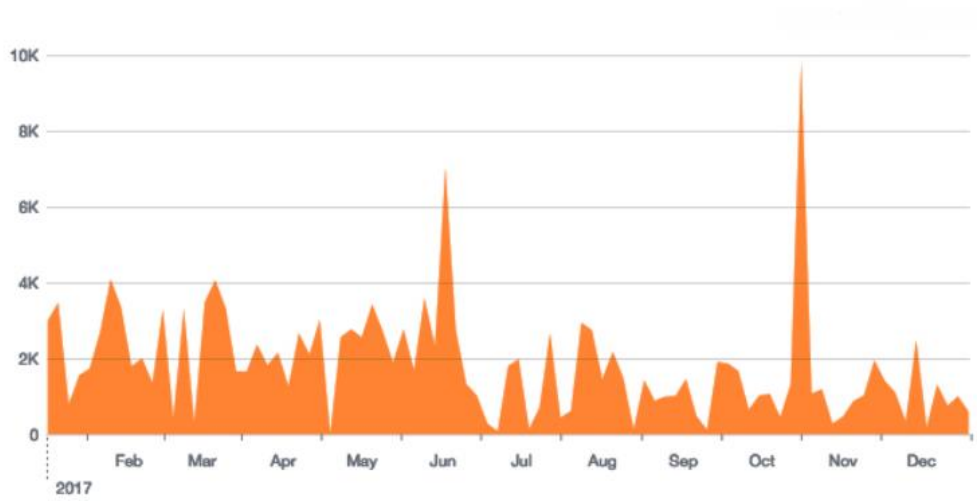

Figure 6-8: Number of people reached via our Facebook posts. Large spikes correspond to high-impact press releases.

Providing timely content based on Gemini's work for all types of public media takes many forms. *Figure 6-9* shows artwork created by Joy Pollard (Gemini PIO staff) to support a press release in April 2017 (see: http://www.gemini.edu/node/12655).

This content and image was picked up broadly by all types of media and, like all of our press releases, it served as the basis for several stories on Gemini's social media pages, as well as in our e-Newscast and other communications products.

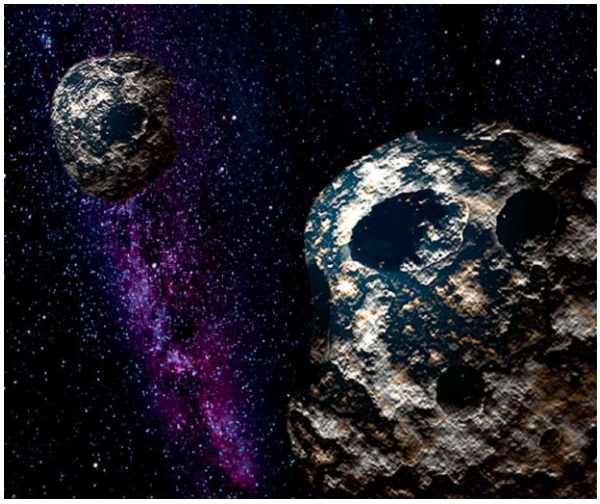

Figure 6-9 Gemini Staff artist's conception of "Blue Binary" planetoids used to support a recent press release. Illustration by Joy Pollard.

Over the period of this report (January through mid-December) a total of 11 press releases and 13 Webfeatures (an average of two per month) disseminated important Gemini science results and other milestones, covering topics ranging from Gemini's role in directing the Juno spacecraft toward scientifically relevant targets to confirmation of the most distant supermassive black hole known. Among the most significant findings based on Gemini data in recent history, was Gemini's involvement in the 2017 gravitational wave source discovery. In mid-October, a major media event, led by the NSF, provided an opportunity for extensive coordination between several AURA centers and the NSF. Gemini developed a diverse assortment of materials in support of this event which can be seen at: http://www.gemini.edu/node/12719.

Finally, an image-based redesigned archive of all press releases and Webfeatures was developed and launched and it can be found at: http://www.gemini.edu/sciops/releases .

6.4 Additional Opportunities and Milestones

A significant effort has continued through most of 2017 to establish a progressive and forward-looking program of Digital Governance (DG) at Gemini. While this effort will ultimately involve a broad cross-section of our staff, during 2017 the work focused on developing a Framework Design Team, Implementation Plan, and a collection of core policies and standards. Ultimately this effort will result in a more unified, structured and communications-based approach to digital media, especially with regards to our website.

The goal of DG is to provide a comprehensive and cohesive framework for the oversight and management of all digital content produced by Gemini. At the core of the DG effort is the Gemini website, but DG also includes products like digital publications (GeminiFocus, e-Newscasts etc.), social media and web applications. *Figure 6-10* shows the structural context for the DM initiative. Once completely implemented during 2018, DG will establish clear and well-defined processes, procedures, allocation of staff resources, and policies for the creation and maintenance of digital content across the Observatory. Areas such as unified content style, templates, and editorial review and oversight will be addressed and we expect it to serve as a future model for all AURA centers. By establishing DG, and organizing our staff committed to digital media, Gemini's long-view is to provide a strong foundation for a top-to-bottom redesign of our website as-well-as reworking our approach for the strategic delivery of all digital media.

The DG effort has been led by PIO group with involvement from many other areas of Gemini from the SUSD to the Directorate. Leading the work is Gemini's Digital Architect II position which is now under the management of the PIO group (this position was formerly under the Information Technology Services department). Digital Governance will be fully implemented at Gemini in 2018, based on the work done over the period of this report.

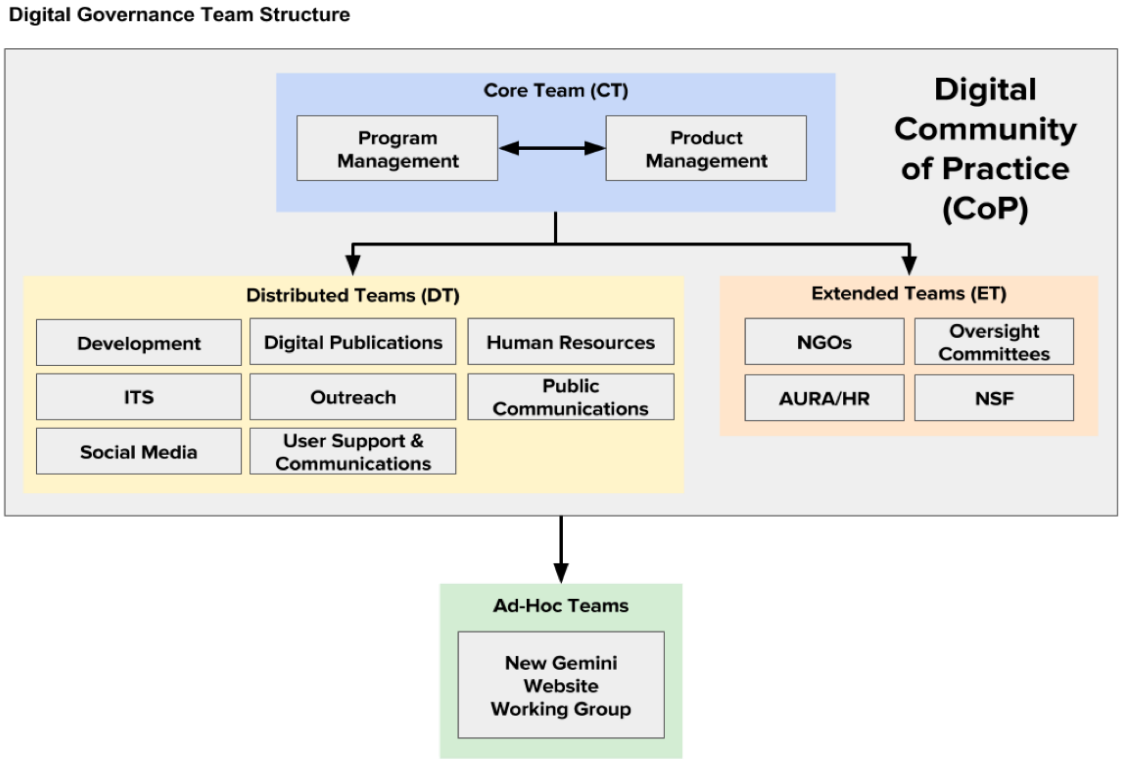

Figure 6-10. Structure of Digital Governance implementation as presented in the project's implementation plan.

6.5 Broadening Participation and Workforce Development

The health and expansion of our local workforce to support our needs is critical to Gemini's future. Beyond the obvious economic advantages, both to Gemini/AURA and local individuals and economies, expanding local hiring provides stability, diversity, local community engagement, and even increases morale among employees. To this end, improving awareness of career opportunities in our host communities is a core principle in all local outreach programming, while at the same time providing resources needed to support diversity efforts across the Gemini participating countries and the AURA community.

Integration of workforce development and Observatory career awareness is increasingly woven into the fabric of Gemini's PIO programming. Events like Observatory career panels for students, and workshops and tours for teachers (see *Figure 6-4*), are core elements of Gemini's flagship local outreach programs, *Journey Through the Universe* (Hawai'i, see: http://www.gemini.edu/journey) and *Viaje al Universo* (Chile, see: http://www.gemini.edu/viaje). Both of these annual programs continue to grow geographically and in overall programmatic diversity, staff engagement, and impact.

Also, Gemini's career resources continue to expand with an updated version of the tri-fold career brochure and new in-depth staff profiles (as shown in *Figure 6-2*).

In October 2017, Gemini sent several staff, including the Associate Director of Development, to the annual Society of Women Engineers meeting in Austin, TX. In April, Gemini North hosted a two-day American Management Association workshop on "Leading in a Diverse & Inclusive Culture" that was attended by most of Gemini's Hilo-based managers. Gemini South hosted the same 2-day workshop in September for Chile-based managers.

7 Finance and Organization

7.1 Finance

A primary responsibility of the Finance team is to interface with various appropriate parties with respect to the Observatory's overall administrative and contractual obligations. Frequent interaction is maintained with the National Science Foundation (NSF); the AURA corporate office; Observatory governance committees; Gemini's International Participants and Limited-Term Collaborators; AURA's independent audit firm; our major subcontractors and audit groups; and our property and casualty insurers. The Finance team supports managers with compliance reporting, strategic planning, project financial implementation/management, and with the financial budgeting and reporting processes.

For the first time, the NSF authorized a fringe benefit rate for 2017, and Gemini introduced the use of fringe benefit rates in the budget analysis, for Gemini US and Chile paid staff. In addition to simplifying the labor cost forecasting process, a foreseen benefit is the future unification of fringe rates with other AURA managed centers. Additionally, in 2017 the Finance and AURA-CAS teams worked actively with NSF-DACS and NSF-CAAR in the closing of the expiring Cooperative Agreement, CA 0647970, and the startup of the renewal Cooperative Support Agreement, CSA 1539773.

7.2 Organization and Staffing

Gemini currently has 167 employees on a Full Time Equivalent (FTE) basis; 51.3% of the staff members are based in Hilo and 48.7% are based in La Serena. *Table 7-1* shows the staff distribution by Division.

FTEs by Division	North	South	Total
Administration	10	7	17
Development	8	7	15
Operations	53	62	115
Deputy Director	8	6	14
Directorate	6	1	7
Total	**85**	**83**	**168**

Table 7-1: 2017 Staffing

7.3 Budget

7.3.1 Participants and Limited-Term Collaborators Contributions

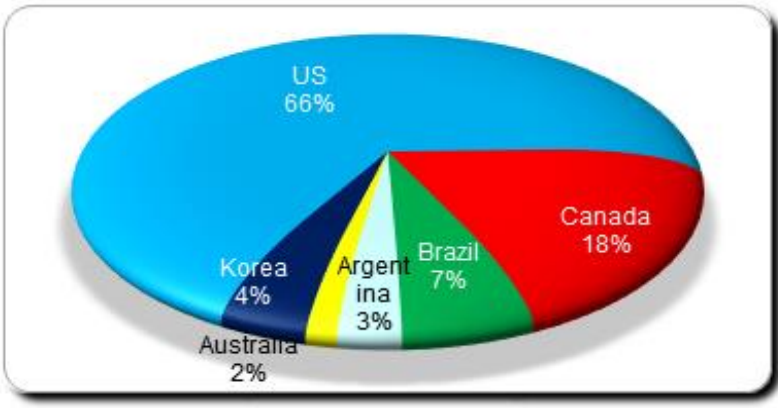

Figure 7-1: Partners' cost shares

The schedule of contributions for the Gemini Observatory budget is governed by a set of Administrative Guidelines (i.e., agreements made among the members of the Gemini international partnership, including the NSF). These agreements clarify partnership shares and the timing for the payment of contributions. The chart in *Figure 7-1* shows the distribution of the Gemini cost shares under the current partnership.

Table 7-2 sets forth 2017 actual contributions by partner for Operations and Maintenance (O&M), Instrument Development Fund (IDF), and the combination of the O&M and IDF funds, including contributions from Limited-Term Collaborators.

Contributions	O&M	IDF	Total
US	18,562	1,856	20,419
Canada	5,108	511	5,619
Australia	0	467	467
Argentina	873	87	960
Brazil	1,834	183	2,017
Korea*		1,350	1,350
Total	26,378	4,385	30,764

*Limited-term arrangement in 2017

Table 7-2: 2016 actual contributions by Partner

We use O&M funds to support the day-to-day activities involved in operating the telescopes and facilities. Broadly speaking, these activities are science support, engineering, instrumentation support, administration (including operations costs for base facilities, fleet and mountain infrastructure), software, information systems, research, public information, safety, and the directorate. The IDF is dedicated to renewal and improvement of instrumentation and telescope facilities, primarily executed as contracts to teams within the partnership and spent over multiple years.

7.3.2 Financial Results for the Year of 2017

Table 7-3 gives the summary of estimated O&M actual expenditures by expense category, Values through the end of 2017Q3 are actuals.

in $ US	2017 Budget - Approved Nov-2016 (1)	2017 Budget Addition - Approved May 2017 (2)	2017 Approved Budget (3)	2017 Forecast (4)	$ Variance 2017 Forecast vs Budget	% Variance 2017 Forecast vs Budget
Wages & Fringe Benefits	20,913,458		20,913,458	20,444,915	-468,543	-2.20%
Permanent Equipment	887,179		887,179	924,842	37,663	4.20%
Travel	912,432		912,432	983,211	70,779	7.80%
Participant Support Costs	88,600		88,600	143,367	54,767	61.80%
Other Direct Costs	5,299,096	1,423,491	6,722,587	7,370,465	647,878	9.60%
Indirect Costs	2,193,500		2,193,500	2,393,500	200,000	9.10%
Unallocated Future Expenses (UFE)	47,735		47,735	0	-47,735	-100.00%
Total Non-Labor	9,428,542	1,423,491	10,852,033	11,815,386	963,353	8.90%
Total Expense	30,342,000	1,423,491	31,765,491	32,260,301	494,810	1.60%

Table 7-3: O&M 2017 Actual vs Budget Expenditures; actual through Q3-2017

Notes: All values are given in US $. *Detailed explanation of the columns in* Table 9 *follows:*

1. **2017 Budget approved in Nov 2016:** 2017 O&M budget approved by the Gemini Board in Nov-2016 (see board resolution 2016.B.6)
2. **2017 Budget Addition - Approved May 2017:** 2017 O&M budget addition of $ 1,423,491 for the Energy Efficiency project that was approved in the May-2017 board resolution 2017.A.8
3. **2017 Approved Budget – Sum of (1) and (2)**
4. **2017 Forecast:** Annual estimated expenses for 2017

Table 7-4 shows the summary of estimated IDF actual expenditures by Instrumentation Development project as of Q3.

IDF PROJECT	2017 Budget	2017 Forecast	2017 Actuals as of 09/30/17	2017 Remaining Forecast ($)	2017 Remaining Forecast (%)
GHOST	$890,000	$1,355,378	$1,012,712	$342,666	25%
Instrument Upgrades	$250,500	$63,490	$11,615	$51,875	82%
AO upgrades (Altair, Canopus)	$246,000	$10,899	$899	$10,001	92%
A&G System Development	$752,000	$108,000	$12,454	$95,546	88%
LGSF upgrades	$895,750	$378,765	$208,541	$170,223	45%
GMOS CCD Replacement	$22,900	$0	$18,271	($18,271)	-

OCTOCAM	$1,000,000	$1,741,589	$1,481,917	$259,672	15%
GeMS-DM0	$390,900	$326,000	$1,501	$324,499	100%
Instr. Prog. Support and Maintenance	$69,610	$27,558	$16,503	$11,055	40%
GPI Relocation Study	$73,500	$33,983	$1,983	$32,000	94%
Visiting Instrument Program	$0	$250,000	$0	$250,000	100%
TOTAL IDF	**$4,671,160**	**$4,295,662**	**$2,766,396**	**$1,529,266**	**36%**

Table 7-4: IDF 2017 Actual vs Budget Expenditures; actual through Q3-2017

7.3.3 2017 Budget vs Actual Variance Analysis

Total O&M 2017 estimated expenses and commitments are $495k or 1.6% *greater* than the 2017 spending authority approved in the Board resolutions, and this total exceeds partnership O&M contributions by $5.882k. This cash deficit is balanced from carry-forward that has accumulated during past years.

Figure 7-2 presents the 2017 budget versus actuals variance analysis (labor and non-labor). Overall, the key factors driving 2017 O&M spending changes are: (1) reduction of 2017 labor costs due to unplanned FTEs reductions or unplanned leavers; (2) increasing relocation for leaving FTEs and new hires; (3) increasing AO spares for the Toptica Laser; (4) AURA F&A, AURA CAS & HR fees changes; (5) increasing facilities expenses; and (6) increasing O&M shutdown projects in the Northern and Southern operations.

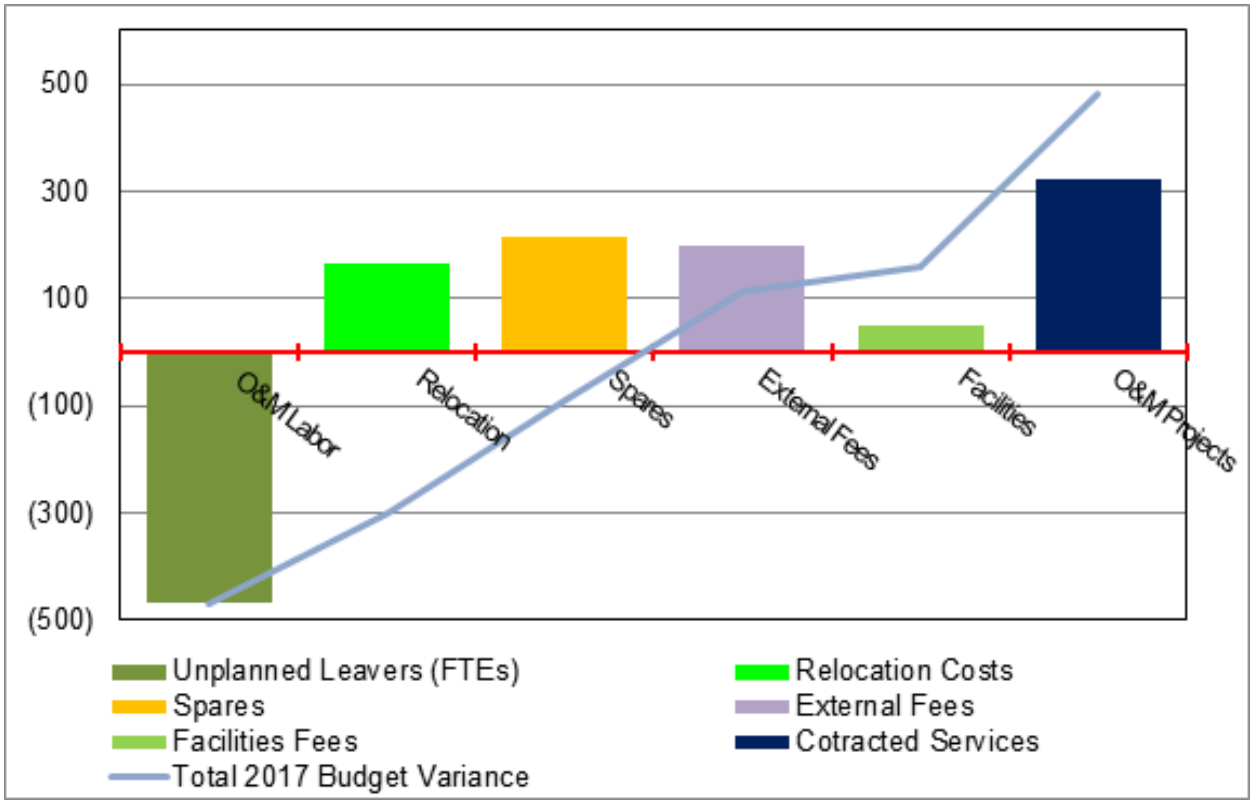

Figure 7-2: 2015 budget vs actuals variance analysis (labor and non-labor)

2017 expenses are estimated based on actual expenses as of September 30, 2017, and best estimates of October - December 2017 O&M spending. There are a few spending risks that have been identified, *Table 7-5* shows the most significant spending risks of O&M Operations' accounts:

Risk Account	2017 Risk Value (USD$)	Justification
Science Visitors	(6,000)	No additional requests for visits have been submitted
Obsolescence	(110,000)	Pending requisitions
Software	(7,500)	Reduced travel expenses
ITS	95,000	Increasing non-capital equipment
GN Energy Savings Initiative	(474,000)	Reduced budget of $474k due to decreasing project costs caused by effective selection and management of the project main contractor
GS SOS	9,500	Due to the fixed 7x7 SOS schedule, this account now incurs overtime expenses
Travel spending	(43,000)	Reduced DEV travel
TOTAL	**(536,000)**	

Table 7-5: 2017 O&M Spending Risks

The summary of IDF 2017 budget vs. actual expenditures is shown in *Table 7-5* above, and *Table 7-6* below presents the drivers of 2017 IDF budget over / under spending.

IDF PROJECT	OVER / UNDER SPENDING
GHOST	In May 2017 the prototype optical cable was finished. AAO completed and tested the prototype optical cable. The science cable is half complete. ANU's software work remains on schedule.
Instrument Upgrades	Third call of the program released in July 2017, and projects to be evaluated at the beginning of 2017Q4
AO upgrades (Altair, Canopus)	A contract amendment for additional work expected to be released in September, with delivery and installation moved into 2018.
A&G System Development	Project is on hold and no significant work has been performed. No project spending is expected until the project is reactivated.
LGSF upgrades	The new laser arrived at the end of 2016 with integration and commissioning planned for Q42017.
GMOS CCD Replacement	The GMOS team installed the new CCDs into GMOS early in March, starting on sky commissioning immediately thereafter. Commissioning work is expected to end in August 2017.
OCTOCAM	OCTOCAM is underway and on schedule with its Conceptual Design Review scheduled for 2-3 August.

GeMS-DM0	Cambridge Innovations expects to complete the electronics in September.
Instr. Prog. Support and Mai	Reduced travel activity as of September 30, 2017
GPI Relocation Study	Reduced spending activity as of September 30, 2017
Visiting Instrument Program	Maroon-X visiting instrument spending activity in Q4-2017

Table 7-6: 2016 IDF budget over / under spending analysis

Appendix A. Acronyms

A&G	Acquisition and Guiding units
AAO	Australian Astronomical Observatory
AFG	Administration and Facilities Group
AFG-N	Administration and Facilities Group-North
AFG-S	Administration and Facilities Group-South
‘Alopeke	An upgraded version of the DSSI speckle imaging visiting instrument
Altair	Altitude Conjugated Adaptive Optics for Infrared
ANU	Australian National University
AO	Adaptive Optics
AC	Air Conditioning
ApJ	Astrophysical Journal
ARC	*Astronomical Research Cameras*
AURA	Association of Universities for Research in Astronomy, Inc.
BFO	Base Facility Operations
BTO	Beam Transfer Optics
CAS	(AURA) Central Administrative Services
CCD	Charge-Coupled Device
CCKB	Cold Classical Kuiper Belt
CFHT	Canada-France-Hawaii Telescope
Chandra	Chandra X-ray Observatory
Co-I	Co-Investigator
Col-OSSOS	Colours of the Outer Solar System Origins Survey
CTIO	Cerro Tololo Inter-American Observatory
DD	Director’s Discretionary
DDT	Director’s Discretionary Time
DG	Digital Governance
DM	Deformable Mirror
DM0	Spare DM project for GeMS
DR	Data Reduction
DRAGRACES	Data Reduction and Analysis for GRACES
DSSI	Differential Speckle Survey Instrument
E-M	Electro-magnetic
ESPaDOnS	Echelle Spectro-Polarimetric Device for the Observation of Stars
F&A	(AURA) Facility & Administrative
F-2	FLAMINGOS-2
Fermi	Fermi Gamma-ray Space Telescope
FLAMINGOS-2	FLoridA Multi-Aperture Imaging Near-Infrared Grism Observation Spectrometer-2
FRB	Fast Radio Burst

FT	Fast Turnaround
FTE	Full-Time Equivalent
GBOD	Gemini Board of Directors
GeMS	Gemini Multi-conjugate Adaptive Optics System
Gen4#3	Gemini's next facility class instrument (Generation 4, #3)
GHOST	Gemini High-resolution Optical SpecTrograph
GMOS	Gemini Multi-Object Spectrograph
GMOS-N	Gemini Multi-Object Spectrograph-North
GMOS-S	Gemini Multi-Object Spectrograph-South
GN	Gemini North
GNIRS	Gemini Near-Infrared Spectrograph
GOA	Gemini Observatory Archive
GPI	Gemini Planet Imager
GRACES	Gemini Remote Access to Canada-France-Hawaii ESPaDOnS Spectrograph
GS	Gemini South (or Gemini Staff, only in time allocation listing)
GSAOI	Gemini South Adaptive Optics Imager
HBF	Hilo Base Facility
HOWFS	High Order Wavefront Sensor
HR	Human Resources
HST	Hubble Space Telescope
IDF	Instrument Development Fund
IDL	Interactive Data Language
IGRINS	Immersion Grating Infrared Spectrometer
ITAC	International Time Allocation Committee
ITS	Information Technology Services
IRAF	Image Reduction and Analysis Facility
JTTU	Journey Through The Universe
KBO	Kuiper Belt Object
KOE	Kama'aina Observatory Experience
LGS	Laser Guide Star
LGSF	Laser Guide Star Facility
LIGO	Laser Interferometer Gravitational-Wave Observatory
LLP	Large and Long Program
LPTAC	LLP Time Allocation Committee
LSST	Large Synoptic Survey Telescope
MOS	Multi-Object Spectrocopy
MOU	Memorandum of Understanding
NCPA	Non-Common Path Aberrations
NGO	National Gemini Office
NGS	Natural Guide Star

NGS2	Natural Guide Star Wavefront Sensor upgrade project (for Gemini South)
NIFS	Near-Infrared Integral Field Spectrometer
NIR	Near-infrared
NIRI	Near Infrared Imager and Spectrometer
NRC-H	National Research Council of Canada, Hertzberg Institute for Astronomy
NSF	National Science Foundation
NTAC	National Time Allocation Committee
O&M	Operations and Maintenance (budget fund)
OCS	Observatory Control Systems
OCTOCAM	8-band imaging spectrometer instrument selected to be built as Gen4#3
OIWFS	On-Instrument Wave Front Sensor
OPERA	Open source Pipeline for ESPaDOnS Reduction and Analysis
OpsWG	Operations Working Group
OSSOS	Outer Solar System Origins Survey
PANSTARRS1	Panoramic Survey Telescope and Rapid Response System 1
PI	Principal Investigator
PIO	Public Information and Outreach
PV	Priority Visitor
QAP	Quality Assessment Pipeline
QC	Quality Control
RfP	Request for Proposals
SOS	Science Operations Specialist
SSD	Solid-state Drive
STAC	Science and Technology Advisory Committee
STEM	Science, Technology, Engineering, and Mathematics
STScI	Space Telescope Science Institute
SUSD	Science User Support Department
SwRI	Southwest Research Institute
TAC	Time Allocation Committee
TEXES	Texas Echelon X[C]ross Echelle Spectrograph
ToO	Target-of-Opportunity
UFE	Unallocated Future Expenses
UV	Ultraviolet
Virgo	European gravity-wave interferometer
VLA	Very Large Array

Appendix B. Publications by Staff

Publications in this appendix list only authors on staff at Gemini Observatory . Author order is indicated in brackets, e.g. “Smith[1]” indicates Smith is the first author.

B.1 Staff Refereed Publications

Miller, B.[3]. Gemini Spectra of Star Clusters in the Spiral Galaxy M101. *The Astrophysical Journal*, 851:63, 12/2017.

Jørgensen, Inger[1], Chiboucas, Kristin[2]. Galaxy Populations in Massive z = 0.2–0.9 Clusters. I. Analysis of Spectroscopy. *The Astronomical Journal*, 154:251. 12/2017.

Goodsell, Stephen J.[22]; Hibon, Pascale[25]; Rantakyrö, Fredrik T.[47]. Evidence That the Directly Imaged Planet HD 131399 Ab Is a Background Star. *The Astronomical Journal*, 154:218. 12/2017.

Simpson, Chris[5]. Massive post-starburst galaxies at z > 1 are compact proto-spheroids. *Monthly Notices of the Royal Astronomical Society*, 472:1401-1412. 12/2017.

Andersen, M.[1]. The Stellar Content of the Infalling Molecular Clump G286.21+0.17. *The Astrophysical Journal*, 850:12. 11/2017.

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Appendix C. Publications by Users

See notes for methodology.[10, 11]

Villar, V. A., Guillochon, J., Berger, E., Metzger, B. D., Cowperthwaite, P. S., Nicholl, M., Alexander, K. D., Blanchard, P. K., Chornock, R., Eftekhari, T., Fong, W., Margutti, R., Williams, P. K. G. The Combined Ultraviolet, Optical, and Near-infrared Light Curves of the Kilonova Associated with the Binary Neutron Star Merger GW170817: Unified Data Set, Analytic Models, and Physical Implications. *The Astrophysical Journal*, 851:L21, 12/2017.

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[10] Gemini maintains an up-to-date database of papers based wholly or in part on Gemini data that appear in the main refereed astronomical research journals. These journals consist of: The Astrophysical Journal, The Astronomical Journal, Astronomy & Astrophysics, Monthly Notices of the Royal Astronomical Society, Publications of the Astronomical Society of the Pacific, Icarus, Science and Nature. In a few exceptional and well-assessed cases, we also count papers from "secondary" journals.

[11] Gemini's qualifying criterion is the same as that used by Hubble Space Telescope and European Southern Observatory. To qualify, papers based on their output, must employ in an original way an image, spectrum or data set produced by Gemini to derive new scientific results. No attempt is made to fractionate papers per telescope used in the case of papers based on the use of two or more other facilities. Hence, the same paper may be counted several times, for example by Gemini, Keck and Subaru, if it includes data from any of these telescopes.

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Appendix D. Science Programs 2016B and 2017A

In the following tables Band C represents classically scheduled programs.

D.1 2016B Science Programs - Gemini North

Band	Gemini ID	PI Name	Partners	Instrument	Title	Time
C	GN-2016B-C-1	Sharp	AU	NIFS	Breaking free of forever confined? Jet, gas and recent starformation in young nearby radio galaxies	1.00 NIGHT
1	GN-2016B-LP-1	Fraser	LP	GMOS North,NIRI	COL-OSSOS: COLours for the Outer Solar System Object Survey	50.00 HR
1	GN-2016B-LP-6	Huitson	LP	GMOS North	The First Survey Dedicated to the Detection and Characterization of Clouds in Exoplanet Atmospheres	23.80 HR
1	GN-2016B-LP-8	Walsh	LP	NIFS	Addressing a Bias in the Relation Between Galaxies and Their Central Black Holes	37.50 HR
1	GN-2016B-LP-11	Hsieh	LP	GMOS North	Observational Characterization of Active Main-Belt Comets and Main-Belt Comet Nuclei (North)	11.20 HR
1	GN-2016B-Q-1	Bastien	CA	GMOS North	Variability of the active RY Tauri bipolar jet	1.80 HR
1	GN-2016B-Q-2	Chambers	UH	GMOS North	Pan-STARRS candidates for LIGO Gravity Wave Events	16.00 HR
1	GN-2016B-Q-3	Chiang	BR	GMOS North	Mapping out the Densest Structures in the COSMOS Field at z~2?3 (North)	4.19 HR
1	GN-2016B-Q-4	Chu	UH	GMOS North	Investigating the Structure and Composition of Molecular Clouds in Preparation for the James Webb Space Telescope	4.20 HR
1	GN-2016B-Q-5	de Kleer	US	NIRI	The Impact of Io's Volcanism on Jupiter's Plasma Environment	8.00 HR
1	GN-2016B-Q-6	Donzelli	AR	GMOS North	Struck by an AGN Jet	1.60 HR
1	GN-2016B-Q-7	Dotto Perottoni	BR	Graces	The nature of the Triangulum-Andromeda stellar structures	9.70 HR
1	GN-2016B-Q-8	Ebeling	UH	GMOS North	GMOS imaging of massive galaxy clusters at z>0.5	7.00 HR
1	GN-2016B-Q-9	Esteves	CA	Graces	Search for H2O in the atmosphere of the Super-Earth 55 Cnc e	24.00 HR
1	GN-2016B-Q-10	Goto	Subaru	GNIRS	Absorption tests, black hole mass, and abundance with a new QSO at z=6.6	5.00 HR
1	GN-2016B-Q-11	Herczeg	US	GMOS North	Accretion and the formation of very low mass objects	21.40 HR
1	GN-2016B-Q-12	Jofré	AR	Graces	The chemical signature of giant stars with planets	5.70 HR
1	GN-2016B-Q-13	Kasliwal	US	GMOS North	Rapid Spectroscopy of Elusive Transients and Young Supernovae (North)	12.16 HR
1	GN-2016B-Q-14	Kilic	J:US/CA	GMOS North	A Candidate Pulsating White Dwarf Companion to PSR J2234+0611	4.00 HR
1	GN-2016B-Q-15	Kim	KR	GMOS North	Investigation of the dust ejection mechanism of active asteroid P/2010 A2	11.00 HR
1	GN-2016B-Q-16	Kim	KR	GMOS North	Unveiling the nature of Hyper Luminous X-ray Sources : Intermediate-mass Black Holes?	5.50 HR
1	GN-2016B-Q-17	Lee	KR	Graces	Raman scattered He II lines in IC5117	2.50 HR
1	GN-2016B-Q-18	Mast	J:AR/BR	NIFS	Integral Field Spectroscopy of Arcs - Unveiling the hundreds pc of a star-forming galaxy at redshift ~0.9	8.10 HR
1	GN-2016B-Q-19	McConnell	J:CA/US	GMOS North	The Black Hole Population of the Most Massive Nearby Galaxies	29.20 HR
1	GN-2016B-Q-20	Meech	UH	GMOS North,GNIRS	The Manx Comets?Testing Solar System Formation Models	12.00 HR
1	GN-2016B-Q-21	Moskovitz	US	GMOS North,GNIRS	Mission Accessible Near-Earth Objects Survey (MANOS) (North)	22.50 HR

1	GN-2016B-Q-22	Scholz	CA	NIRI	Rapid Target of Opportunity Gemini Infrared Observations of Magnetars in Outburst (North)	5.00 HR
1	GN-2016B-Q-23	Shafter	US	GMOS North	M31N 2008-12a - The Remarkable Recurrent Nova in M31: Gemini Spectra of the 2016 Eruption and surrounding 'Super-remnant'	7.20 HR
1	GN-2016B-Q-24	Skemer	US	GNIRS	A Thermal Infrared Spectroscopic Sequence of the Coldest Brown Dwarfs	42.00 HR
1	GN-2016B-Q-25	Spekkens	CA	GMOS North	Confirming the tidal origins of stellar features in two interacting galaxy groups	3.10 HR
1	GN-2016B-Q-26	Stockton	UH	GMOS North	Deep Imaging of Massive, Extremely Compact Post-Starburst Galaxies	5.20 HR
1	GN-2016B-Q-27	Storchi-Bergmann	BR	NIFS	NIFS survey of feeding and feedback processes in nearby Active Galaxies	15.00 HR
1	GN-2016B-Q-28	Takami	Subaru	NIFS	Understanding the Mechanism of Jet Launching in Active Young Stars	5.00 HR
1	GN-2016B-Q-29	Treu	US	GMOS North	A reverberation mapping black hole mass measurement at z=2.82	12.00 HR
1	GN-2016B-Q-30	Troja	US	GMOS North,NIRI	Unveiling the elusive progenitors of short duration gamma-ray bursts (North)	1.90 HR
1	GN-2016B-Q-31	Woo	KR	GMOS North	AGNs with powerful outflows: positive or negative feedback? (North)	6.90 HR
2	GN-2016B-LP-5	Crossfield	LP	Dssi Gemini North,NIRI	Validating K2?s Habitable and Rocky Planets with AO Imaging	10.00 HR
2	GN-2016B-LP-7	Shen	LP	GNIRS	A GNIRS Near-IR Spectroscopic Survey of z>5.7 Quasars	44.40 HR
2	GN-2016B-LP-10	Foley	LP	GMOS North	DES Supernova Cosmology (North)	49.50 HR
2	GN-2016B-Q-32	Ansdell	UH	Graces	Accretion & wind properties of protoplanetary disks in ? Orionis	30.00 HR
2	GN-2016B-Q-33	Bassino	AR	GMOS North	Globular cluster systems of intermediate-luminosity early-type galaxies	5.70 HR
2	GN-2016B-Q-34	Bennert	US	NIRI	Exploring the Origin of the BH Mass Scaling Relations: A Pilot Study	6.50 HR
2	GN-2016B-Q-35	Capellupo	CA	GMOS North	High Velocity Outflows from an Over-Massive Black Hole at z=3.3 (North)	11.00 HR
2	GN-2016B-Q-36	Carlberg	US	Graces	A Lithium Survey of Red Giants in the Kepler Field	18.20 HR
2	GN-2016B-Q-37	Carlos	BR	Graces	Constraining the late evolution of our Sun: lithium in solar twins of the old open cluster NGC 188.	8.00 HR
2	GN-2016B-Q-38	Cidale	AR	NIFS	Resolving the structure and kinematics of the circumstellar material of evolved massive stars	2.80 HR
2	GN-2016B-Q-39	Do	US	NIFS	Constraining the formation of the nuclear star cluster in IC 342 with NIFS	2.00 HR
2	GN-2016B-Q-40	Grossi	BR	GMOS North	Starburst dwarf galaxies at z~0.2: insights from resolved observations of the ionized gas	7.40 HR
2	GN-2016B-Q-41	Hodapp	UH	NIFS	S255 NIRS3: An Accretion Burst in a Young High-Mass Star	6.00 HR
2	GN-2016B-Q-42	Hulsebus	US	GNIRS	Follow-up Spectroscopy for Common-Proper-Motion T-Dwarf Companion Candidate	3.80 HR
2	GN-2016B-Q-43	Jha	US	GMOS North	Spectroscopy of Type Iax Supernovae (North)	6.50 HR
2	GN-2016B-Q-44	Ji	US	Graces	Detailed Chemical Abundances of the Ultra-faint Dwarf Galaxy Triangulum II	9.00 HR
2	GN-2016B-Q-45	Kilic	US	GMOS North	The Shortest Period Binary White Dwarfs in SDSS DR10 (North)	5.70 HR
2	GN-2016B-Q-46	Leggett	US	NIRI	Measuring vertical mixing in late-T and Y dwarf atmospheres	25.50 HR
2	GN-2016B-Q-47	Malo	CA	Graces	Timescales of exoplanet formation	8.00 HR

2	GN-2016B-Q-48	Mendez	UH	Graces	A search for spectroscopic binary central stars of planetary nebulae	23.00 HR
2	GN-2016B-Q-49	Moffat	CA	GNIRS	Wind Collision in WR 140 at maximum	2.80 HR
2	GN-2016B-Q-50	Morley	US	GNIRS	The Second Spectrum of the Coldest Brown Dwarf	7.50 HR
2	GN-2016B-Q-51	Moskovitz	US	GMOS North,GNIRS	Mission Accessible Near-Earth Objects Survey (MANOS) (North)	22.50 HR
2	GN-2016B-Q-52	Orton	US	NIRI	High-Resolution Mapping of Jupiter's Clouds in the Near-Infrared: Support for the Juno Mission	5.10 HR
2	GN-2016B-Q-53	Paudel	KR	GMOS North	Origin of Isolated Compact Elliptical Galaxy Hosting an Active Nucleus	3.50 HR
2	GN-2016B-Q-54	Pelisoli	BR	GMOS North	Time Resolved Spectroscopy of the Lowest Mass White Dwarfs (North)	3.00 HR
2	GN-2016B-Q-55	Ross	CA	NIFS	Testing the triggering mechanisms of SMGs with spatially-resolved dynamics	15.00 HR
2	GN-2016B-Q-56	Saker	AR	GMOS North	Gaseous disks in white dwarfs (North)	0.80 HR
2	GN-2016B-Q-57	Sand	US	GNIRS	Constraining Type Ia Supernova Physics with Near-Infrared Spectroscopy (North)	13.50 HR
2	GN-2016B-Q-58	Scholz	CA	NIRI	Target of Opportunity Gemini Infrared Observations of Magnetars in Outburst (North)	13.13 HR
2	GN-2016B-Q-59	Shin	KR	GMOS North	Spatially Resolved Galactic Winds and Star Formation Quenching in a Strongly Lensed Post-Starburst Galaxy with MgII Absorption	7.81 HR
2	GN-2016B-Q-60	Spina	BR	Graces	Unveiling chemical signatures of triggered star formation in the Orion B NGC2068/71 clusters	7.70 HR
2	GN-2016B-Q-61	U	US	NIFS	Nature and Dynamics of Clumps in Star-Forming Galaxies at z ~ 1 - 2	4.00 HR
2	GN-2016B-Q-62	Wylezalek	US	GMOS North	Probing AGN feedback models by zooming into active galaxies	10.50 HR
3	GN-2016B-Q-63	Brodie	US	GNIRS	Testing Stellar Population Models in the Near-Infrared	18.20 HR
3	GN-2016B-Q-64	Chiang	US	GMOS North	Mapping out the Densest Structures in the COSMOS Field at z~2?3 (North)	12.30 HR
3	GN-2016B-Q-65	Chick	US	GMOS North	Characterization of Bowshock-Supporting Massive Runaway Stars	9.40 HR
3	GN-2016B-Q-66	Cidale	AR	GNIRS	Search for molecular emission bands in the circumstellar environment of symbiotic stars	1.70 HR
3	GN-2016B-Q-67	Cox	US	NIRI	Charcterizing the Youngest Multiplicity Systems in the Perseus Molecular Cloud	12.50 HR
3	GN-2016B-Q-68	Ferrero	AR	GNIRS	A High Resolution Near Infrared Spectral Atlas of O stars with Gemini	2.60 HR
3	GN-2016B-Q-69	Harrison	US	GNIRS	Characterizing the L-dwarf Donor and the System Parameters of WZ Sagittae	3.60 HR
3	GN-2016B-Q-70	Maccarone	US	GNIRS	Calibrating the FWHM-K2 relation of quiescent BHs in the NIR (North)	1.80 HR
3	GN-2016B-Q-71	Malo	CA	Graces	Identification and characterization of very low-mass and brown dwarf candidate members of nearby young associations	24.40 HR
3	GN-2016B-Q-72	Manset	CA	Graces	Confirming the Binarity Hypothesis of Four FS CMa Stars	26.00 HR
3	GN-2016B-Q-73	Petric	UH	GMOS North,GNIRS	NIR and Optical Spectroscopy to Find How Luminous Infrared Galaxy Mergers Get and Use their Gas	12.00 HR
3	GN-2016B-Q-74	Reggiani	BR	Graces	Distinct halo populations revealed through precise chemical abundances of very metal-poor stars	10.00 HR
3	GN-2016B-Q-75	Rich	US	GMOS North	Quenching Caught in the Act: Measuring Feedback in Shocked Post-Starburst Galaxies	15.20 HR

3	GN-2016B-Q-76	Riffel	BR	GNIRS	New stellar libraries in the infrared: towards improving stellar population models	8.60 HR
3	GN-2016B-Q-77	Schlaufman	US	GMOS North	An All-Sky Search for the Brightest Metal-poor Stars (North)	6.40 HR
3	GN-2016B-Q-78	Shih	US	GMOS North	Host Galaxy Morphologies of Low-Excitation Radio Galaxies with Strong Emission Lines	16.00 HR
3	GN-2016B-Q-79	Takir	US	GNIRS	Searching for Volatiles and Organics in the Outer Main Asteroid Belt	20.80 HR
3	GN-2016B-Q-80	Toyland	UH	GMOS North	Noddy Goes to Toyland	21.00 HR
3	GN-2016B-Q-81	Truebenbach	US	GMOS North	Measuring Quasar Redshifts to Observe the Real-Time Recession and Collapse of Large-Scale Structures	7.00 HR
3	GN-2016B-Q-82	Winkler	US	GMOS North	The Expansion and Evolution of the Tycho Supernova Remnant	18.00 HR
4	GN-2016B-Q-83	Cochetti	AR	GNIRS	Be stars spectroscopic variability in the infrared	7.60 HR

D.2 2016B Science Programs - Gemini South

Band	Gemini ID	PI Name	Partners	Instrument	Title	Time
C	GS-2016B-C-1	Kool	AU	GSAOI	Project SUNBIRD: Supernovae UNmasked By Infra-Red Detection	2.00 NIGHT
C	GS-2016B-C-2	Opitz	AU	GSAOI	Astrometry and Binarity of WISE Y dwarfs with MCAO	1.00 NIGHT
1	GS-2016B-LP-1	Balogh	LP	GMOS South	The GOGREEN Survey of dense galaxy environments at 1<z<1.5	50.70 HR
1	GS-2016B-LP-2	Fritz	LP	GSAOI	XProbing the dark halo of the Milky Way with GeMS/GSAOI	20.40 HR
1	GS-2016B-LP-3	Masiero	LP	GMOS South	Followup of newly discoverd Near-Earth objects from the NEOWISE survey	8.00 HR
1	GS-2016B-LP-11	Hsieh	LP	GMOS South	Observational Characterization of Active Main-Belt Comets and Main-Belt Comet Nuclei (South)	3.07 HR
1	GS-2016B-Q-1	Antoniadis	CA	GMOS South	Spectroscopic follow-up of infant supernovae discovered by the KMTNet Supernova Project	14.00 HR
1	GS-2016B-Q-2	Benson	US	GMOS South	Slaying Systematics: Maximizing Cosmological Power from HST-Measured Weak Lensing Masses of SPT Galaxy Clusters at Redshift z~0.9	17.50 HR
1	GS-2016B-Q-3	Brittain	US	Phoenix Gemini South	The Search for Forming Planets in Transition Disks	9.00 HR
1	GS-2016B-Q-4	Cerqueira	BR	GMOS South	Spatially distributed line ratios for the HH 1/2 system	9.80 HR
1	GS-2016B-Q-5	Chornock	US	Flamingos 2,GMOS South	Gemini Confirmation of Optical Counterparts to LIGO/Virgo Sources Found with DECam	6.80 HR
1	GS-2016B-Q-6	Cohen	CL	GSAOI	Opening the Window to Galaxy Assembly, Part II: Breaking the IR Age-Metallicity Degeneracy	3.50 HR
1	GS-2016B-Q-7	Conn	US	GMOS South	A Census of Satellites: Is Mass Segregation common in the smallest Milky Way Satellites?	9.40 HR
1	GS-2016B-Q-8	Dupree	US	Phoenix Gemini South	Sleuthing Helium in NGC 2808	14.10 HR
1	GS-2016B-Q-9	Gonzalez-Gaitan	CL	GMOS South	New Approaches to Supernova Standardisation for Cosmology	14.00 HR
1	GS-2016B-Q-10	Kasliwal	US	GMOS South	Rapid Spectroscopy of Elusive Transients and Young Supernovae (South)	3.04 HR
1	GS-2016B-Q-11	Kim	KR	GMOS South	Spectroscopic Confirmation of Faint Quasars at z~6	9.00 HR
1	GS-2016B-Q-12	Lee	KR	Phoenix Gemini South	PHOENIX observation of AG Car: revealing its mass loss history	2.00 HR

1	GS-2016B-Q-13	Lira	CL	Flamingos 2	Reverberation Mapping of high-z QSOs: the final stages	1.50 HR
1	GS-2016B-Q-14	Maccarone	CL	Flamingos 2	Calibrating the FWHM-K2 relation of quiescent BHs in the NIR (South)	3.20 HR
1	GS-2016B-Q-15	Martini	US	GMOS South	Search for z>6 QSOs with the Dark Energy Survey	10.00 HR
1	GS-2016B-Q-16	Moskovitz	US	GMOS South	Mission Accessible Near-Earth Objects Survey (MANOS) (South)	6.50 HR
1	GS-2016B-Q-17	Parisi	J:CL/AR	GMOS South	Accurate Metal Abundances and Kinematics of a Large Sample of Small Magellanic Cloud Star Clusters and Surrounding Fields	9.20 HR
1	GS-2016B-Q-18	Pforr	US	GMOS South	A GMOS spectroscopy survey of Herschel sources in the CANDELS UDS field	24.20 HR
1	GS-2016B-Q-19	Rameau	CA	GPI	Imaging other worlds around remarkable stars with GPI	14.00 HR
1	GS-2016B-Q-20	Rotermund	J:US/CA	GMOS South	Detecting Dark Matter Subhalos with ALMA and GMOS-S/IFU using Strongly Lensed Submm Galaxies	26.00 HR
1	GS-2016B-Q-21	Saker	AR	GMOS South	Gaseous disks in white dwarfs (South)	3.00 HR
1	GS-2016B-Q-22	Sand	US	Flamingos 2	Constraining Type Ia Supernova Physics with Near-Infrared Spectroscopy (South)	8.50 HR
1	GS-2016B-Q-23	Scholz	CA	Flamingos 2	Rapid Target of Opportunity Gemini Infrared Observations of Magnetars in Outburst (South)	5.20 HR
1	GS-2016B-Q-24	Schulze	CL	Flamingos 2,GMOS South	Chasing Kilonovae Detected by Their Gravitational-Wave Emission	4.60 HR
1	GS-2016B-Q-25	Steiner	BR	GMOS South	LLP - The Gemini Survey of Galactic Nuclei - GSGN	17.00 HR
1	GS-2016B-Q-26	Tanaka	Subaru	GMOS South	Unveiling the Nature of Luminous Short-Timescale Transients	10.00 HR
1	GS-2016B-Q-27	Tappert	CL	GMOS South	Recovery of old novae	4.00 HR
1	GS-2016B-Q-28	Troja	US	Flamingos 2,GMOS South	Unveiling the elusive progenitors of short duration gamma-ray bursts (South)	1.90 HR
1	GS-2016B-Q-29	Vantyghem	CA	GMOS South	Stellar Velocity Dispersions in Molecular Gas-Rich Brightest Cluster Galaxies	3.30 HR
1	GS-2016B-Q-30	Woo	KR	GMOS South	AGNs with powerful outflows: positive or negative feedback? (South)	6.90 HR
1	GS-2016B-Q-31	Wright	US	GPI	Unveiling the Inner Regions of Thermally Pulsing Asymptotic Giant Branch (TP-AGB) stars	6.00 HR
2	GS-2016B-LP-5	Buckley-Geer	LP	GMOS South	Spectroscopic Confirmation and AO imaging Follow-Up of Dark Energy Survey Strong Lensing Systems and Spectra for Photometric Redshift Calibration	80.00 HR
2	GS-2016B-LP-6	Chen	LP	GPI	Characterizing Dusty Debris in Exoplanetary Systems	19.80 HR
2	GS-2016B-LP-10	Foley	LP	GMOS South	DES Supernova Cosmology (South)	5.00 HR
2	GS-2016B-Q-32	Ammons	US	GSAOI	The Best Parallaxes and a Limit on the Giant Planet Occurrence Rate for Nearby T Dwarf Hosts	7.00 HR
2	GS-2016B-Q-33	Baron	CA	Flamingos 2,GMOS South	WEIRD : Wide orbit Exoplanet search with InfraRed Direct imaging	17.00 HR
2	GS-2016B-Q-34	Barth	US	GMOS South	Bulge structure and kinematics in an extreme spiral galaxy hosting megaparsec-scale radio jets	6.00 HR
2	GS-2016B-Q-35	Britt	US	GMOS South	Spectroscopic evolution of a Black Hole X-ray Transient	10.00 HR
2	GS-2016B-Q-36	Burgasser	US	GMOS South	Mass Measurements Across the Hydrogen Burning Limit: Astrometric Orbits for Spectral Binaries	11.30 HR
2	GS-2016B-Q-37	Caso	J:CL/AR	GMOS South	Wealth alone: wide-field study of a field elliptical with a rich globular cluster system	5.60 HR
2	GS-2016B-Q-38	Chiang	J:BR/US	GMOS South	Mapping out the Densest Structures in the COSMOS Field at z~2?3 (South)	5.78 HR

2	GS-2016B-Q-39	Erb	US	GMOS South	Lya emission at high resolution: a probe of neutral hydrogen content and Lyman continuum escape in low metallicity galaxies at z~2	8.20 HR
2	GS-2016B-Q-40	Escudero	AR	Flamingos 2,GMOS South	Exploring the Telescopium group through the globular cluster systems.	3.41 HR
2	GS-2016B-Q-41	Foley	J:US/BR	GMOS South	DES Supernova Cosmology (South)	26.60 HR
2	GS-2016B-Q-42	Gibson	US	GMOS South	Solving the TiO mystery in hot exoplanets: the optical transmission spectrum of WASP-121b	9.70 HR
2	GS-2016B-Q-43	Gromadzki	CL	GSAOI	Trigonometric parallax of ancient T dwarf WISE0833+0052 (2016B)	2.50 HR
2	GS-2016B-Q-44	Hinkle	US	Phoenix Gemini South	Isotopes on a hot bottom: Nucleosyntheis in massive AGB stars	20.00 HR
2	GS-2016B-Q-45	Hwang	KR	GMOS South	Origin of the Outermost Stellar Disk of Spiral Galaxy NGC 300	10.00 HR
2	GS-2016B-Q-46	Im	KR	GMOS South	Spectroscopic Identification of Faint Quasars at z ~ 5	8.29 HR
2	GS-2016B-Q-47	Jha	US	GMOS South	Spectroscopy of Type Iax Supernovae (South)	2.30 HR
2	GS-2016B-Q-48	Kilic	US	GMOS South	The Shortest Period Binary White Dwarfs in SDSS DR10 (South)	3.80 HR
2	GS-2016B-Q-49	Kremin	BR	GMOS South	Constraining the Scatter in Galaxy Cluster Mass as a Function of Redshift via Dynamical Estimates	6.00 HR
2	GS-2016B-Q-50	Liu	US	GMOS South	Spectroscopic Follow-Up of Variability Selected Binary Supermassive Black Hole Candidates	5.00 HR
2	GS-2016B-Q-51	Moskovitz	US	GMOS South	Mission Accessible Near-Earth Objects Survey (MANOS) (South)	6.50 HR
2	GS-2016B-Q-52	Neilson	CA	GPI	Gemini Planet Imager Classical Cepheid Survey	4.00 HR
2	GS-2016B-Q-53	Olivares E.	CL	GMOS South	Late-time spectroscopy of stripped supernovae: probing the progenitor populations and the final stages of massive star evolution	5.60 HR
2	GS-2016B-Q-54	Pelisoli	BR	GMOS South	Time Resolved Spectroscopy of the Lowest Mass White Dwarfs (South)	9.10 HR
2	GS-2016B-Q-55	Pichel	AR	GMOS South	Meassuring the redshift of the BL Lac Blazar KUV 0031-1938	1.80 HR
2	GS-2016B-Q-56	Puzia	J:CL/US	GSAOI	The GeMS/GSAOI Galactic Globular Cluster Survey (G4CS)	14.00 HR
2	GS-2016B-Q-57	Richer	CA	GSAOI	White Dwarf Debris Disks in 47 Tucanae	10.80 HR
2	GS-2016B-Q-58	Scholz	CA	Flamingos 2	Target of Opportunity Gemini Infrared Observations of Magnetars in Outburst (South)	13.88 HR
2	GS-2016B-Q-59	Sheen	KR	GMOS South	An IFU study of a central elliptical galaxy in a satellite halo: the early stage of a halo merger	6.60 HR
2	GS-2016B-Q-60	Smith	US	Phoenix Gemini South	[Fe II] Kinematics of Magellanic Cloud Luminous Blue Variables	30.00 HR
2	GS-2016B-Q-61	Spekkens	CA	GMOS South	Chasing the Faintest Galaxies	1.60 HR
2	GS-2016B-Q-62	Telles	BR	GSAOI	How massive can a Super Star Cluster be?	4.40 HR
2	GS-2016B-Q-63	Torres-Flores	CL	GMOS South	Disentangling the central ionization mechanism in compact group galaxies	7.95 HR
2	GS-2016B-Q-64	Vuckovic	CL	GMOS South	The EREBOS Project: Determining the Influence of Substellar Objects on Stellar Evolution	12.20 HR
2	GS-2016B-Q-65	Weidmann	AR	GMOS South	Determining the actual nature of weak emission line stars in the nucleus of Planetary Nebulae	1.80 HR
3	GS-2016B-Q-66	Arnason	CA	GMOS South	Investigating Compact Binaries in the Sculptor Dwarf Galaxy	3.70 HR
3	GS-2016B-Q-67	Britt	US	GMOS South	Spectroscopic evolution of a Black Hole X-ray Transient	21.00 HR
3	GS-2016B-Q-68	Chapman	J:US/CA	Flamingos 2,GMOS South	Optical followup of the new Cycle3 ALMA-SPT sample of lensed submillimeter galaxies	33.10 HR

3	GS-2016B-Q-69	Chiang	BR	GMOS South	Mapping out the Densest Structures in the COSMOS Field at z~2?3 (South)	10.00 HR
3	GS-2016B-Q-71	Geballe	US	Phoenix Gemini South	Temperatures and Densities in the CO line-emission Disk and outflow from NGC2071 IRS1	8.50 HR
3	GS-2016B-Q-72	Hamilton-Drager	US	GMOS South	Rotational Velocities and Radii of Pre-Main Sequence Stars in the Young Cluster NGC 2362	5.30 HR
3	GS-2016B-Q-73	Hebrard	CA	Phoenix Gemini South	Doppler Imaging of Brown Dwarfs (South)	22.00 HR
3	GS-2016B-Q-74	Kim	KR	GMOS South	Optical Imaging of Faint Quasar Candidates at z~6	8.30 HR
3	GS-2016B-Q-75	Lin	US	GMOS South	Measuring the distance to a supercritically accreting tidal disruption event candidate with Gemini	5.00 HR
3	GS-2016B-Q-76	Maas	US	Phoenix Gemini South	Phosphorus Abundances in the Thin and Thick Disks	21.50 HR
3	GS-2016B-Q-77	Maas	US	Phoenix Gemini South	Measurements of the Chlorine Isotope Ratio in Cool Stars	8.30 HR
3	GS-2016B-Q-78	Pelisoli	BR	GMOS South	Time Resolved Spectroscopy of the Lowest Mass White Dwarfs (South)	8.30 HR
3	GS-2016B-Q-79	Rodriguez	CL	GMOS South	Testing Type II supernovae as cosmological probes at near-infrared wavelengths	16.80 HR
3	GS-2016B-Q-80	Schlaufman	US	GMOS South	A Massive Compact Object Companion to an Ultra Metal-poor Star in the Solar Neighborhood	5.40 HR
3	GS-2016B-Q-81	Schlaufman	US	GMOS South	An All-Sky Search for the Brightest Metal-poor Stars (South)	19.35 HR
3	GS-2016B-Q-82	Smith Castelli	AR	GMOS South	Stellar population and Initial Mass Function analysis of the bright elliptical galaxy NGC 7619	5.20 HR
3	GS-2016B-Q-83	Stubbs	US	GMOS South	Pachon Aerosol Monitoring Campaign	30.00 HR
3	GS-2016B-Q-84	Urrutia-Viscarra	CL	GMOS South	Metallicity and Stellar Masses across Condor?s Tidal Dwarf Galaxy	4.40 HR
3	GS-2016B-Q-85	Vantyghem	CA	GMOS South	Stellar Velocity Dispersions in Molecular Gas-Rich Brightest Cluster Galaxies	7.80 HR

D.3 2017A Science Programs - Gemini North

Band	Gemini ID	PI Name	Partners	Instrument	Title	Time
C	GN-2017A-C-1	Koyama	Subaru	GMOS North	Pinpointing dusty star-forming regions within starburst galaxies in z=0.4 cluster	10.00 HR
C	GN-2017A-C-2	Kedziora-Chudczer	AU	GNIRS	Mapping and Characterisation of Jovian Aurora in near Infrared bands	1.00 NIGHT
C	GN-2017A-C-3	Nesvadba	CFHT	NIFS	Does turbulence suppress star formation in AGN hosts?	9.00 HR
C	GN-2017A-C-4	Fouque	CFHT	GRACES	Using activity proxy to estimate the small-scale magnetic field strength for M5-M6 dwarfs	15.00 HR
C	GN-2017A-C-5	Petric	CFHT	GNIRS	Growing Black Holes and their Hosts	5.00 HR
1	GN-2017A-LP-1	Fraser	LP	GMOS North,NIRI	COL-OSSOS: COLours for the Outer Solar System Object Survey	50.00 HR
1	GN-2017A-LP-4	Balogh	LP	GMOS North	The GOGREEN Survey of dense galaxy environments at 1<z<1.5 (North)	55.90 HR
1	GN-2017A-LP-11	Hsieh	LP	GMOS North	Observational Characterization of Active Main-Belt Comets and Main-Belt Comet Nuclei (North)	6.90 HR
1	GN-2017A-Q-1	Yang	KR	GMOS North	What Stops Galactic Star Formation in Gas-Rich Post-Starburst Galaxies?	4.00 HR
1	GN-2017A-Q-2	Woo	KR	GMOS North	The shortest reverberation lag of NGC 4395 and testing the size-luminosity relation.	18.00 HR
1	GN-2017A-Q-3	Szkody	US	GMOS North	Do white dwarfs in cataclysmic varibales grow in mass?	13.60 HR

1	GN-2017A-Q-4	Storchi-Bergmann	BR	NIFS	NIFS survey of feeding and feedback processes in nearby Active Galaxies	15.00 HR
1	GN-2017A-Q-5	Skemer	US	GNIRS	A Thermal Infrared Spectroscopic Sequence of the Coldest Brown Dwarfs	22.00 HR
1	GN-2017A-Q-6	Ross	US	NIFS	Spatially-resolved dynamics in the most luminous known galaxy in the Universe	7.00 HR
1	GN-2017A-Q-7	Park	KR	GNIRS	Investigating black hole-galaxy coevolution with dust-obscured galaxies in local universe	5.00 HR
1	GN-2017A-Q-8	Overzier	BR	GMOS North	Spectroscopic Confirmation of the Most Distant Radio Sources in the Early Universe	7.00 HR
1	GN-2017A-Q-9	Orton	US	Texes Gemini North	Testing the Onset of a Polar Vortex at Saturn's Northern Summer Solstice by Mapping Stratospheric Temperature and Hydrocarbons	6.00 HR
1	GN-2017A-Q-10	Orton	US	NIRI	High-Resolution Mapping of Jupiter's Clouds in the Near-Infrared: Support for the Juno Mission	9.80 HR
1	GN-2017A-Q-11	Onoue	Subaru	GNIRS	Exploring the Least Massive and Active SMBHs Ever Known at z>6	30.00 HR
1	GN-2017A-Q-12	Molina Lera	AR	GNIRS	Spectroscopic study in embedded clusters	3.50 HR
1	GN-2017A-Q-13	Moffat	CA	GNIRS	Wind Collision in WR 140 at maximum	2.00 HR
1	GN-2017A-Q-14	Meech	UH	GMOS North,GNIRS	The Manx Comets?Testing Solar System Formation Models	13.00 HR
1	GN-2017A-Q-15	McConnell	J:US/CA	GMOS North	The Black Hole Population of the Most Massive Nearby Galaxies	16.80 HR
1	GN-2017A-Q-16	Ly	US	GNIRS	Recalibrating Strong-line Metallicity Diagnostics for z>1 Chemical Enrichment Studies, with T_e-based Metallicities from MACT and DEEP2	17.30 HR
1	GN-2017A-Q-17	Lee	KR	Graces	Raman Scattered O VI 1032 and 1038 in symbiotic stars	5.10 HR
1	GN-2017A-Q-18	Jencson	US	GNIRS,NIRI	Confirming Obscured SN Candidates with Gemini (North)	2.90 HR
1	GN-2017A-Q-19	Fletcher	US	Texes Gemini North	Wave Phenomena and Deep Plumes in Jupiter's Tropical Atmosphere	10.00 HR
1	GN-2017A-Q-20	Esteves	CA	Graces	Comparative Exoplanetology: Probing the Atmospheres of Hot Saturns	6.00 HR
1	GN-2017A-Q-21	Ebeling	UH	GMOS North	GMOS imaging of massive galaxy clusters at z>0.5	4.00 HR
1	GN-2017A-Q-22	Cote	CA	NIFS	Black Holes in the Smallest Galaxies	14.90 HR
1	GN-2017A-Q-23	Chambers	UH	GMOS North	Follow-up of LIGO Gravity Wave and IceCube neutrino events	16.00 HR
1	GN-2017A-Q-24	Burgasser	US	GMOS North	Mass Measurements Across the Hydrogen Burning Limit: Astrometric Orbits for Spectral Binaries (Northern Sample)	10.70 HR
1	GN-2017A-Q-25	Bresolin	UH	GMOS North	Metallicity gradients in the smallest spiral galaxies	5.60 HR
1	GN-2017A-Q-26	Bassino	AR	GMOS North	Globular cluster systems of early-type galaxies in low-density environments	4.30 HR
1	GN-2017A-Q-27	Arroway	CA	GMOS North	Tracking Observations of New Horizons Post-Pluto FlyBy Targets	7.20 HR
1	GN-2017A-Q-28	An	KR	GNIRS	Is Methanol Ice Localized or Widespread in the Central 300 pc of the Galaxy?	11.40 HR
2	GN-2017A-LP-5	Crossfield	LP	Dssi Gemini North,NIRI	Validating K2?s Habitable and Rocky Planets with AO Imaging (North)	15.00 HR
2	GN-2017A-LP-6	Huitson	LP	GMOS North	The First Survey Dedicated to the Detection and Characterization of Clouds in Exoplanet Atmospheres	23.80 HR
2	GN-2017A-LP-7	Shen	LP	GNIRS	A GNIRS Near-IR Spectroscopic Survey of z>5.7 Quasars	44.40 HR
2	GN-2017A-Q-29	Williams	UH	GNIRS	GNIRS spectroscopy	21.00 HR

2	GN-2017A-Q-30	Turnshek	US	GMOS North	A z=0.633 galaxy that may be both a DLA absorber and a LAE	2.00 HR
2	GN-2017A-Q-31	Stockton	UH	GNIRS	The Cold-Gas Environments of Sub-Millimeter Galaxies	11.20 HR
2	GN-2017A-Q-32	Skemer	US	GNIRS	A Thermal Infrared Spectroscopic Sequence of the Coldest Brown Dwarfs	22.00 HR
2	GN-2017A-Q-33	Sinclair	US	Texes Gemini North	High resolution mapping of Jupiter's stratospheric-auroral interactions during the Juno mission	10.00 HR
2	GN-2017A-Q-34	Shara	J:CA/US	GMOS North	CK Vulpecula (nova 1670): The best test of the hibernation scenario	6.00 HR
2	GN-2017A-Q-35	Scholz	CA	NIRI	Target of Opportunity Gemini Infrared Observations of Magnetars in Outburst (North)	13.13 HR
2	GN-2017A-Q-36	Scarlata	US	GMOS North	Pressure and strange cooling: halo gas in galaxies with OVI emission	12.00 HR
2	GN-2017A-Q-37	Salyk	US	Texes Gemini North	Structure and chemistry of protoplanetary disk gaps	2.30 HR
2	GN-2017A-Q-38	Saker	AR	GMOS North	Gaseous disks in white dwarfs	3.98 HR
2	GN-2017A-Q-39	Rusu	US	GMOS North,NIRI	Quantifying mass structures along strong-lens lines of sight for accurate cosmology	6.50 HR
2	GN-2017A-Q-40	Rodríguez Ardila	BR	GNIRS	Coronal Line Forest AGN: a NIR overview	5.40 HR
2	GN-2017A-Q-41	Peterson	US	GNIRS	The first spectroscopic dust reverberation program on a luminous AGN: case study Mrk 876	3.60 HR
2	GN-2017A-Q-42	Melis	J:US/CA	Graces	Scratching the surface of other worlds: water anyone?	14.00 HR
2	GN-2017A-Q-43	Kim	KR	GMOS North	Are Tidal Disruption Events Enhanced by Galaxy Mergers?	4.74 HR
2	GN-2017A-Q-44	Kellogg	CA	GNIRS	A Survey of Peculiar L and T Dwarfs in a Cross-Correlation of the SDSS, 2MASS and WISE Databases	18.60 HR
2	GN-2017A-Q-45	Irwin	US	GMOS North	A New Type of Explosive Highly Energetic X-ray Flaring Source	10.00 HR
2	GN-2017A-Q-46	Hamann	US	Graces	Monitoring the Extraordinary Transient Outflow in the Quasar PG1411+442	1.00 HR
2	GN-2017A-Q-47	Grossi	BR	GMOS North	Starburst dwarf galaxies at intermediate redshift: insights from resolved observations of the ionized gas	10.50 HR
2	GN-2017A-Q-48	Griffiths	UH	GMOS North	An Unusual Gravitational Lens found in a HST WFC3 Image	4.00 HR
2	GN-2017A-Q-49	Greathouse	US	Texes Gemini North	Characterizing Wave Phenomena in Jupiter's Stratosphere using High Spectral Resolution Thermal IR Observations	11.50 HR
2	GN-2017A-Q-50	Fohring	UH	GMOS North	Spectral Classication of Earth Co-Orbital Asteroid 2016 HO3	1.50 HR
2	GN-2017A-Q-51	Ferrero	AR	GNIRS	A High Resolution Near Infrared Spectral Atlas of O stars with Gemini	2.30 HR
2	GN-2017A-Q-52	Debes	US	GNIRS	Confirming new white dwarf-brown dwarf binaries	24.00 HR
2	GN-2017A-Q-53	de Kleer	US	NIRI	The Impact of Io's Volcanism on Jupiter's Plasma Environment	20.00 HR
2	GN-2017A-Q-54	Corral-Santana	US	GNIRS	Calibrating the FWHM-K2 relation of quiescent BHs in the NIR (North)	3.80 HR
2	GN-2017A-Q-55	Chiang	Subaru	GMOS North	JWST High-z Pathfinder: 3D-HST Metal Poor Galaxies at z~0.8	9.50 HR
2	GN-2017A-Q-56	Boogert	US	Texes Gemini North	Survey of the Organic Inventory of Hot Cores	9.90 HR
2	GN-2017A-Q-57	Beck	US	Texes Gemini North	High Resolution Gas Kinematics in Young Embedded Super Star Clusters	8.50 HR
2	GN-2017A-Q-58	Akras	BR	NIRI	Are low-ionization knots in planetary nebulae H2 condensations?	6.80 HR

3	GN-2017A-Q-59	Wylezalek	US	GMOS North	What is driving quasar winds in radio-quiet luminous AGN?	15.00 HR
3	GN-2017A-Q-60	WONG	US	NIRI	Time-Critical M-band Mapping of Jupiter --- Synergy with Juno, Hubble, VLA, Keck, and IRTF	13.10 HR
3	GN-2017A-Q-61	Torres Zafra	AR	GMOS North	Spectroscopic study of the blazar MAGIC J2001+439 and its environment	5.00 HR
3	GN-2017A-Q-62	Torres	AR	GNIRS	Evolutionary state and circumstellar environment of evolved massive stars	2.80 HR
3	GN-2017A-Q-63	Takir	US	GNIRS	Searching for Volatiles and Organics in the Outer Main Asteroid Belt	14.00 HR
3	GN-2017A-Q-64	Stockton	UH	GNIRS	The Cold-Gas Environments of Sub-Millimeter Galaxies	11.20 HR
3	GN-2017A-Q-65	Romero	BR	GMOS North	Spectroscopy of massive DB white dwarf stars (North)	1.10 HR
3	GN-2017A-Q-66	Riffel	BR	GNIRS	New stellar libraries in the infrared: towards improving stellar population models	3.40 HR
3	GN-2017A-Q-67	Petric	UH	GNIRS	Growing Black Holes and their Hosts	6.00 HR
3	GN-2017A-Q-68	Pablo	CA	Graces	Unraveling LS 4948: A Pre-merger Candidate	3.40 HR
3	GN-2017A-Q-69	Mendez	UH	Graces	A search for spectroscopic binary central stars of planetary nebulae	6.00 HR
3	GN-2017A-Q-70	Maas	US	GNIRS	Carbon Isotope Ratios in M10	13.50 HR
3	GN-2017A-Q-71	Lee	KR	GNIRS	NIR spectroscopy of SNRs (North)	8.00 HR
3	GN-2017A-Q-72	Krafton	US	GMOS North	Red-Blue Line Asymmetries in CCSNe	30.30 HR
3	GN-2017A-Q-73	Kilic	US	GMOS North	A Benchmark Pulsating White Dwarf Companion to PSR J1738+0333	9.00 HR
3	GN-2017A-Q-74	Jha	US	GMOS North	Spectroscopy of Type Iax Supernovae (North)	6.50 HR
3	GN-2017A-Q-75	Im	KR	NIRI	NIR imaging of faint quasasr candidates at z ~ 7	10.20 HR
3	GN-2017A-Q-76	Hamann	US	GNIRS	Feedback vs Cold Mode Accretion: Accurate Velocities for Complex Infall/Outflow Gas Near Redshift 3 Quasars	3.00 HR
3	GN-2017A-Q-77	Fohring	UH	GMOS North	Spectral Classication of Near Earth and Potentially Hazardous Asteroids	2.00 HR
3	GN-2017A-Q-78	Davidge	CA	GMOS North,GNIRS	Carbon Star Signatures in Integrated Light	15.50 HR
3	GN-2017A-Q-79	Cruz	BR	Graces	Short-period eclipsing binaries and the inflated radii of low-mass stars.	8.20 HR
3	GN-2017A-Q-80	Armentrout	US	GMOS North	High-Mass Star Formation in the Outer Scutum-Centaurus Arm	16.80 HR
3	GN-2017A-Q-81	Albert	CA	GNIRS	Spectroscopy of Taurus Star Forming Region Candidates Down to 3 Jupiter Masses	19.50 HR
4	GN-2017A-Q-82	Schlaufman	US	GMOS North	An All-Sky Search for the Brightest Metal-poor Stars	202.00 HR
4	GN-2017A-Q-83	Schirmer	US	GMOS North	Characterizing low-redshift Lyman-alpha blobs (North)	105.80 HR
4	GN-2017A-Q-84	Cochetti	AR	GNIRS	Be stars spectroscopic variability in the infrared	7.90 HR

D.4 2017A Science Programs - Gemini South

Band	Gemini ID	PI Name	Partners	Instrument	Title	Time
C	GS-2017A-C-1	Kool	AU	GSAOI	Project SUNBIRD: Supernovae UNmasked By Infra-Red Detection	2.00 NIGHT
1	GS-2017A-LP-1	Balogh	LP	GMOS South	The GOGREEN Survey of dense galaxy environments at 1<z<1.5 (South)	7.80 HR
1	GS-2017A-LP-2	Fritz	LP	GSAOI	XProbing the dark halo of the Milky Way with GeMS/GSAOI	20.40 HR
1	GS-2017A-LP-3	Masiero	LP	GMOS South	Followup of newly discoverd Near-Earth objects from the NEOWISE survey	8.00 HR

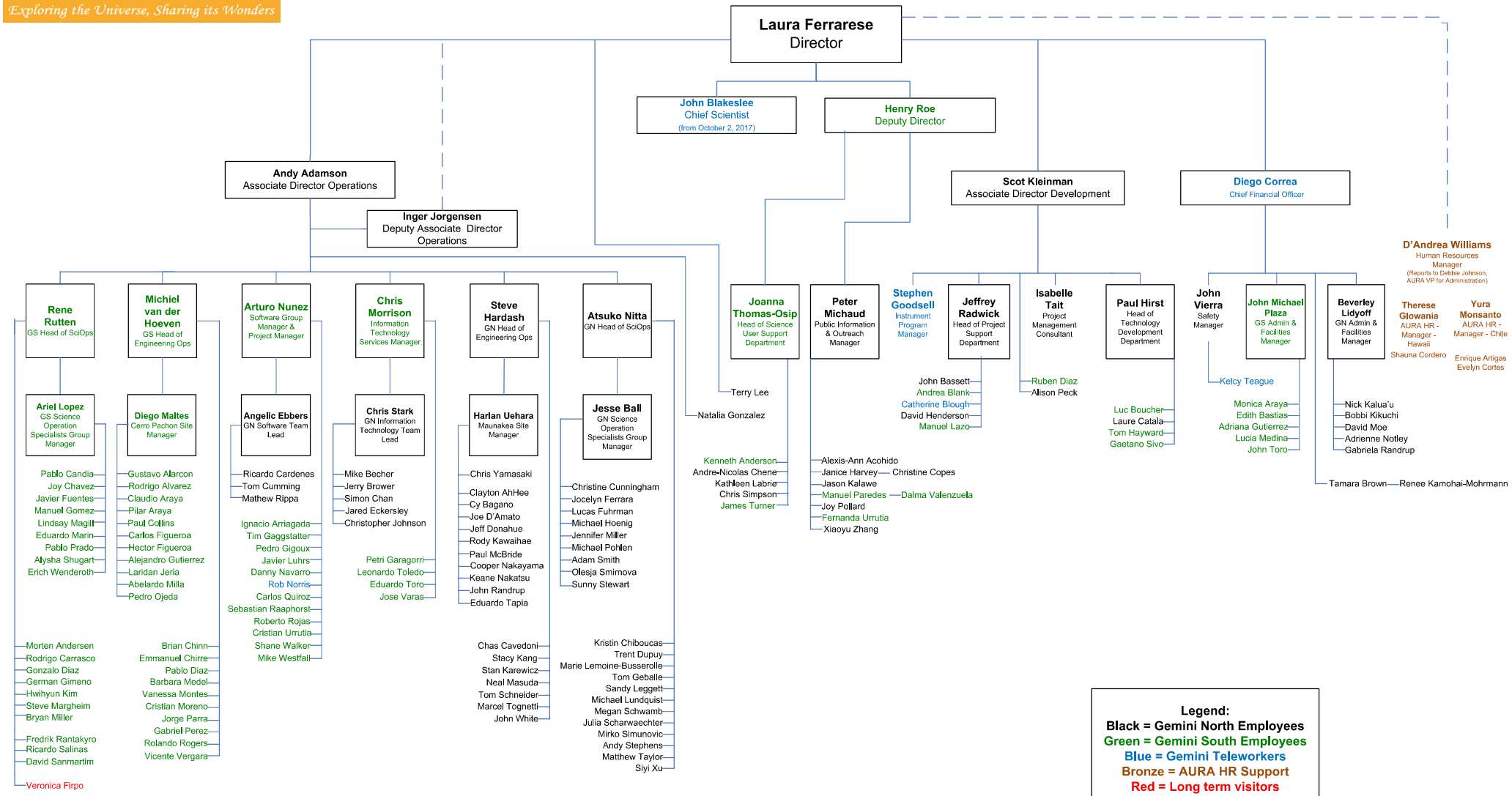
1	GS-2017A-LP-11	Hsieh	LP	GMOS South	Observational Characterization of Active Main-Belt Comets and Main-Belt Comet Nuclei (South)	6.13 HR
1	GS-2017A-LP-12	Monnier	LP	GPI	Scattered Light imaging of YSOs: Probing the Fundamental Stages of Planet Formation	20.00 HR
1	GS-2017A-Q-1	Yang	KR	GMOS South	What Stops Galactic Star Formation in Gas-Rich Post-Starburst Galaxies?	12.00 HR
1	GS-2017A-Q-2	Wagner	US	GPI	Probing the Physics of Exoplanet Atmospheres: Characterization of a Cold, Low-mass Exoplanet w/GPI	7.00 HR
1	GS-2017A-Q-3	Tejos	J:US/CL	GMOS South	Rapid Spectroscopic Follow-up of Fast Radio Bursts	1.60 HR
1	GS-2017A-Q-4	Tappert	CL	GMOS South	Recovery of old novae	5.40 HR
1	GS-2017A-Q-5	Steiner	BR	GMOS South	LLP - The Gemini Survey of Galactic Nuclei - GSGN	17.00 HR
1	GS-2017A-Q-6	Schulze	CL	Flamingos 2,GMOS South	Chasing Kilonovae Detected by Their Gravitational-Wave Emission	6.00 HR
1	GS-2017A-Q-7	Scalia	AR	GMOS South	The stellar population content of Pegasus I	5.90 HR
1	GS-2017A-Q-8	Rameau	CA	GPI	Imaging other worlds around remarkable stars with GPI (Part 2)	19.00 HR
1	GS-2017A-Q-9	Perlmutter	US	GMOS South	Probing Dark Energy with z>1 Type Ia Supernova from Subaru/HSC and HST	48.00 HR
1	GS-2017A-Q-10	Papovich	J:US Rejected: CA	Flamingos 2	ZFK2: The First Systematic Exploration of the K-band Window and a Census of Massive Galaxies at 4 < z < 6	10.00 HR
1	GS-2017A-Q-11	Otsuka	Subaru	GMOS South	Investigations of warm-cold dust mass and gas-to-dust mass ratio in LMC PNe	15.00 HR
1	GS-2017A-Q-12	Nusdeo	US	Dssi Gemini South	Searching for Companions to K Dwarfs within 50 Parsecs on Solar System Scales	20.00 HR
1	GS-2017A-Q-13	Moriya	Subaru	GMOS South	Spectroscopic confirmation of high-redshift superluminous supernovae	20.00 HR
1	GS-2017A-Q-14	Mauro	CL	GSAOI	Age-dating past multiple bursts of star formation in Terzan 5, a fossil relic of the Galactic bulge	1.60 HR
1	GS-2017A-Q-15	Lee	KR	GMOS South	Mapping the Young Stellar Populations of E+A Galaxies with Different Star Formation Histories	9.20 HR
1	GS-2017A-Q-16	Kraus	:US	GPI	The Planetary Systems of Young Massive Stars	23.40 HR
1	GS-2017A-Q-17	Johns-Krull	US	Phoenix Gemini South	Magnetic Field Evolution During the Pre-Main Sequence	19.60 HR
1	GS-2017A-Q-18	Jencson	US	Flamingos 2	Confirming Obscured SN Candidates with Gemini (South)	2.91 HR
1	GS-2017A-Q-19	Im	KR	GMOS South	Spectroscopic identification of faint quasars at z ~ 5 to understand the cosmic re-ionization	24.00 HR
1	GS-2017A-Q-20	Gromadzki	CL	GSAOI	Trigonometric parallax of ancient T dwarf WISE0833+0052 (2017A)	2.50 HR
1	GS-2017A-Q-21	Ghez	US	GSAOI	Using MCAO to Enable Unique Test of General Relativity at the Galactic Center	7.20 HR
1	GS-2017A-Q-22	Garcia Lambas	AR	GMOS South	Classification of aLigo GW compact mergers by the TOROS collaboration	2.30 HR
1	GS-2017A-Q-23	Fernandes Lopes Soares	BR	GMOS South	Deciphering the star-formation scenario of the Sh2-296 nebula	3.60 HR
1	GS-2017A-Q-24	Cucchiara	US	GMOS South	High-Redshift Gamma-Ray Bursts as Probes of Cosmic Dawn (South)	4.00 HR
1	GS-2017A-Q-25	Cuadra	CL	GSAOI	Star formation and dynamics at < 2.5 pc from Sgr A*	10.00 HR
1	GS-2017A-Q-26	Cohen	CL	GSAOI	Unveiling the Heart of the Milky Way: Ages and Structural Parameters of Inner Galactic Bulge Globular	9.00 HR

					Clusters	
1	GS-2017A-Q-29	Blakeslee	J:CA/US	GSAOI	Stellar Population GeMology: Long Period Variables at High Metallicity in the Nearest Elliptical Galaxy	10.00 HR
1	GS-2017A-Q-31	Ammons	US	GSAOI	The Best Parallaxes and a Limit on the Giant Planet Occurrence Rate for Nearby T Dwarf Hosts	7.00 HR
2	GS-2017A-LP-5	Buckley-Geer	LP	GMOS South	Spectroscopic Confirmation and AO imaging Follow-Up of Dark Energy Survey Strong Lensing Systems and Spectra for Photometric Redshift Calibration	12.00 HR
2	GS-2017A-LP-6	Chen	LP	GPI	Characterizing Dusty Debris in Exoplanetary Systems	24.80 HR
2	GS-2017A-LP-8	Hynes	LP	GMOS South	Dynamical Masses of Black Holes and Neutron Stars from the Galactic Bulge Survey	60.00 HR
2	GS-2017A-LP-9	Crossfield	LP	Dssi Gemini South	Validating K2?s Habitable and Rocky Planets with AO Imaging (South)	15.00 HR
2	GS-2017A-Q-32	Scholz	CA	Flamingos 2	Probing the IR emission of magnetar 1E 1048.1-5937 during extreme torque variations	15.00 HR
2	GS-2017A-Q-33	Sand	US	Flamingos 2	Constraining Type Ia Supernova Physics with Near-Infrared Spectroscopy (South)	8.50 HR
2	GS-2017A-Q-34	Romero	BR	GMOS South	Spectroscopy of massive DB white dwarf stars (South)	2.90 HR
2	GS-2017A-Q-35	Rembold	BR	GMOS South	Revealing the origin of compact elliptical galaxies through their stellar population content	7.70 HR
2	GS-2017A-Q-36	Ravindranath	US	GMOS South	Semi-forbidden CIII]1909 Emission in the Rest-frame UV Spectra of Extreme Emission Line Galaxies	8.50 HR
2	GS-2017A-Q-37	Puzia	J:US/CA/CL	GSAOI	The GeMS/GSAOI Galactic Globular Cluster Survey (G4CS)	23.00 HR
2	GS-2017A-Q-38	Olofsson	CL	GPI	Confirming candidate companions around two young debris disks	1.50 HR
2	GS-2017A-Q-39	Nogueira-Cavalcante	BR	GMOS South	The Dependence of Star Formation Quenching in Green Valley Galaxies with Environment at 0.5 < z < 1.0	13.00 HR
2	GS-2017A-Q-40	Nielsen	US	GPI	Orbits of Moving Group Binaries: Constraining the Ages of Planet-Hosting Moving Groups using GPI NRM Astrometric Monitoring	7.40 HR
2	GS-2017A-Q-41	Neilson	US	GPI	Gemini Planet Imager Classical Cepheid Survey	4.00 HR
2	GS-2017A-Q-42	Mennickent	CL	GSAOI	Confirmation of the optical counterpart of the Fermi pulsar J1741-2054	2.40 HR
2	GS-2017A-Q-43	Kim	KR	GMOS South	Are Tidal Disruption Events Enhanced by Galaxy Mergers?	1.58 HR
2	GS-2017A-Q-44	Kerber	BR	GSAOI	Very deep NIR photometry for the inner bulge globular clusters HP 1 and Palomar 6	2.80 HR
2	GS-2017A-Q-45	Jha	US	GMOS South	Spectroscopy of Type Iax Supernovae (South)	2.30 HR
2	GS-2017A-Q-46	Howell	US	Dssi Gemini South	K2 Exoplanet Candidates: Small Planet Validation and Host Star Binarity (South)	20.00 HR
2	GS-2017A-Q-47	Hartigan	US	GSAOI	A Test of Triggering in Carina's Western Wall	10.00 HR
2	GS-2017A-Q-48	Ferrero	AR	GSAOI	GSAOI+GeMS high resolution images of protostellar jets: The case of HH 137/138	3.90 HR
2	GS-2017A-Q-49	Currie	J:CA/US	GPI	The First Spectrum of a Protoplanet	3.30 HR
2	GS-2017A-Q-50	Cummings	US	GMOS South	The Initial-Final Mass Relation: An Ultramassive White Dwarf in the Open Cluster M7	6.50 HR
2	GS-2017A-Q-51	Corral-Santana	J:CL/US	Flamingos 2	Calibrating the FWHM-K2 relation of quiescent BHs in the NIR (South)	11.80 HR
2	GS-2017A-Q-52	Cieza	J:US/CL/AR	GMOS South	Spectroscopic characterization for the Ophiuchis DIsk Survey Employing ALMA (ODISEA)	18.00 HR
2	GS-2017A-Q-53	Burgasser	US	GMOS South	Mass Measurements Across the Hydrogen Burning Limit: Astrometric Orbits for Spectral Binaries	11.30 HR

2	GS-2017A-Q-55	Brandt	US	GPI	Imaging the Only Known White Dwarf with a >8 Msun Progenitor	1.50 HR
2	GS-2017A-Q-56	Bezanson	US	GMOS South	The Morphological Transformation of Compact Quiescent Galaxies as Revealed by Age Gradients and Rotational Support in Post-starburst Galaxies at z~0.6 (South)	6.20 HR
2	GS-2017A-Q-57	Bessiere	CL	GMOS South	Are all high luminosity AGN triggered at the peaks of major, gas-rich mergers ?	10.80 HR
2	GS-2017A-Q-58	Baron	CA	Flamingos 2,GMOS South	Wide orbit Exoplanet search with InfraRed Direct imaging	12.70 HR
2	GS-2017A-Q-59	Bahramian	CA	Flamingos 2	Determining the nature of donor stars in sub-luminous transient X-ray binaries	7.60 HR
2	GS-2017A-Q-60	Arias	AR	Phoenix Gemini South	Molecular emission bands in the symbiotic star BI Crucis	3.70 HR
2	GS-2017A-Q-61	Andersen	US	GSAOI	Probing the deepest inner of a massive star cluster in the making	3.30 HR
2	GS-2017A-Q-62	Abia	US	Phoenix Gemini South	The origin of fluorine: the contribution by AGB stars	20.20 HR
3	GS-2017A-Q-63	Tokovinin	US	Dssi Gemini South	Angular momentum in triple systems as a diagnostic of their formation (South)	6.00 HR
3	GS-2017A-Q-64	Thomas-Osip	US	GMOS South	Mutual event campaign to characterize AIDA target NEA Didymos (South)	6.80 HR
3	GS-2017A-Q-65	Singer	US	Flamingos 2	Going the Distance: Mapping Host Galaxies of LIGO and Virgo Gravitational-Wave Sources in Three Dimensions (South)	16.00 HR
3	GS-2017A-Q-66	Schlaufman	US	GMOS South	A Compact Object Companion to an Ultra Metal-poor Star in the Solar Neighborhood	11.00 HR
3	GS-2017A-Q-67	Rodriguez	CL	GMOS South	Testing Type II supernovae as cosmological probes at near-infrared wavelengths	20.20 HR
3	GS-2017A-Q-68	Pelisoli	BR	GMOS South	Time Resolved Spectroscopy of the Lowest Mass White Dwarfs (South)	14.00 HR
3	GS-2017A-Q-69	Pablo	J:US/CA	GMOS South	Adventures in Binarity: Confirming the First Binary Magnetar	6.50 HR
3	GS-2017A-Q-70	Oka	US	Phoenix Gemini South	Probing the Galactic Center's Molecular Gas using H3+ and CO	27.30 HR
3	GS-2017A-Q-71	Monaco	CL	GMOS South	A GMOS survey of CEMP stars	2.00 HR
3	GS-2017A-Q-72	Marchesini	AR	GMOS South	Looking for blazars in a sample of unidentified high-energy emitting Fermi sources II	4.50 HR
3	GS-2017A-Q-73	Liu	US	GMOS South	Spectroscopic Identification for Six Offset/Dual AGN Candidates at z~2 Selected by Centroid Shifts in Multi-epoch Quasar Images	9.00 HR
3	GS-2017A-Q-74	Levesque	US	GMOS South	Multi-Wavelength Monitoring of the Young HMXB SN 2010da	6.00 HR
3	GS-2017A-Q-75	Lee	KR	Flamingos 2	NIR spectroscopy of SNRs (South)	2.00 HR
3	GS-2017A-Q-76	Kane	US	Dssi Gemini South	Searching for Wide-Binary Companions to Exoplanet Host Stars	9.00 HR
3	GS-2017A-Q-77	Hinkle	US	Phoenix Gemini South	Isotopic abundances and binary star evolution	10.00 HR
3	GS-2017A-Q-78	Hillwig	US	GMOS South	Exploring Possible post-RGB Central Stars of Planetary Nebulae	21.70 HR

3	GS-2017A-Q-79	Eikenberry	US	Flamingos 2	The Source of Extreme IR Variability in a Galactic Center X-ray Binary	4.00 HR
3	GS-2017A-Q-80	Demarco	CL	GMOS South	Star formation histories in high-density environments: stellar populations in cluster galaxies at z=1.24	9.00 HR
3	GS-2017A-Q-81	Davidge	CA	Flamingos 2,GMOS South	Carbon Star Signatures in Integrated Light	34.00 HR
3	GS-2017A-Q-82	Chick	US	Flamingos 2	Characterization of Bowshock-Supporting Massive Runaway Stars	19.20 HR
3	GS-2017A-Q-83	Brittain	US	Phoenix Gemini South	Warm Molecular Gas in Systems Bridging the Primordial/Debris Disk Divide	8.00 HR
3	GS-2017A-Q-85	Bary	US	Phoenix Gemini South	High-Resolution Spectroscopy of Orbitally-Modulated Accretion Activity in Pre-Main Sequence Binaries	18.00 HR
4	GS-2017A-Q-86	Schlaufman	US	GMOS South	An All-Sky Search for the Brightest Metal-poor Stars (South)	142.50 HR
4	GS-2017A-Q-87	Schirmer	J:CL/US	GMOS South	Characterizing low-redshift Lyman-alpha blobs (South)	122.80 HR

Exploring the Universe, Sharing its Wonders



Gemini Observatory

Effective as of December 1, 2017

Appendix F. Completion of the 2017 Program Plan

The original 2017 Program Plan is included here, excerpted for brevity, and annotated with specific comments on progress in blue. We do not list optional projects undertaken on a best-effort basis, nor do we list additional activities and accomplishments during 2017. The main report body provides more explanation of these activities.

F.1 Science and Engineering Operations in 2017

F.1.1 Regular Operations

Regular day-to-day and night-to-night Operations is the Observatory's top priority. It includes the following items:

- Maintain the instruments and telescopes in working order consistent with the requested science time on sky; monitor performance and take remedial action as needed.
    - Shutter repair project completed at Gemini North.
- Run the International Time Allocation Committee (ITAC) process to combine the national TAC results into an executable queue and visitor program consistent with available time, conditions, and instrumentation.
    - ITAC meetings for 2016B and 2017A resulted in the successful scheduling of 337 science programs in the regular queue.
- Provide web-based documentation suitable for PI reference on instrumentation, software and Observatory processes.
    - Largely completed the Digital Governance project, which sets the standards and policies for an overhaul of the website in 2018.
- Support visiting observers in their execution of their own and others' programs on the telescopes.
    - Over Semesters 2016B and 2017A, a total of 77 visitor nights were executed at Gemini North, and a total of 119 were executed at Gemini South.
- Support visiting instruments as needed and as possible.
    - Supported multiple GRACES observing runs at Gemini North.
    - Supported one TEXES observing run at Gemini North.
    - Supported three PHOENIX observing runs at Gemini South.
    - Supported one DSSI observing run at Gemini South.
    - Commissioned 'Alopeke at Gemini North.
    - Worked with IGRINS team toward bringing IGRINS to Gemini South in 2018.
    - Worked with teams of several potential future visiting instruments.
- Propose and execute continual improvements in instrumentation, telescope, and enclosure to maintain performance levels.
    - Completed GMOS-N Hamamatsu CCD installation.
- Propose and execute continual improvements in operations software on behalf of the community and for internal usability, to maintain performance levels.
    - Commenced OCS upgrade project, involving members of the NGOs, User community and Gemini staff
- Propose and execute continual improvements in operations processes on behalf of the user community, with guidance and input from the appropriate committees.
    - Continued the simplification of Science Operations, agreeing a change to

Rollover and gathering further information on the consequences of balancing allocated, rather than executed, time.

- To ensure economical operations and a consistent interface with the user community, maintain approximate symmetry between the processes, equipment, and staffing at the two Gemini sites.
    - Executed real-time upgrades project at both Gemini sites.
    - Comprehensively shared information and expertise on GN shutter repair project.
- Staff the "third" and final level of a helpdesk to respond to queries from the user community. (The first two levels are (i) NGOs and (ii) instrument specialists at the NGOs.)
    - Ongoing activity.

F.1.2 Science and Engineering Operations Core Projects and Goals

In addition to this regular operations support, in 2017 we will undertake a number of projects to improve longer-term sustainability impact or to improve service to users.

- Implement first round of work on Observatory-wide Obsolescence Mitigation Plan
    - Completed majority of first round of work on the Longevity Program. Work will continue in 2018 and beyond on this 5 year project.
- Real-time Software Upgrades
    - Completed more than half of the work on this project.
- Replace the Gemini North dome shutter drive chains and gearboxes
    - Completed within budgeted down time and cost.
- Science Operations Model Upgrade
    - Completed approximately half of the planned work and the project will continue in 2018.
- Upgrade the Cerro Pachón Network Link
    - In 2017 we established a new redundant microwave link to Cerro Pachón from the AURA Recinto in La Serena. This link provides for more reliable network connections to the summit in the event of downtime in the regular link provided via CTIO. Work on the LSST fiber optic connection is nearly complete. This work is outside of Gemini's control, but we expect to begin using the upgraded network link in 2018.

F.1.3 Science User Support in 2017

The Science User Support Department (SUSD) advocates for the users and enables Gemini Principal Investigators to produce world-class scientific results in a timely manner. The SUSD leads post-observing user support. Its staff maintain a data reduction package for the user community that enables astronomers to remove instrumental signatures from data obtained using Gemini facility instruments, and they support its use. The SUSD maintains communications between the Observatory and the National Gemini Offices and ensures that NGO staff members receive appropriate training. Specific goals for 2017 follow.

- Complete implementation of a coherent system of user communication throughout the "science lifecycle", including regular support for the Data Reduction User Forum (DR Forum), post-observing contact with PIs, and improvements to the regular support mechanism that the Helpdesk currently provides.

- Evaluate DR Forum traffic in the context of the "user contributor" role (Q1)
  Completed. Contributors found to increase posts and decrease staff effort.
- Begin collecting and tracking user satisfaction data and feedback (Q1)
  Completed. We have collected data for three of four phases (including one repeat) of the science lifecycle. The fourth phase will be launched in 2018Q1 and then we will continue to run four surveys each semester.
- Implement new external Helpdesk (Q2)
  Delayed into 2018 due to lack of resources.
- Implement post-observing contact with PIs and revise Contact Scientist duties and responsibilities (Q4)
  Ongoing. Expected completion in 2018Q1.

- Improve data reduction software documentation and cookbooks.
  - GNIRS cookbook (Q2)
    Delayed indefinitely in favor of work on a GSAOI cookbook as a higher priority among users.
  - FLAMINGOS-2 cookbook (Q2)
    Ongoing. Expected completion in 2018Q1.
- Release Python science quality data reduction software for facility imaging modes (GMOS, F2, NIRI, and GSAOI) for users (Q3).
  - Delayed into 2018 due to lack of resources.
- Update Gemini IRAF for new GMOS-N Hamamatsu CCDs (Q2) and F2 MOS mode (Q1). These will be the last releases of Gemini IRAF.
  - GMOS-N Hamamatsu support released on time. F2 MOS mode testing and release waiting on commissioning data.

F.2 Instrumentation and Facility Development in 2018

The 2018 plans for instrumentation and facility development build on several substantial on-going projects. We list principal objectives for the year in Table F-1. Table F-2 outlines our goals for the lower priority projects we will execute on a best-efforts basis. We expect to make substantial progress on many of these projects while understanding that we may postpone or alter any and/or all of them to accommodate increased needs for any of the higher priority projects.

Project	2017 Plan
GHOST	Start on-site testing at Gemini South (Q4)
OCTOCAM	Preliminary Design Stage Review (Q2)
Toptica Laser for GN	Commission on telescope (Q2)
GNIRS controller	Complete engineering level design and testing (Q4)
Instrument Upgrades	Complete 2016 project 1 (Q3); Start 2016 project 2 (Q1); Start 2017 Project (Q2)
NGS2	Receive, test, and install (Q3)

Table F-1: High-priority projects for Development and their planned activities in 2017

- GHOST completed its final design review in May, 2016 and the instrument is now in the build phase. On site preparations for GHOST are on track for delivery in late 2018.

- OCTOCAM successfully completed its Conceptual Design Review in August, 2017. The next major project milestone is the Preliminary Design Review scheduled for May, 2018.
- The GS Toptica laser was installed and commissioned. The laser is working as promised, producing significantly better results with much less maintenance and downtime.
- The GN Toptica laser was delivered to the telescope and is in the lab going through acceptance testing as of late 2017.
- The 2017 Instrument Upgrade Program selection process is complete and we expect to sign the contract and start work in 2018.
- Work on NGS2 continued and delivery is now expected in 2018.

Project	2017 Goals
A&G	Demonstrate new mechanism controller functionality with all required mechanisms
	Test and characterize new wavefront detector system for higher sensitivity
Altair	Start contracted work to replace the real-time computer to allow for higher performing algorithm implementation
	Commission the new Altair dichroics
DM0	Receive DM0 and electronics to serve as spare for existing DMs.
IR Detector Controller	Demonstrate ARC controller with Multiplexer
	Develop requirements for software needed to support new controller

Table F-2: Goals for non-priority Development projects in 2017

- A&G proceeded on a best-effort basis in 2017, with mostly some prototyping and bench-testing completed. The A&G will become part of the Longevity Program in 2018.
- Work on the Altair RTC is waiting for contractor resources and contractor discussions will resume in early 2018. We started commissioning the new L+M band dichroic and expect to offer it to the community in 2018. The GMOS-N dichroic commissioning will be some time after the new laser is commissioned in 2018.
- DM0: In 2017, Xinetics completed the mirror and Cambridge Innovations expects to complete the electronics in early 2018, after which we will do integrated testing at Xinetics prior to shipping to Gemini South.
- The IR detector controller project proceeded on a best-effort basis in 2017. The project is slated to receive higher priority and more resources in 2018.

F.3 Administration & Facilities and Safety in 2017

F.3.1 Finance and Administration

Administration provides cost-effective administrative support and delivers timely and accurate information to management and governance. The Administration and Facilities Group (AFG) supports in the areas of facilities, infrastructure, fleet, administration, visitor services, and travel services to staff and visitors. The Finance team delivers financial guidance and information to management to support executing budgets within the Board authorized limits. Specific goals for 2017 follow, to be completed by the end of the year.

- Budgetary responsibility
    - Following a May 2017 Board approved revision to the budget, Gemini completed the 2017 within [-2%; +3%] of the approved O&M Budget ($32.0M).The following table shows O&M's 2017 approved budget and 2017 spending, and 2017 spending vs budget variance of 1.6%.

Expense Code	2017 Approved Budget	2017 Spending	$ Variance 2017 Spending vs Budget	% Variance 2017 Spending vs Budget
TOTAL WAGE & BENEFITS	20,913,458	20,418,806	-494,652	-2.40%
PERMANENT EQUIPMENT	887,179	924,842	37,663	4.20%
TRAVEL	912,432	976,211	63,779	7.00%
PARTICIPANT SUPPORT	88,600	143,367	54,767	61.80%
OTHER DIRECT COSTS	6,722,587	7,403,574	680,987	10.10%
INDIRECT COSTS	2,193,500	2,393,500	200,000	9.10%
UFE	47,735	0	-47,735	-100.00%
TOTAL NON LABOR	**10,852,033**	**11,841,495**	**989,462**	**9.10%**
TOTAL EXPENSE	**31,765,491**	**32,260,301**	**494,810**	**1.60%**

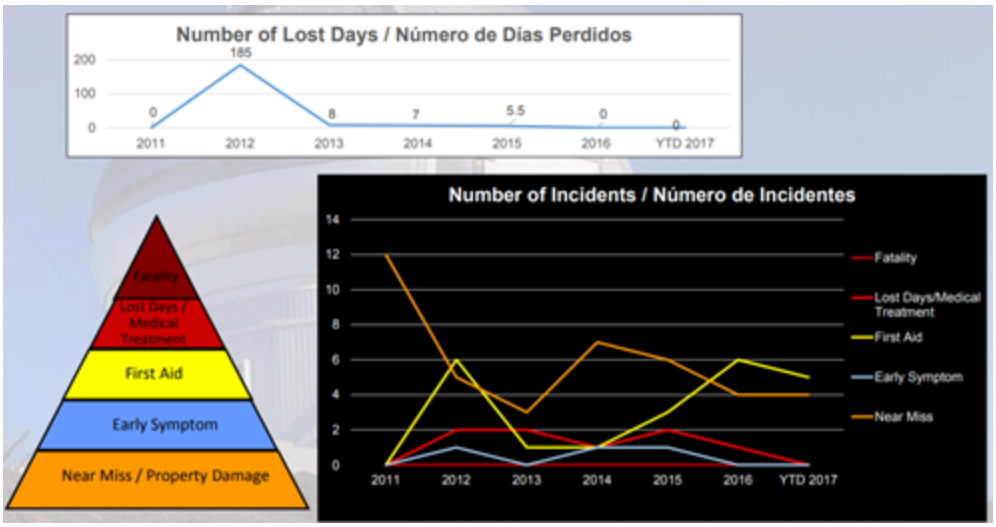
Table F-3: O&M's 2017 approved budget and 2017 spending, and 2017 spending vs budget variance of 1.6%.

- Business Services
  - Implemented CONTROL V10 ®, the most recent version of CONTROL planning and reporting system, and delivered one-on-one training sessions in May, June and July, 2017.
- Business Systems Review (BSR)
  - Gemini joined AURA's policies working group, and assisted with reviewing and developing revised policies that address findings in recent AURA's BSRs and set unified guidelines for AURA's NSF funded centers. NSF external auditors completed the AURA/Gemini accounting systems audit, and Gemini implemented actions in response to the NSF external auditors' recommendations as stated in the audit report.
- Facilities Services
  - Completed several upgrades to HBF & SBF facilities
  - Signed contracts for final phase of Gemini North Energy Savings. Work will be completed in 2018

F.3.2 Safety

The Safety program assures a safe and healthy environment for employees and visitors. Gemini's working culture explicitly emphasizes safety of people and equipment. Safety will fully integrate safety into the Observatory operational activities, and will work jointly with partner telescopes on Cerro Pachón and Maunakea to establish shared Safety programs that combine best practices and resources. Specific goals to complete by the end of 2017 follow.

- Staff Safety
  - Began migration of staff safety training to the SafetyPlusWeb system. Migration will be complete in early 2018.
  - The following chart shows the decreasing trend of safety incidents and lost days since 2012 to date:



- Safety Operations
  - Refurbished Safety Leadership Team that is responsible for advising the Director on safety policies and practices.
- Managers' Safety responsibilities
  - Worked with Managers to train them on their roles and responsibilities regarding safety.
  - Hired a Safety Specialist for Gemini South who assisted Gemini South operation managers to complete Safety training and strengthen the Manager's Safety role.

F.4 Public Information and Outreach in 2017

We will continue our regular local outreach programming, including: Journey Through the Universe (*JTTU*), Viaje al Universo (*Viaje*), AstroDay, StarLab, media relations, publications, electronic and social media, user communications support, PIO internship, library services, and science result tracking. We also identify the following specific expanded activities to complete in 2017.

- Integrate assessment into local observatory STEM career awareness as pilot at Gemini North; utilizing outside contracted evaluation firm to assess student and teacher understanding of Observatory career opportunities. (Q3)
  - Completed with one additional assessment event planned for early 2018. Initial data expected from contractor by end of 2017.
- Expand Observatory STEM career resources outreach program to include a minimum of 3 new events/activities at each site over the full year, to increase awareness and understanding of observatory career opportunities available in host communities. (Q4)
  - Completed with Journey career panel events and assessment events at GN and new *Viaje* events (throughout year) at GS.
- Extend *JTTU/Viaje* beyond concentrated "Journey Week" into multiple (minimum of 6) year-long activities, interactions, and programming in local host communities. (Q4)
  - Completed with several teacher summit tours at both sites, career events and expanded StarLab programming. Additionally a Next Generation Science Standards event for teachers was supported by Gemini in Hawai'i.

- Expand capacity of new Gemini-South PIO hire in user communications support and media relations.
    - Implement formal training and work-plan for new position (Q1)
      Completed
    - Independent completion of at least 2 press releases and 2 web features (Q3).
      Completed with two press releases and 4 webfeatures
    - Expand (and update) international media contact list to 50 relevant journalists (Q4).
      75% completed as of 12/15/17 with remaining work expected to be finished by the end of December by PIO intern.
- Integrate new press release template within Gemini website (Q1)
    - Template completed, pending full integration of Drupal 7 which is behind schedule but on track for completion by end of 2017.
- Complete audience segregation of social media content into separate (distinct) accounts (Q2)
    - Approach modified based on study of best practices and implemented approach in which we identify audience by hashtags (#public, or #user).

F.5 Gemini External Relations in 2017

- Members of Gemini's staff attended the XIV Annual Meeting of the Chilean Astronomical Society Astronomía (SOCHIAS) on January 23-26, 2017 and Laura Ferrarese, Gemini's Interim Director, attended the Annual Meeting of the Canadian Astronomical Society (CASCA) from May 30 to June 1, 2017.

- Develop Strategic Plan to implement Gemini Board's Strategic Vision
    - Chief Scientist presented progress on developing the Strategic Plan to the GBOD at its November 2017 meeting.

- Lead the development of memoranda of understanding with any new limited-term Partners
    - Signed MOU with Ben-Gurion University for a limited-term partnership.
    - Signed MOU with Weizmann Institute for a limited-term partnership.

F.6 HR Plans in 2017

The following goals focus on increasing staff satisfaction and engagement, as measured by achieving a staff voluntary turnover rate below 6%.

- Implement changes to researcher roles, including changing time allocations for research, specialized roles for Fellow vs. Scientist vs. Astronomer, collaborative activity of Instrument Scientists, and support of Science User Support Department activities
    - Completed.
- Issue completed Manager's Handbook
    - Completed.
- Identify and implement actions following the Staff Engagement Survey.
    - In progress.

Appendix G. Staff Accomplishments

G.1 AURA Awards

G.1.1 Science Award

Mischa Schirmer, assistant scientist, for research on Green Beans their connection to high redshift Ly-α blobs

In 2013 Mischa published the discovery paper (Schirmer et al. 2013, ApJ, 763, 60) on a rare type of galaxies *Green Beans*, first found by accident in an observation from the Canada-France-Hawaii-Telescope of a galaxy cluster at redshift 0.45. Recognizing the potential importance of these objects, Mischa selected a complete sample of similar candidate objects from the Sloan Digital Sky Survey covering redshifts 0.12-0.35. Only 17 such galaxies were found in this redshift interval. Mischa's follow up observations with Gemini, provided accurate redshifts, and confirmed the presence of extremely luminous oxygen emission, [OIII], in these objects.

In his latest paper (Schirmer et al. 2016, MNRAS, 463, 1554), Mischa pulls together multi-wavelength observations of this 17-object sample, stretching from X-ray with *Chandra*, UV with *GALEX*, to optical from *Gemini, VLT* and other ground based observatories, and mid-IR from *WISE*. He then proceeds to argue that the *Green Beans* are indeed Ly-alpha blobs. However, even though they look similar to the very luminous Ly-alpha blobs at z>2, the cause of their ionization, which we see as the strong oxygen emission, is the left over ionization from now inactive Active Galactic Nuclei (AGN). Thus, the cold accretion that is thought to be the cause of the high-redshift Ly-alpha blobs must have ceased at some point earlier than redshift 0.3. The rarity of these objects at redshift 0.3 means that the duration of this phase in the life of the AGN must be extremely short; Mischa proposes AGN flickering as the explanation of the properties of the objects.

It is now clear that what started as a serendipitous detection of a usual object in an imaging observation, has led to the discovery of a new class of rare objects, Ly-alpha blobs at low redshift. Those objects in turn enable us to understand the ionization sources of Ly-alpha blobs and their evolution over time. Ultimately through understanding of the frequency of the occurrence of these objects over time can contribute to the understanding of the AGN duty cycle and evolutionary phases.

G.1.2 Service Award

David Moe, Gemini North Facility Specialist

General Criteria: During the past 19 years of continuous service to AURA Gemini Observatory, David has constantly strived to anticipate the service requirements of the users of Gemini's facilities. David values the human dimension of his job. He readily responds to the service requirements of his internal customers and actively communicates the status of their service requests. In order to keep an agile and equitable service process, David is a champion of the facilities helpdesk system that is now used extensively by Gemini's users to request facilities and administration services. David has helped to develop the capacity of Gemini's facilities contractors; for instance, during the past year he managed a set of contractors that Gemini retained to work on facilities improvements and energy projects, and he worked jointly with the

AFG-N and Safety Managers to certify the safety and insurance compliance of all contractors. No new contractors were allowed to work in Gemini's premises unless they could certify that they were in compliance with Gemini's Safety and insurance requirements.

Excellence in Service. David exceeds the service expectations of the AURA Gemini facilities' users, and treats all customers as his guests in his own home. David solves problems quickly and, through applying his interpersonal skills, he's able to turn naysayers into advocates. A challenge that David has faced over time has been the increasing time demand needed to keep up with the service level, and in response to this challenge he has developed strong time and task management skills.

Focus on Service Contribution. David's contributions have been fundamental to the timely completion of Gemini's facilities projects. David developed the Gemini Recycle Program for Gemini North and created a tool to manage the inventory of the Shipping & Receiving area. David has also been a key collaborator to the improvement of GN Base facilities infrastructure and, with a reduced budget, he managed the renovation of GN countertops and replaced offices' carpets at the GN Base Facilities (HBF). David has also contributed to Gemini's energy projects, namely the implementation of LED lights and the establishment of PV panels at Gemini's Hilo Base Facilities.

Performance above and beyond the specifications. David completed the Train the Trainer Forklift Certification Class, and he offered Forklift operational training to GN and AURA-CAS staff members. In addition to supporting the professional growth of his team members, David's action contributed noticeable savings to Gemini's budget. In the pursuit of his professional growth, David has also filled in for the AFG-N manager when needed. David has gone beyond his job specifications, assisting colleagues whenever they need extra help or when they are away on a planned leave.

G.1.3 Technology/Innovation Award

Chas Cavedoni, Lead Mechanical Engineer; Paul Collins, Electrician Supervisor; and Steve Hardash, Gemini North Head of Engineering Operations; for envisioning and leading the projects to procure and install photovoltaic panels on Gemini North and Gemini South.

During the period 2014-2016 Gemini has installed three large photovoltaic systems to lower our electricity cost at our facilities and to lower our carbon footprint. Photovoltaic systems are now in operations at the two summit facilities, Gemini North on Maunakea and Gemini South at Cerro Pachón, as well as at the Gemini North Base Facility in Hilo.

The successful installations of the photovoltaic systems are large components of the Transition Program, now complete, at Gemini. The electricity from the photovoltaic systems result in savings at Gemini North of about $60k and $35k annually at the summit and the base, respectively, producing 10% and 20% of the required electricity at the two facilities. At Gemini South the savings are $55k annually and the system produces 22% of the required electricity at the Gemini South summit facility.

Paul Collins championed the idea of photovoltaic systems and inspired us to consider installation of photovoltaic panels at Maunakea. He then led the project to install the photovoltaic system at Cerro Pachón, always seeking the best solution for Gemini. His work significantly improved the implemented solution and ensured that we got the most efficient system for the funds available. After the installation was complete, our power factor significantly

worsened. This was a known consequence that needed further work. Thanks to Paul's perseverance and interest in this problem we now better understand this issue, and Paul has adjusted the photovoltaic system such that our power factor is much better even than before installation of the photovoltaic system. This will add further savings on the electricity cost. It improves our energy transfer efficiency on the summit of Cerro Pachón, which will benefit all telescopes operating there.

Chas Cavedoni was the project manager on the two Gemini North projects. Chas went well beyond the expectations for a project manager in understanding both the potential of the Maunakea site due to altitude and temperature, and the optimization of the selection of equipment given the limited roof area available for the system. Chas was also instrumental in navigating the many approval layers for work on both Maunakea and at our base facility in Hilo, always providing technically accurate and well-documented information to all relevant parties.

Steve Hardash served as the expert in the area of photovoltaic electricity production and available equipment. He guided the design decisions, based on his previous experience in the area, to ensure that the best possible equipment was chosen both for the electricity production itself and for the mechanical installation of the panels on our roofs, keeping in mind that hurricane force winds can be encountered at the altitude of Maunakea.

The installation of the photovoltaic systems has attracted attention from other observatories at Maunakea, who are interested in similar installations to lessen their carbon footprint and lower their electricity expenses. The Gemini North Maunakea photovoltaic system has also been featured extensively in the press as the highest altitude grid-connected photovoltaic system in the world, as well as the second highest overall (the highest altitude system is located in Tibet).

The installations of the photovoltaic systems are a very visual consequence of Gemini's commitment to our positive stewardship of both telescope sites, Maunakea and Cerro Pachón, and our planet. The three staff members included in this award nomination were instrumental in seeing the work through.

G.1.4 Team Award

Nominee: Base Facility Operations (BFO) Team, Gemini Observatory

As of the end of 2016, after a two-year team effort spanning essentially the entire Observatory, both Gemini North and Gemini South telescopes operate from their respective base facilities. We propose the BFO team for the AURA team award, for completing an extraordinary and highly successful project.

The proposal to operate Gemini's two telescopes from their respective base facilities in Hilo and La Serena was first made in earnest in the very first "Transition Plan" which sought to deal with the impending departure of the UK from the Gemini partnership in 2012. At that time, very few telescopes, even of much smaller aperture, were operating from the base and the challenges of operating an 8-m remotely were quite unknown; however the benefits of doing it were clearly recognized, both intrinsically (saving money by bringing night staff down from the expensive mountain lodging) and as a stepping stone to possible future remote operation from anywhere in the world.

BFO's project management team comprised members of both Development and Operations divisions, and the extended project team included members of every department within the observatory. BFO required all of its staff to work together more closely than they had ever done

before in order to accomplish their complex objectives in a small amount of time. Although the original proposal was made in 2010, concerted work did not begin until late 2014 with the team nominated here. The project had two false starts (with different teams) earlier, which for various reasons did not get past the planning stage; these aborted attempts left the team with much less time than originally envisioned to complete their work and forced them to overcome difficult team management challenges at the very start of the project.

Team members from one Gemini site were required quite frequently to work at the other site. Since the engineering department at Gemini North was already at its post-transition staffing level by that time, the project needed to bring staff from Gemini South to work in the North. A number of Gemini South engineering staff spent significant amounts of time in Hilo through 2015, working along with the Hawaii staff to effect the long list of changes that were needed to make base operation a safe reality. Around ten staff in all made the trip and others provided support from Chile.

In many large projects, the task of documenting what was done is one of the most challenging and is often done late (if ever) and ends up incomplete. However the team determined that the project mantra “do the bare minimum” did not mean sacrificing quality or, in particular, documentation. It is a tribute to the team that almost all of the required documentation was delivered on time and of suitable quality to get approval from the “customer” - Gemini Operations. The BFO team blazed a number of other trails for Gemini, including being the first major internal project to make significant use of the PRINCE-2 project management methodology, which Gemini had adopted just before BFO started work. The team also made every attempt to learn and document its own lessons, and this resulted in some significant changes in how the Gemini South part of the project was organized, starting at the beginning of 2016. In the coming year, we intend to use the results and lessons of the BFO management team to provide standards, templates, and examples for future internal project at Gemini.

The first night of operation of a major facility from the base might be expected to be somewhat tense. But by “first night” in Hawaii, essentially the only change was that observers were working with more oxygen in their lungs. The final transition to working from the base went off without significant issues at either site. Operationally, the final move was a “non-event”. The project had been granted significant amounts of night time engineering time had it proved necessary, and the original specification allowed the project to result in a significant percentage of lost observing time (in exchange for all the other benefits). In practice, no engineering time was used and virtually no time has been lost to faults with BFO-provided systems.

Gemini is the first 8-m observatory routinely running night time operations from sea level, an extraordinary achievement and (we propose) one worthy of the AURA team award.

BFO was a team effort supported by staff members across the entire Observatory. This table lists the main core-team contributors.

Andy Adamson	Herman Diaz	Francisco Meza	Chris Stark
Monica Araya	Jeff Donahue	Chris Morrison	Hector Swett
Gustavo Arriagada	Carlos Figueroa	Keane Nakatsu	Eduardo Tapia
Cy Bagano	Pedro Gigoux	Atsuko Nitta	Eduardo Toro
Chas Cavedoni	Steve Hardash	Arturo Nuñez	Harlan Uehara
Simon Chan	Stacy Kang	Gabriel Perez	Cristian Urrutia

Fabian Collao	Stan Karewicz	John Michael Plaza	Jose Varas
Paul Collins	Markus Kissler Patig	John Randrup	Vicente Vergara
Dolores Coulson	Beverley Lidyoff	William Rambold	Mike Westfall
Martin Cordova	Diego Maltes	Rolando Rogers	
Tom Cumming	Neal Masuda	Andrew Serio	

G.2 Invited Talks

Trent Dupuy

"Exploring Substellar Evolution with the Coldest Brown Dwarfs" at the 229th AAS meeting special session: W. M. Keck Observatory: A Resource for NASA and the Entire US Community, Grapevine, Texas (January 5, 2017).

"PSF-Reconstruction at Keck & (Sub)Stellar Science" at the CfAO Fall Science Retreat, Lake Arrowhead, California (October 21, 2017).

Tom Geballe

"Adventures with H3+: in the Laboratory, Planets, Interstellar Clouds, the Galactic Center, and Beyond" at Carnegie Institution of Washington, Washington DC, Oct 10, 2017.

Sandy Leggett

"From White to Brown and Banded - Dwarfs and their Atmospheres" at BDEXOCON 2017, University of Delaware, US (October 27, 2017).

Siyi Xu

"Planetary Systems around White Dwarfs" at Institute for Astronomy, University of Hawaii, USA (December 13, 2017).

G.3 Additional Awards & Honors

Meg Schwamb

Carl Sagan Medal for Excellence in Public Communication in Planetary Science (American Astronomical Society, Division for Planetary Sciences) - Awarded October 2017 at the AAS DPS Meeting in Provo, UT.

Asteroid named for Meg Schwamb

(11814) Schwamb = 1981 EW26 Discovered 1981 Mar. 2 by S. J. Bus at Siding Spring. “Megan Schwamb (b.1984) is a scientist at the Gemini Observatory in Hilo, Hawaii, whose research includes the search for trans-Neptunian objects”.