Dark Energy Camera (DECam) images of the Galactic bulge from the Blanco DECam Bulge Survey (BDBS) as shown on six monitors in the Blanco control room. Each monitor shows a one-chip image; all six represent only 10% of DECam’s 60-chip field of view. The color images are constructed from a single raw exposure in each of $Y$, $z$, and $i$ filters, which correspond to red, green, and blue, respectively. This image is centered near $(l,b)_{J2000.0} = (7.11^\circ, -1.63^\circ)$.

Image credit: Will Clarkson (U. of Michigan-Dearborn), Kathy Vivas (NOAO), R. Michael Rich (UCLA), and the BDBS collaboration.

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1 OBSERVATORY MANAGEMENT

1.1 SUMMARY OF OBSERVATORY ACTIVITY

From FY14 NSF base funding, NOAO plans to deliver and/or enable:

- Deliver detailed transformation plans, to be executed in FY15, per NSF directives.
  
  **Status:** A document entitled “NOAO Transformation Plan FY16” was delivered during the first quarter (Q1) of FY14 and then reviewed by the NSF NOAO Program Review Panel later that quarter.

- Operation and maintenance of NOAO facilities in Tucson and on Kitt Peak (Mayall 4-m, WIYN 3.5-m, and 2.1-m telescopes).
  
  **Status:** On-going. Specific highlights included completion of commissioning for the new Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS), support for the Dark Energy Spectrographic Instrument (DESI) project, and start of closure of the KPNO 2.1-m telescope. See the subsections of section 2.2 (NOAO North) for further information.

- Operation and maintenance of NOAO facilities in La Serena (including the AURA recinto—compound) and on Cerro Tololo and Cerro Pachón (Blanco 4-m and SOAR 4.1-m telescopes).
  
  **Status:** On-going. Specific highlights were improvements in the Blanco telescope’s Delivered Image Quality (DIQ) and completion of the first year of the Dark Energy Survey (DES). See the subsections of section 2.1 (NOAO South) for further information.

- Scientific user support services and community development activities for the non-NOAO facilities within the US Ground-Based Optical/Infrared (O/IR) System, especially the Gemini Observatory.
  
  **Status:** Beyond Gemini, significant effort was focused on the community development activity for the Large Synoptic Survey Telescope (LSST) and the Thirty Meter Telescope (TMT). See section 2.3.3 (System Community Development) for further information.

- Community and DES operation of the Dark Energy Camera (DECam) at the Blanco 4-m telescope.
  
  **Status:** The first year of the Dark Energy Survey (DES) was completed successfully during the second quarter (Q2) of FY14. DECam has proven to be extremely popular with the user community. See section 2.1.1 (Cerro Tololo Inter-American Observatory) for further information.

- Final science verification and operations of the SOAR Adaptive Module (SAM) at the SOAR 4.1-m telescope.
  
  **Status:** Completed during Q2. SAM is now available to the entire SOAR user community. See section 2.1.1 (Cerro Tololo Inter-American Observatory) for further information.

- Commissioning, science verification, and operation of the Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS) at the Mayall 4-m telescope.
  
  **Status:** Completed during the third quarter (Q3) of FY14. KOSMOS is now available to the entire Mayall user community. See section 2.2.1 (Kitt Peak National Observatory) for further information.
• Commissioning and operations of the repaired and upgraded f/8 secondary mirror at the Blanco 4-m telescope.

**Status:** Completed during Q3. The f/8 instruments are available once again to the NOAO user community. See section 2.1.1 (Cerro Tololo Inter-American Observatory) for further information.

• Commissioning and operations of the Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS) at the Blanco 4-m telescope.

**Status:** Nearly completed. COSMOS was delivered to CTIO during Q2. The initial (and very successful) commissioning run was completed during Q3. Final commissioning activity is planned for the fourth quarter (Q4) of FY14. See section 2.1.1 (Cerro Tololo Inter-American Observatory) for further information.

• Delivery to Cornell University of a complete detector package for TripleSpec4, a medium resolution near-infrared spectrograph for the Blanco 4-m telescope.

**Status:** On-going. All technical work is expected to be completed during FY14, but delivery to Cornell will occur in early FY15 to accommodate the revised laboratory integration plan at Cornell. See section 2.4.1 (System Instrumentation) for further information.

• Design and development activity for the Large Synoptic Survey Telescope (LSST), including telescope systems and on-site support facilities.

**Status:** All planned work is completed. Subject to final NSF approval, LSST is expected to transition to the construction phase during Q4. See section 2.4.2 (LSST Technology) for further information.

• Science data management services that are focused on immediate NOAO needs, including science operations of the Dark Energy Camera and WIYN One Degree Imager.

**Status:** On-going per plan. See section 2.3.3 (Science Data Management) for further information.

• Education and Public Outreach program that is focused on critical, local activities and needs while maintaining a national (global) perspective through targeted, innovative programs.

**Status:** On-going per plan. See section 3.2 (Education and Public Outreach) for further information.

• Technical and management support/planning for the deployment of the Dark Energy Spectroscopic Instrument (DESI) on the Mayall 4-m telescope.

**Status:** Anticipated DESI-related activities shifted from early FY14 toward mid-FY14 as needed, in large part due to the rescheduling of the DESI Critical Decision Review 1 from Q2 to Q4. NOAO was able to accommodate these changes and delivery-required work. See discussion in section 2.2.1 (Kitt Peak National Observatory) under “Program Highlights” for further information.

• Science support activities for LSST and the LSST community.

**Status:** On-going. Specific highlights include continued progress on the LSST Operations Simulator (OpSim) project, Arizona-NOAO Temporal Analysis and Response to Events System (ANTARES), and planning for the LSST survey cadence workshop. See section 2.3.3 (System Community Development) for further information.
• Administrative and facility operations services necessary for an organization with more than 250 employees at two geographically distributed sites.

**Status:** On-going without major unforeseen incidents. See sections 2.1.3 (NOAO South Facilities Operations), 2.1.4 (NOAO South Computer Infrastructure Services), 2.2.3 (NOAO North Central Facilities Operations), 2.2.4 (NOAO North Computer Infrastructure Services), and 3.3 (NOAO Director’s Office) for further details.

From FY14 (or earlier) NSF supplementary funding, NOAO plans to deliver and/or enable:

• Annual Research Experiences for Undergraduates (REU) programs in Tucson and La Serena.

**Status:** Completed per plan. See sections 3.2.

• Continued support of current partners (Vanderbilt University/Fisk University and South Carolina State University) in the Partnerships in Astronomy & Astrophysics Research and Education (PAARE) program.

**Status:** No PAARE students have been forwarded to NOAO during FY14. These programs have now been completed.

• Additional design and development activity for LSST.

**Status:** Comingled with base funded activity, see above.

• Delivery of the Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS) to the Blanco 4-m telescope.

**Status:** Completed during Q2, see above.

• Continue construction of a new, medium-resolution near-infrared spectrograph (TripleSpec) for the Blanco 4-m telescope through a sub award to Cornell University (ReSTAR Phase 1).

**Status:** On-going per plan. Delivery by Cornell University to NOAO is on-schedule for Q1 of FY15. See section 2.4.1 (System Instrumentation) for more details.

• Participation in the development of scientific user support services for the Virtual Astronomical Observatory (VAO).

**Status:** Due to VAO funding reductions by NSF, the scope of work for NOAO under its sub-award was significantly reduced. All work assigned to NOAO under the revised plan is proceeding according to schedule. See section 2.3.2 (Science Data Management) for further information.

On a cost-recovery basis, NOAO also plans to deliver and/or enable:

• Technical and facility operations support services for tenant and/or partner observatories on Kitt Peak, Cerro Tololo, Cerro Pachón, and Cerro Las Campanas.

**Status:** On-going per plan. See section 3.2 (Education and Public Outreach) for further information.
1.2 ORGANIZATION AND KEY MANAGEMENT CHANGES

The organizational structure as presented in the NOAO Annual Program Plan FY 2014 (with two changes):

The top-level NOAO organization chart for FY14 is shown in the above figure. Circles are top-level programs. Boxes are major sub-activities. Activity managers are shown in parentheses.

On 1 February 2014, Dr. Nicole van der Bliek stepped down as the interim Associate Director for NOAO South and Director of CTIO. Dr. Stephen Heathcote assumed both of those positions on that date. During FY14, Jeff Barr transferred to the LSST Project, and his duties as Head of Program for NS Facilities Operations are being handled temporarily by Nicole van der Bliek.
2 NOAO DIVISIONS

2.1 NOAO SOUTH

The NOAO South (NS) division is responsible for operations, maintenance, and development for all NOAO activities in Chile. For program management purposes, these activities are separated into the following subprograms:

- Cerro Tololo Inter-American Observatory
- NOAO South Engineering & Technical Services
- NOAO South Central Facilities Operations
- NOAO South Computer Infrastructure Services

2.1.1 Cerro Tololo Inter-American Observatory

Program Highlights

Science

- Almost the first images obtained for the Dark Energy Survey (DES) permitted the discovery of DES13S2cmm, a new member of the exotic class of superluminous supernovae, by Andreas Papadopoulos (University of Portsmouth) and colleagues as reported at the UK National Astronomy meeting 2014 (Figure 1). DES13S32cmm joins the less than 40 members of this class of objects, which at maximum can be 10 to 50 times brighter than the brightest normal supernova. However, the very slow decline in brightness of DES13S32cmm sets it apart from other members of the class and presents challenges to efforts to understand how it is powered; producing its peak luminosity through radioactive decay, as in normal supernovae, would require production of more than three solar masses of $^{56}\text{Ni}$ and could not explain the very slow decline in brightness, while more exotic models invoking a “Magnetar” at the core of a normal supernova to boost its luminosity are also a poor fit to the observed light curve.

![Figure 1: Before (left) and after (center) images of the region where the superluminous supernova DES13S2cmm was discovered. On the right, the difference of these two images shows the bright new supernova. (Image credit: Dark Energy Survey.)](image-url)
• Francisco Forster (Center for Mathematical Modeling, Universidad de Chile) and colleagues, including R. Chris Smith (NOAO/AURA), have used a novel, real-time, high-cadence image subtraction pipeline to process Dark Energy Camera (DECam) data to detect 12 candidate supernova explosions within hours of their becoming visible. To achieve this, forty fields were observed with DECam, every two hours, for a period of five nights, allowing time series photometric monitoring of more than a million potential host galaxies. The resulting images, totaling more than 400 Gigapixels, were transferred in real time to computers at the Laboratorio Nacional de Computación de Alto rendimiento (NLHPC), in Santiago, where they were processed through the pipeline. The rapid detection allowed follow-up spectra to be obtained for three of the candidates by PESSTO, the Public ESO Spectroscopic Survey for Transient Objects, using the 3.5-m New Technology Telescope (NTT) on La Silla within only three nights of discovery, and using the FORS2 spectrograph at the Very Large Telescope (VLT) some eighteen days after discovery. From the FORS2 spectra, one of the targets was classified as a Type Ia supernova, the other two as Type II, all near maximum light, implying that discoveries were made within a few days (possibly hours) of the explosion.

• P. Melchior (Ohio State University) and colleagues have measured the weak-lensing masses and galaxy distributions of four massive galaxy clusters observed during the science verification phase of the Dark Energy Survey (DES) (arXiv:1405.4285, MNRAS 2014). Melchior et al. first performed rigorous quality control tests to demonstrate that the DECam data are suitable for lensing analyses, and explored the optimum data reduction procedures and parameters for this purpose. They then exploited DECam’s large field of view to map out the clusters and their environments on scales of up to 90 arcmin. For each of the clusters, photometric redshifts were used to reject foreground and background galaxies and a “red cluster sequence” finding algorithm was used to measure cluster richness and map galaxy distributions, while Navarro, Frenk and White (NFW profile fitting was used to gauge weak-lensing masses. For three of the clusters studied, the derived weak-lensing masses for the inner regions are in good agreement with previous work, while for Abell 3261 (Figure 2) this work provides the first estimate of weak-lensing mass and richness. In addition, Melchior et al. find that the cluster galaxy distributions of 1E 0657-56 and RXC J2248.7-4431 indicate the existence of filamentary structures stretching out as far as one degree (approximately 20 Mpc), showcasing the potential of DECam and DES for detailed studies of degree-scale structure.

![Figure 2: Weak-lensing mass and galaxy distribution of Abell 3261. (left) Multi-color image of the inner 5 arcminutes of the cluster; (center) weak-lensing aperture mass significance map of the inner 30 arcminutes, overlaid with cluster member galaxies identified on the basis of photometric redshifts and red sequence cluster identification (black dots); (right) the distribution of cluster member galaxies over the full 90-arcminute field. Each panel is centered on the brightest cluster galaxy (BCG), and the black boxes bound the region shown in the next smaller field. (Image credit: Melchior et al. 2014 arXiv:1405.4285.)](image-url)
Instrumentation/Management

During this reporting period, CTIO’s efforts were focused on three activities: (1) supporting the first observing season of the Dark Energy Survey (DES), as well as the use of DECam by the open-access community; (2) on improvements to the Blanco 4-m telescope; and (3) on commissioning of the new Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS).

The first season of DES observations started on 31 August 2013 and ended on 9 February 2014. The equivalent of 105 nights (91 full nights plus 28 half nights) on the Blanco Telescope were dedicated to the survey, during which 14,340 survey-quality images were obtained. The weather in September and October was poor and variable so that only 60% of the images taken were judged to be of survey quality. Since November, the fraction of survey quality images obtained has been greater than 90% due to better weather and CTIO’s improvements to the telescope in the areas of Delivered Image Quality (DIQ), tracking and guiding, and observing efficiency (see section 2.1.2). As a result, completeness with survey-quality data was obtained for 44% of the fields targeted for the first two years of the survey (82% of the goal for season one, plus 16% of that for season two, see Figure 3). However, the slow start of the season resulted in non-uniform depth over the “early” part of the survey footprint. NOAO worked closely with DES planners to develop a telescope schedule for the second DES season that will allow mitigation of this without unduly limiting community access.

![Figure 3: Progress during the first season of the Dark Energy Survey. The first season goal was to obtain four exposures (“tilings”) in each of the grizY filters over the two polygonal areas outlined in black, an area of 2,000 square degrees. The remaining 3,000 square degrees of the footprint are to be covered to the same depth during the second season. In practice, 82% of the exposures required to meet the first season goal were obtained, and a start was made on the second season goal with 16% of the required exposures taken. However, poor weather at the beginning of the season resulted in non-uniform coverage in the West and North parts of the footprint. (Image credit: G. Bernstein, DES.)](image)

The balance of the science time in this reporting period was used by community scientists to obtain data with DECam for 35 distinct programs that spanned a diverse range of science topics involving tracking space debris and Near-Earth Objects (NEOs), crowded field photometry of the galactic center and Magellanic clouds, and the far universe.

Commissioning of the f/8 secondary mirror of the Blanco telescope was completed during this reporting period with engineering runs in October and April used to collect data to populate control tables for the optical system and check its proper function and to build pointing maps. Progress was
made with the refurbishment of the infrastructure needed to support f/8 instruments, in particular the new COSMOS. That instrument was delivered to Chile at the beginning of March and had a first successful commissioning run in April when both its imaging and single-slit spectroscopic modes were thoroughly tested. The remaining mode, multi slit spectroscopy, will be tested in July after which COSMOS is expected to be ready for general community science use. The measured peak throughput of COSMOS on Blanco in spectroscopic mode is greater than 40%, comparable to that achieved by the Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS) on Mayall and the Goodman Spectrograph on the Southern Astrophysical Research (SOAR) telescope, and more than three times greater than that achieved with the Ritchey-Chrétien Spectrograph, which it replaces.

La Serena School for Data Science

During the second quarter of FY14, planning and development of the Second La Serena School for Data Science (2014) began in earnest. In January 2014, the web pages were updated and advertisements for the 2014 School were sent to an extensive list of US and Chilean universities. For the US, the CTIO REU program mailing list—specifically built to reach the underrepresented and minority-serving institutions—was updated with email addresses, so announcements were sent digitally. The School was also advertised in “big data” related mailing lists and websites. Registration opened on March 21 and closed on April 21. Over 100 applications were received for the 30–40 slots, roughly half from the US and half from Chile with a few applications from Europe and South America. In late May/early June, students were notified, and detailed planning began for their travel to Chile. Two of the program organizers will meet the group of US students, who are a mix of senior undergraduates and beginning graduate students, in Dallas, Texas, and fly to Chile with them in order to manage any issues that might come up during the international trip.

In the meantime, the professors for the 2014 program were confirmed, and the program content is under active development. The 2014 School will take place August 15–22 on the AURA campus in La Serena, Chile. The NSF funding for the activities in La Serena is being roughly matched again by Chilean contributions from CONICYT (the Chilean version of NSF), the Millennium Institute of Astrophysics, and the University of Chile’s Center for Mathematical Modeling. Ten professors have been confirmed for the program. They will work with the 30–40 students in a variety of settings, including traditional lectures, hands-on activities with data management tools, and group projects using the tools with real data.

Status of FY14 Milestones

- Complete the commissioning of the f/8 secondary mirror of the Blanco 4-m telescope using the Infrared Side Port Imager (ISPI) and Hydra f/8 instruments.

  **Status:** Two further commissioning runs for the f/8 secondary mirror were carried out during this reporting period, at which time the repeatability of the f/8 alignment was verified, the image quality was checked over the entire field, and pointing maps and look-up tables for control of the optical system were generated. The commissioning of the f/8 secondary itself is now effectively complete. The first engineering run in October was followed by two nights of observations with the Infrared Side Port Imager (ISPI), of which one was for a scheduled science program. The second run in April was used for commissioning the COSMOS spectrograph. Substantial progress also was made in the refurbishment of the infrastructure for the f/8 instruments. The first phase of the upgrade of the control electronics and software for the f/8 atmospheric dispersion compensator (ADC) and comparison lamps was completed and tested during the April engineering run. An electronic and mechanical upgrade of the instrument rotator drive mechanisms was substantially completed during the third quarter (Q3) of FY14 and
will be tested during the next engineering run scheduled for July. A second phase, contemplated for FY15, will replace some remaining obsolete electronics and upgrade software to ensure robust operation going forward.

- Support the first season of observations for the Dark Energy Survey (DES).

**Status:** Completed. The first season of DES observations started on 31 August 2013 and ended on 09 February 2014. The equivalent of 105 nights (91 full nights plus 28 half nights) on the Blanco telescope were dedicated to the survey, during which 14,340 survey-quality images were obtained. Of this time, 84.6% was used for DES observations, with 10.2% lost due to weather and the remaining 5.2% being unscheduled technical down time that was shared approximately equally between DECam and the telescope. As a result, completeness with survey-quality data was obtained for 44% of the fields targeted for the first two years of the survey (82% of the goal for season one, plus 16% of that for season two).

- Commission the CTIO Ohio State Multi-Object Spectrograph (COSMOS) on the Blanco 4-m telescope.

**Status:** COSMOS was delivered to Chile in March 2014 where it was unpacked and reassembled. Post-shipment laboratory tests were carried out to verify that the image quality and other instrument performance metrics reproduced those measured in Tucson prior to shipping. It was installed on the telescope for the first time in April, and both the imaging and single-slit spectroscopy modes of the instrument were tested thoroughly during a first engineering run. The multi-slit spectroscopy mode will be commissioned during a second run scheduled for July 2014, after which the instrument is expected to be fully ready for science use.

- Complete science verification of the SOAR Adaptive-optics Module (SAM) on the SOAR Telescope, and start regular science operations with SAM.

**Status:** Completed. During successful science runs in January and March 2014, data was obtained for the remaining science verification projects and for two science programs: one each from the NOAO and Brazilian communities selected through the regular semester 2014A telescope time allocation process. All the partners of the Southern Astrophysical Research (SOAR) consortium offered SAM for unrestricted use in the 2014B proposal cycle.

- Commission the SOAR Telescope Echelle Spectrograph (STELES) and SOAR Integral Field Spectrograph (SIFS) on the SOAR Telescope, if they are delivered by the SOAR partners during FY14.

**Status:** No progress during this reporting period. Progress is pending delivery of STELES by the SOAR partners and the completion of the repair by the manufacturer of the SIFS spectrograph camera.

### 2.1.2 NOAO South Engineering & Technical Services

**Program Highlights**

During this reporting period, the NOAO South Engineering & Technical Services (NS ETS) group focused primarily on work to improve the performance of the Blanco telescope and to refurbish the instrument support infrastructure at its f/8 focus in preparation for the commissioning of COSMOS.

Improvements to the control of the primary mirror cooling system, and the reimplementation of cooling for the observing floor and the hydrostatic bearing oil were completed in the first quarter
leading to a measurable improvement in DIQ. The installation of air handling units for daytime cooling of the dome air and the work to enclose and cool the prime focus cage will be completed during the fourth quarter (Q4) of FY14 in time for the start of the second DES season. Good progress was made on the project to improve the active control system for the primary mirror, for which integration and testing will continue into FY15.

The electronics and software that control the f/8 ADC and comparison lamps were upgraded during the second quarter (Q2) of FY14, while work to revamp the drive mechanism for the instrument rotator will be completed during Q4. This finishes the essential work needed to support commissioning and use of COSMOS; however, further work to addresses issues of obsolescence and long-term maintenance will continue into FY15.

NS ETS engineers worked with the SOAR Telescope Operations (TelOps) team to install and commission the SOAR ADC and a new hexapod for the SOAR secondary mirror. Members of the NS ETS electronics group worked on the laboratory characterization of the infrared (IR) detectors for TripleSpec4 and testing of the thick fully depleted “red” CCDs for the KOSMOS and COSMOS spectrographs. They also carried out emergency repairs to the CCD controllers for the Goodman Spectrograph at SOAR and for the imager on the Small and Moderate Aperture Research Telescope System (SMARTS) 0.9-m telescope.

![Figure 4: Diverse aspects of NS ETS activities: (left) NS ETS and TelOps staff maneuver one of the two air handling units into place in the Blanco dome; (right) members of the electronics group in the clean room during testing of the infrared detectors for TripleSpec4.](image)

**Status of FY14 Milestones**

- Upgrade the control of the Active Optics of the Blanco primary mirror, upgrade the Blanco Environmental Control Systems (ECS), and implement methods to analyze the telescope performance telemetry to improve and stabilize the image quality of the Blanco 4-m telescope.

**Status:** (a) Active Optics: Following successful testing during the first quarter (Q1) of FY14 of a prototype high-precision pressure controller for the M1 pneumatic actuators, components were procured for the remaining 32 controllers plus spares. These are being assembled and tested with an anticipated completion during Q4 of FY14. In parallel, the interface box that incorporates limit switches, interlock functions, hard points, and a pressure sensor for the supply line was designed and parts were procured to build a test set that will be used in development of the high-level control software. System integration, testing, and software development will continue during Q4 of FY14 with the delivery and integration at the telescope anticipated for early in
FY15. The active control of the secondary mirror to correct coma for the f/8 configuration was implemented successfully and tested during Q3.

(b) Environmental Control System (ECS): During Q1 of FY14, several improvements were made to the control of the thermal environment of the telescope, including reimplementation of cooling for the observing floor and for the hydrostatic bearing oil and implementation of a more effective control algorithm for daytime cooling of the primary mirror, designed to match the nighttime air temperature eliminating mirror seeing. The combination of these steps resulted in a measurable improvement in the DIQ of images taken by DES from November onward (the median r and i band DIQ of the Blanco telescope is now 0.94 arcsec). The air handling units for daytime cooling of the dome air were installed, plumbed into the cooled glycol system, and connected to electric power; and the prime focus cage is being enclosed so that it can be actively cooled. Both these systems will be brought into service and have their operating parameters tuned during Q4 of FY14 in preparation for the start of the second DES season.

- Begin upgrading the SOAR Telescope Control System (TCS) to the same standard as the recently upgraded TCS of the Blanco 4-m telescope. This project will continue into FY15.

**Status:** The upgrade of the software associated with the Active Optics system was completed during Q1 of FY14 as part of the effort to install the new Hexapod. Work on the main telescope control application, operators interface, and pointing kernel was begun in Q3 of FY14 and will continue into FY15. The software for peripheral systems such as the Instrument Support Boxes and for the various instruments will begin in FY15.

### 2.1.3 NOAO South Facilities Operations

**Program Highlights**

NOAO South Facilities and Operations (NS FO) progressed with work on facility infrastructure projects, supported new tenant projects, and made progress on administrative issues during the first three quarters of FY14. The transformer and generator serving the Cerro Pachón hotel/Andes LIDAR Observatory area were relocated to improve the quality of the power serving those facilities. On Cerro Tololo, the MEarth facility was completed and went into operation; the Korea Astronomy and Space Science Institute (KASI) team and their contractor installed their telescope; and construction began on the new Brazilian telescope project, T-80 South, with completion expected during Q4 of FY14. On the La Serena recinto, the deep-well pump for the water system was replaced because of its poor performance over the last year. Administratively, additional sections of the Service Level Agreement were drafted, reviewed, and translated into Spanish. The cost structure for fees was revised, reviewed, and implemented. A management transition plan for NS FO was developed and is being carried out due to the NS FO manager transferring full time to the LSST Project Center.

**Status of FY14 Milestones**

- Complete and implement new Service Level Agreements between NOAO and tenants.

**Status:** The Service Level Agreement document (SLA) is substantially complete. All technical service sections have been drafted except the Emergency Medical Service section, which is pending further definition of changes in the way that service will be provided. The completed sections of the SLA have been reviewed thoroughly by the stakeholders, edited, and translated into Spanish. Departmental feedback is being collected and will be incorporated into the final version of the SLA.
• Review and revise, as required, the fee structure for services to tenant programs hosted at NOAO South.

Status: The revised fee structure for 2014, based on a sustainable cost model, was reviewed in Q1 and has been in use since then. A revision of the basis for the mountain share fees was proposed and will be open for observations from the tenant programs and revision during Q4. The current share fee distribution model was appropriate when there were only a few major users (Gemini, SOAR, Blanco, and SMARTS), but it is no longer applicable as many small tenants have come to Cerro Tololo and Cerro Pachón. Moreover, with construction of the Large Synoptic Survey Telescope (LSST) commencing in FY15, a revision of the share fee distribution model is timely. The new distribution will be implemented and effective at the start of FY15.

• Define a long-term solution for the upper (north) entry to the La Serena recinto. Currently, there are two options for the north entry, neither being a long-term solution. The first option, which has been available for many years, uses an entrance from the Universidad de La Serena that the university is planning to close. The other option is an entry located at a curve in the main road. Take steps to formalize the long-term plan with the neighboring university and the Municipality.

Status: NS FO maintains regular contact with the Universidad de La Serena to be aware of their plans as they relate to the AURA recinto entrances and continues to communicate to AURA the need for attention to this issue at the organizational/legal level.

• Complete the project to upgrade the power feed to the Hotel/Andes LIDAR Observatory area on Cerro Pachón.

Status: Completed. During Q1 of FY14, planning was completed and the decision taken to relocate the transformer and generator set that serve the Hotel/Andes LIDAR Observatory to a site closer to those facilities, thereby avoiding an expensive upgrade of the main feeder cable. Site work to create the required access road, platform, and utility trenches was carried out during the Q1 and Q2, and the equipment was relocated and put into use during Q3.

• Support the completion of the design and the construction bidding for the LSST Project on Cerro Pachón.

Status: The design was completed, and bidding for construction of the LSST Project was initiated on 23 October 2013. The bids were due on 7 April 2014 and were reviewed during the remainder of Q3 of FY14. A construction start is anticipated for Q1 of 2015, pending final NSF authorization.

• Complete the reroofing project for NOAO offices in the La Serena recinto and other headquarters building renovations.

Status: The reroofing projects for the main scientific office building and the AURA-CAS/HR building (Modulux) were completed in Q1 of FY14. The repairs necessary to the remaining roof sections are planned with work expected to start in Q4 of FY14.

• Support the installation of new facilities for the MEarth and T80-south projects on Cerro Tololo.

Status: Construction of the MEarth facility was completed on December 2; this was followed by a period of testing and commissioning. MEarth has been in use for regular science operations since February 2014. Construction of the facility building for the T-80S project, a Brazilian 80-cm telescope began in January 2014 and is expected to be completed during Q4 of FY14.
2.1.4 NOAO South Computer Infrastructure Services

Program Highlights

NOAO South Computer Infrastructure Services (NS CIS) worked on improving network connections during this reporting period. Preparation for the proposed fiber installation from the summits to La Serena has intensified now that FY15 funding for LSST appears to be a reality. Proposals for carrying out the work have been solicited from several potential vendors. Among these, Entel has demonstrated a strong interest in being part of the project to improve our fiber connectivity making an extremely attractive offer to carry out the work as a part of their new installation of a fiber bundle from La Serena to Vicuna.

A CISCO Wireless LAN Controller was purchased and NS CIS is in the process of configuring it to allow for a more user-friendly wireless system at NOAO South.

Status of FY14 Milestones

- Install a 10-Gbs Ethernet segment in La Serena for virtual machines backbone.
  
  **Status:** The 10-Gbs switch was received, but transceivers and spf connectors still must be purchased.

- Complete the upgrade of the current 622 Mbps network backbone to the planned 1-Gbps international segment of the AURA network backbone.
  
  **Status:** Completed.

- Move essential information technology (IT) services in La Serena to virtual server machines for improved reliability.
  
  **Status:** Ongoing. The required hardware was purchased during Q1 of FY14, and the progressive migration of services is underway.

- Upgrade the Cerro Tololo Private Internet eXchange (PIX) to an Adaptive Security Appliance (ASA) firewall.
  
  **Status:** Completed during Q3 of FY14.
• Continue working to isolate Cerro Tololo tenants from NOAO Internet traffic.

Status: The equipment to accomplish this arrived and NS CIS is continuing to organize and document the fiber cable runs that connect all the tenants.

2.2 NOAO NORTH

The NOAO North (NN) division is responsible for the administration, facilities, and information technology (IT) support for NOAO activities based in southern Arizona. For program management purposes, these activities are separated into the following subprograms:

• Kitt Peak National Observatory
• NOAO North Engineering & Technical Services
• NOAO North Central Facilities Operations
• NOAO North Computer Infrastructure Services

2.2.1 Kitt Peak National Observatory

Program Highlights

Science

In the third quarter of FY14, astronomer and frequent Kitt Peak National Observatory (KPNO) observer Dr. Arlo Landolt (Louisiana State University) was recognized on Kitt Peak for his many years of service to the astronomical community, and as KPNO’s longest continuous user of telescopes (55 years). Dr. Landolt was honored by the mountain facilities crew, current and past technical staff, NOAO scientists, and visiting observers in a brief ceremony on the mountain (Figure 6). A few nights later on 30 June 2014, Dr. Landolt completed his last scheduled observing run on the 2.1-m telescope, which is scheduled to be shut at the end of semester 2014A.

Figure 6: (Left) Dr. Arlo Landolt as the first official KPNO observer on 1 June 1959. (Right) Dr. Landolt with the award presented to him in June 2014 as KPNO’s longest continuous user of telescopes (spanning 111 observing semesters: starting 1 June 1959, ending 30 June 2014).
Management

In June, the NOAO Safety Manager Tammie Lavoie began her employment at NOAO. She replaces C. Gessner, the NOAO safety and risk manager. She will report to the NOAO associate director (AD) for KPNO. In collaboration with outgoing and incoming NOAO North Engineering & Technical Services (NN ETS) managers, a twice-monthly KPNO/ETS management meeting was initiated. The meetings will involve the outgoing NN ETS manager (until 1 August), the incoming NN ETS manager, and the NN ETS group leaders. The purpose of the meetings is to help KPNO AD and new NN ETS manager coordinate ETS work for KPNO.

The KPNO AD attended various meetings during this reporting period: AAS in January and June, Dark Energy Spectroscopic Instrument (DESI) in November and May, NOAO Observatory Council in February, and NOAO Users Committee in June. She also represented NOAO at the WIYN board meeting in March, along with two other NOAO scientific staff. The AD participated in an operations readiness review at the Las Cumbres Observatory Global Telescope (LCOGT) in April and visited CTIO in April/May, observing with the Dark Energy Camera on the Blanco 4-m telescope.

NOAO/KPNO staff continued to contribute to DESI development. The KPNO AD and other NOAO staff participated in the Lawrence Berkeley National Laboratory (LBNL) Director’s review of the DESI project in November and the DESI collaboration meeting in May, both in Berkeley, California. KPNO hosted a gathering of DESI scientists and engineers in April. Sixteen people from five different institutions (LBNL, Fermilab, Ohio State University, New York University, University of California Los Angeles) attended, plus six KPNO staff. The group worked together for two full days on Kitt Peak with a wrap-up on the third day at the NOAO offices in Tucson. The meeting covered 22 items for review and discussion, which resulted in a list of 50 action items to participants for write-ups of work done or further investigation of questions raised. DESI was featured in the NOAO booth at both the January and June AAS meetings. In June, NOAO staff were first author or co-author on three DESI-related papers at the SPIE “Astronomical Telescopes and Instrumentation” conference in Montreal, Canada. The next important DESI meeting will be the Critical Decision 1 (CD-1) review in September, which will be attended by NOAO/KPNO staff.

In February, NOAO reached an agreement with LBNL and other collaborators on a list of DESI Interface Control Documents (ICDs) to be prepared; 15 ICDs affect the KPNO Mayall telescope or building infrastructure. In March, the project completed and approved the initial version of the ICD between the Mayall telescope structure and DESI top end. In July, KPNO and LBNL staff will perform surface profilometry of the Mayall M1 mirror on Kitt Peak (prior to re-aluminizing) using a laser tracker system with the goal to define mechanical and optical axes of the mirror with respect to six fixed fiducial points around its circumference.

In Q1, approximately 77 tons of scrap metal were removed from the Kitt Peak meadow. Tohono O’odham wildfire fighters spent several days working on Kitt Peak in Q3 clearing brush from steep slopes near the summit to reduce the risk of fire. A new voice over internet phone (VoIP) system was installed on Kitt Peak and became operational in Q2.

Kitt Peak Visitor Center

The table below summarizes the number of visitors who participated in paid groups/programs at Kitt Peak during the first nine months of FY14.
Kitt Peak Visitor Center & Tours
Summary of Participants
(9 months ending 6/30/14)

<table>
<thead>
<tr>
<th>Group/Program</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>General public tours</td>
<td>569</td>
<td>3,402</td>
<td>1,696</td>
<td>5,667</td>
</tr>
<tr>
<td>School groups K-college</td>
<td>157</td>
<td>31</td>
<td>114</td>
<td>302</td>
</tr>
<tr>
<td>Special tours</td>
<td>102</td>
<td>20</td>
<td>10</td>
<td>132</td>
</tr>
<tr>
<td>VIP tours</td>
<td>54</td>
<td>75</td>
<td>30</td>
<td>159</td>
</tr>
<tr>
<td>Nightly Obs. Program</td>
<td>1,642</td>
<td>2,071</td>
<td>2,384</td>
<td>6,097</td>
</tr>
<tr>
<td>Advanced Obs. Program</td>
<td>34</td>
<td>25</td>
<td>46</td>
<td>105</td>
</tr>
<tr>
<td>Other classes &amp; workshops</td>
<td>7</td>
<td>66</td>
<td>87</td>
<td>160</td>
</tr>
<tr>
<td>Youth Group Overnights</td>
<td>54</td>
<td>18</td>
<td>101</td>
<td>173</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>2,619</td>
<td>5,708</td>
<td>4,468</td>
<td>12,795</td>
</tr>
</tbody>
</table>

**Status of FY14 Milestones**

- Install and commission the new Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS) on the Mayall 4-m telescope.

  *Status*: Completed in Q3. KOSMOS was successfully commissioned in both single-slit and multi-slit modes in semesters 2013B and 2014A. Currently, it is offered as a facility instrument on the Mayall. KOSMOS needs a few more grisms to completely replace the capabilities of the R-C Spectrometer. These are currently being specified by the instrument scientist.

- Initiate work on a prioritized list of Delivered Image Quality (DIQ) improvements for the Mayall 4-m telescope, developed based on tests completed in FY13. As many of these improvements as time and resources permit will be completed during FY14.

  *Status*: Ongoing, but significant progress was made during this reporting period. A final list of tasks was produced to assess DIQ as were some recommendations that will be implemented in semester 2014B.

- Efforts to investigate and improve the pointing and tracking performance of the Mayall 4-m will continue.

  *Status*: Ongoing. Further improvements in pointing and tracking are anticipated following installation of the new Telescope Control System, which is slated as a major project in FY15.

- End community access to the KPNO 2.1-m telescope after semester 2014A, and then place it in a safe state of hibernation.

  *Status*: Completed in Q3. Observing proposals for semester 2014B were not solicited. In anticipation of closing the 2.1-m telescope, the Telescope Operations staff completed an inventory of all equipment and supplies in the 2.1-m telescope building.
• Work with NSF to develop and release a solicitation for proposals to operate the KPNO 2.1-m telescope. If time and opportunity permit, choose a new operator and complete the transfer by the end of FY14.

**Status:** Completed in Q3. A solicitation was released on 11 April 2014 for a new operator for the 2.1-m telescope. Letters of Intent from prospective proposers are due by 1 August 2014 and complete proposals by 1 October 2014. As of June 30, one proposal had been received.

• Continue targeted building modification and/or renovation efforts on KPNO telescope and support facilities to address building deficiencies, telescope and instrumentation support system needs, and program requirements.

**Status:** The Kitt Peak Instrument Handling Facility (IHF) became operational in Q2. The Mayall mirror lift was rebuilt in Q2–Q3 to higher capacity and better safety standards. Work on the lift was mostly completed in June 2014. The lift is operational, although a few performance issues regarding some components remain and are being pursued with the manufacturer.

### 2.2.2 NOAO North Engineering & Technical Services

#### Program Highlights

The main focus of the NOAO North Engineering & Technical Services (NN ETS) group during Q3 of FY14 has been on completing the Mayall mirror lift upgrade in order to enable re-aluminization of the primary mirror and other summer shutdown work. In addition, initial work on the Telescope Control System servo systems was performed, with completion scheduled for early FY15. NN ETS personnel also are heavily engaged in summer shutdown activities at both the Mayall and WIYN telescopes, which include re-aluminization of both primary mirrors.

#### Status of FY14 Milestones

• Complete transfer of electronic drawings into the new documentation system.

  **Status:** This work was largely completed during Q3, and should be complete by the end of FY14.

• Initiate conversion of hard-copy drawings into electronic form and begin adding them into the new documentation system.

  **Status:** There was considerable progress. The process includes evaluation of old documentation. Documents for projects that were not built, or are now no longer in service, will not be preserved.

• Complete installation of the Mayall mirror lift upgrade.

  **Status:** Installation and initial testing was completed during Q3, allowing summer shutdown efforts to proceed. The work was delayed from original projections by extensive lateness of vendor deliveries. Additional tuning and replacement of unreliable components is needed before the project can be declared fully complete, which will occur prior to the end of FY14.

• Complete design work on the Mayall shutter brake replacement.

  **Status:** The delays in the mirror lift work and associated problems have prevented significant progress from occurring during this reporting period. This project has evolved somewhat into a project to optimize shutter safety, rather than addressing the brakes in isolation.
• Develop, review, and initiate a shutter-brake implementation plan.
  
  **Status:** See “Status” of preceding milestone.

• Complete detailed planning for the Mayall servo-system upgrade.
  
  **Status:** Completed prior to the end of Q3.

• Perform all major procurements for the servo-system upgrade, and initiate implementation.
  
  **Status:** All major procurements were completed, and the subsystem integration began in early Q3. Critical work associated with the removal of the primary mirror will take place in Q4 of FY14, with integration and initial testing to begin at the start of FY15.

• Provide support for the Dark Energy Spectroscopic Instrument (DESI) Critical Decision 1 (CD-1) review.
  
  **Status:** This review was originally scheduled for late January 2014 (Q2) but was rescheduled for September 2014 (Q4). Development of the DESI concept progressed substantially during this reporting period, in particular in the development of interface documents, operations plans, and installation and facility preparation plans.

  
  **Status:** Due to the rescheduled CD-1, any necessary work will be completed during FY15.

• Provide support for commissioning and acceptance of the repaired Blanco f/8 secondary mirror.
  
  **Status:** Completed in Q1.

### 2.2.3 NOAO North Central Facilities Operations

**Program Highlights**

During Q3 of FY14, the NOAO North Central Facilities Operations (NN CFO) group focused on numerous efforts to plan and begin the renovation of a basement electronics laboratory space into new staff office space to accommodate program needs, in particular, the Tucson-based LSST construction team (Figure 7 and Figure 8). This effort included support for the removal of contents, obtaining architectural and engineering (AE) services, purchasing materials, obtaining contracted services, and beginning construction. This phase of the project is projected to be complete and the offices occupied by the end of the fiscal year. In parallel, staff is working with AE firms to prepare plans for work in Q1 of FY15 to prepare the office space for the LSST Program. Bid documents were prepared and sent to the AURA contracts group to pursue contracted efforts to upgrade the primary building fire detection system and coat building roofs during Q4 of FY14.
The NN CFO staff also was involved in several other activities supporting both Kitt Peak and the Tucson facilities. Video conference systems were updated in several meeting rooms, safety improvements were completed on a primary material lift unit, and some offices were upgraded for new occupants. Staff provided support to the Safety Officer selection process and is providing orientation of the new hire as of 23 June. Tucson technical staff efforts have been ongoing to support updates to various Kitt Peak systems: staff computers, building fire alarm panels, the central fire alarm receiver, and miscellaneous vehicle needs.

**Status of FY14 Milestones**

- Continue targeted building modification and renovation efforts at NOAO North to address program needs.

  **Status:** During the third quarter, a local architectural and engineering (AE) firm worked with staff to prepare drawings for the renovation of two large areas within the NOAO headquarters facility to accommodate program needs. Work on one area was started during the quarter, and the area is expected to be occupied at the end of this fiscal year. The AE firm anticipates completion of renovation drawings for the remaining area during the fourth quarter and work is planned for the first quarter of FY15.

- Continue to upgrade selected restrooms by replacing fixtures to improve water conservation efforts and to improve the deteriorated interior finishes and accessibility.

  **Status:** Planned upgrading efforts were completed during Q2 of FY14, and minor efforts on various fixtures and finishes will continue as time becomes available.

- Continue the window upgrade program to replace original exterior single-pane windows with double-pane windows to improve energy efficiency and reduce solar heat gain.

  **Status:** Staff is working with local vendors to address the single pane windows at the main lobby entrance; their replacement is planned for the next quarter. Other efforts are ongoing to reduce solar heat gain at specific offices and to pursue in-house or contracted efforts to replace single...
pane windows on the west side of the headquarters building and deteriorated windows in the La Quinta complex.

- Upgrade and/or replace deteriorated or obsolete portions of the mechanical air distribution system and associated heating/chilled water system valves.

  *Status:* Staff have been reviewing air handler valves and evaluating the various water pumping systems to finalize requirements and order the proper materials for the work.

- Complete installation and initiate operation of a new Voice over Internet Protocol (VoIP)-based PBX system procured in FY13.

  *Status:* This project is complete and has been performing well.

### 2.2.4 NOAO North Computer Infrastructure Services

**Program Highlights**

The NOAO North Computer Infrastructure Services (NN CIS) staff committed a large effort during FY14 to updating the Ethernet switch infrastructure in the Tucson facility to provide Power over Ethernet connections to offices and labs to support the installation of VoIP phones. In addition, the newly replaced Ethernet switches were equipped with uninterruptible power supply units to keep the building telephone system operational during power failures.

The Kitt Peak mountain network infrastructure was mapped and made more robust in preparation for the installation of VoIP telephones. Finally, the Tucson and Kitt Peak Dynamic Host Configuration Protocol (DHCP) servers were updated to support VoIP phones.

The operating systems of several “central” servers (Scope, ADASS, and dhcp-KP) were upgraded from obsolete versions to fully supported versions. New disk drives were installed on these servers to increase their longevity. All of the “central” servers were upgraded to the latest appropriate FreeBSD (Free Berkeley Software Distribution) version.

Windows systems throughout the Tucson facility continue to be admitted to the Windows Active Directory Domain. A backup Active Directory Domain Controller was installed during this reporting period. Currently, 86 Windows systems have been added to the Active Directory.

The transition from the old McAfee/Symantec anti-virus system to the new Shavlik anti-virus plus patch management system for Windows machines went well.

NN CIS staff are studying suitable software and procedures for Linux systems, but an initial implementation will begin before the end of FY14.

During this reporting period, NN CIS began the effort to implement demilitarized-zone (DMZ) functionality for Tucson-based servers. A DMZ for LSST was implemented that will isolate the DMZ machines used for modeling and experimentation by the LSST community from the rest of the NOAO network. The ftp.noao.edu server, used for FTP (File Transfer Protocol) access to various archives, will be placed in a DMZ prior to the end of FY14. On Kitt Peak, a project to isolate tenant observatory networks from the NOAO network and from each other is well underway. Finally, the anyconnect virtual private network (VPN) system was modified so that tenant observatory staff who use this service will be limited to accessing their observatory’s network and be blocked from the rest of the NOAO network.
Status of FY14 Milestones

- Continue to implement Windows Active Directory Domain in Tucson and the AURA policies on passwords and account lockout by bringing approximately 100 Apple Mac workstations and laptops and approximately 225 Linux workstations, laptops, and servers into the Active Directory Domain.

  **Status:** Well under way. The Centrify Suite software package was selected for “managing” Apple computers and incorporating them into the Windows Active Directory Domain. An initial increment of licenses was ordered, and they are being rolled out slowly to a few systems to allow NN CIS staff to refine installation procedures; currently, six Mac systems are members of the Active Directory.

- Implement a secondary (or back-up) Active Directory Domain controller.

  **Status:** Completed. The merger of the current CFO/Kitt Peak Active Directory with the CIS Active Directory will bring in another 65 Windows systems. The combined Active Directories will allow use of a combined database for authentication purposes and will centralize resources. As part of the merger, a third Active Directory Domain Controller will be installed, this one on Kitt Peak.

- Collaborate with NOAO North Central Facilities Operations to implement the network portion of the new, facility-wide Voice over Internet Protocol (VoIP) telephone system.

  **Status:** Completed. See “Program Highlights” above.

- Continue to implement Security Domains in Tucson and on Kitt Peak. In Tucson, implement a DMZ for several Internet-facing machines and finish a comprehensive Security Domain for servers, switches, and controllers managed by NN CIS. On Kitt Peak, fully isolate tenant networks from the NOAO networks.

  **Status:** Well under way. See “Program Highlights” above. The comprehensive Security Domain for servers, switches, and controllers managed by NN CIS will not be implemented until FY15.

2.3 NOAO SYSTEM SCIENCE CENTER

NSSC consists of four major programs: System User Support (SUS), Science Data Management (SDM), System Community Development (SCD), and the Time Allocation Committee (TAC). SUS provides help to users of the currently available open-access time to facilities that are not managed by NOAO. SDM support revolves around the archiving of all raw data from NOAO facilities and pipeline processing for selected imaging instruments, as well as the data needs and support for future projects that involve NOAO. SCD maintains a broad view of the current state of the System and how community desires and needs are best mapped into the future evolution of this System. The TAC program handles the Phase I process of observing proposals submitted to NOAO, which includes the maintenance of web pages and a Call for Proposals document covering all the necessary information on facilities available under NOAO-managed time.
2.3.1 System User Support

Program Highlights

Science

In addition to the published science noted in the first and second quarter reporting periods, two publications in the third quarter of FY2014 were based on US Gemini time.

First, Westmoquette et al. (2014, ApJ 789, 94) report an exciting result for M82. M82 is an archetypal nearby starburst galaxy with the starburst activity centered in the nucleus. This starburst activity is known from high-resolution Hubble Space Telescope (HST) imaging to consist of a number of high surface brightness clumps, containing many young massive star clusters. Using US Gemini telescope time to obtain near-infrared integral field spectroscopy with NIFS (Near-Infrared Integral Field Spectrograph), and HST time to obtain optical spectroscopy with STIS (Space Telescope Imaging Spectrograph), the authors were able to derive ages, masses, extinctions, and radial velocities for three individual star clusters. These clusters are located neither in the cold molecular torus, nor in the circumnuclear ring of young star-forming knots, but between the two, in the outer orbits of the well-known stellar nuclear bar. The NIFS integral-field spectroscopy measured the depths of the CO features that form in red supergiant populations more accurately than what was previously possible in these super star clusters, allowing much better age determinations. The very young ages of these super star clusters derived from this study mean that the clusters must have formed in situ, in regions of dense molecular gas that were previously available but now have been ionized, rather than forming in a nuclear ring and moving outward.

Second, Sakurai’s object (V4334 Sgr), the final flash object discovered in the mid-1990s, underwent rapid cooling during the first decade of the 21st century becoming as faint as K ~ 25. Using the Near-Infrared Imager with Altair (NIRI/Altair) on Gemini North, Hinkle and Joyce (2014, ApJ, 785, 146) imaged the V4334 Sgr debris cloud at 2.3 microns. The adaptive optics images show that V4334 Sgr has started brightening and now consists of a central source with two extended globules. Near-simultaneous, long-slit, 0.85- to 2.5-micron GNIRS spectra reveal nebular lines that include He I at 1.083 microns. The cloud imaged in He I is five times more extended than the dust debris showing that the nebula is being shaped by wind interaction. By combining the wind expansion velocity and change of angular size, the distance and luminosity of V4334 Sgr were measured for the first time.

Management and User Support

After thorough planning that lasted several semesters, notable changes were initiated in this review period with the way NOAO and SUS support Gemini users. After consultation with Gemini, SUS is planning to redirect most of its future support efforts from Phase II user support to post-observing activities such as data analysis.

In observing semester 2014B, Gemini Observatory will be handling the Phase II programs for all US principal investigators (PIs), and SUS will devote the corresponding time to post-observing support.

SUS staff reviewed all Gemini 2014B proposals for technical issues during this reporting period and provided the Time Allocation Committee (TAC) panels with answers and general technical support during the 2014B TAC process. Both the PIs and the panel members have matured to a higher knowledge of Gemini observing modes, thus the support needed was minimal during the past semester. SUS is planning to limit systematic pre-TAC reviews in the future to new instruments and will be implementing quick post-TAC reviews for the successful programs.
Status of FY14 Milestones

- Continue effective support of US Gemini access and programs, such as Phase I and Phase II observing processes, the HelpDesk, and site visits, with the view toward productive user access to the increased number of US nights on the Gemini telescopes that resulted from the UK withdrawal as well as any new observational capabilities that come online.

**Status:** SUS staff supported pre-TAC technical reviews in 2014B, but will no longer support Phase II programs. Gemini and NOAO/SUS agreed to support post-data activities other than Phase II programs in order to streamline the processes. Gemini will support Phase II programs in 2014B and onward for the US community. SUS began plans to provide post-data support, which will include data workshops, handbooks, and other activities.

- As needed, provide user support for open-access, NOAO-allocated time on the Keck telescopes, Center for High Angular Resolution Astronomy (CHARA) array, and Australian Astronomical Telescope (AAT).

**Status:** SUS supported Gemini programs during the 2014B TAC. NOAO did not allocate Keck or CHARA time in the past semester.

- Represent the US National Gemini Office (NGO) in the Gemini Operation Working Group, and participate in the joint Gemini/NGO meetings to discuss all operation issues.

**Status:** The SUS head of program participated in all joint meetings and is a member of the Gemini Operation Working Group. In the past couple of months, most SUS members also participated in the joint meetings, in order to liaise between Gemini and the US community, especially in view of the implementation of the new SUS post-data support role.

- Represent the US National Gemini Office (NGO) in the International Telescope Allocation Committee.

**Status:** SUS staff participated in the International Telescope Allocation Committee in May 2014 for the 2014B semester, representing the US community.

- Foster close ties and lines of communication with the Gemini directorate and staff, with the goal of promoting the effective use of the Gemini telescopes by the US user community.

**Status:** SUS communicates all news, e.g., major policy changes, and new modes and instruments to the US community through the NOAO Newsletter and by email.

- As appropriate and requested by Gemini, implement the trading of effort between Gemini and the US National Gemini Office (NGO). If Gemini will be solely responsible for the Phase II support and for most of the HelpDesk tickets, the SUS will endeavor to support the data reduction effort for a variety of Gemini instruments and modes.

**Status:** We have already implemented this trade, with Gemini supporting Phase II programs beginning in semester 2014B and NOAO/SUS implementing data packages to support data analysis. SUS is planning a data workshop in the near future, editing different cookbooks for data handling, and producing informed samples for the most used (but under-published) modes.

- Provide support (such as technical reviews and panel orientation materials) to the Time Allocation Committee for the Gemini and other selected facilities offered through the NOAO Call for Proposals.
Status: The SUS part of the TAC orientation material this past semester was centered on the new modes of observation. SUS collaborated with the relevant NOAO members in the successful development of the 2014B Call for Proposals.

- Work with the community, relevant committees, and NOAO staff in supporting the processes necessary to plan and procure new instruments or capabilities for NOAO and Gemini telescopes.

Status: One SUS member is currently a member of the Gemini Science and Technology Committee. The hope is that when his term is over, SUS will be given other opportunities to be in close connection with this particular group.

2.3.2 Science Data Management

Program Highlights

The NOAO Science Archive continued serving large volumes of data from DECam and other NOAO instruments. The Science Data Management (SDM) group continued to provide data handling support for new instruments using MONSOON/TORRENT controllers; the latest are KOSMOS and COSMOS. SDM also supported the development and operation of the Data Transport System (DTS) and is archiving the data produced by KOSMOS and COSMOS. The DTS and Archive were tested during the third quarter of FY14 when an observer took more than 1,100 DECam observations in a single night. All data were transported and archived promptly.

Operation of the Mosaic and NEWFIRM pipelines as well as the DECam community pipeline (CP) and pODI pipeline (AuCaP) is ongoing. The CP is currently operating with version 3.0 (based on DES-DM 2.2.3) and is routinely processing all non-DES DECam data. The CP was in active development during the year in collaboration with the Community Pipeline Team at the National Center for Supercomputing Applications (NCSA) and the pODI pipeline continued to evolve in collaboration with the pODI scientists.

The emphasis in development for SDM during FY14 has been in the areas of user support tools for the archive system, pipeline development for the large imagers, data handling systems for new instruments, and prototyping tools for the new Data Lab. The new local security and authentication system deployed with Archive System v2.0.2 makes it much easier for users to access their proprietary data, significantly reducing help requests. With the deployment of archive release v2.1.1 in July, users will have a new, easier to use, more efficient download client at their disposal. Development and testing for v2.1.1 was completed in Q3; this significant upgrade also includes a Java-Web Start application that streamlines data retrieval and allows faster parallel data transfer. Also, a new file naming convention which makes data easy to identify by their file names was deployed in Q3 for both raw and reduced data. Gzipped data from previous years were converted to FITS Rice compression for a homogenous data archive and the release of 16 TB of disk space.

Work continued on writing design and operational documents in support of the development of the NOAO Data Lab in preparation for a Conceptual Design Review early next year, in close coordination with scientists within the System Community Development group. The Data Lab will provide services and interfaces for working with large, curated data sets, particularly the massive catalogs from DECam imaging surveys such as DES and various ongoing or future NOAO Survey programs. The Data Lab will also provide a workspace environment for survey teams to share data within their collaboration and facilities for customized data publication. SDM staff developed prototypes of a collaborative work space environment for science teams using the SciDrive (developed at Johns Hopkins University) and preliminary tools for data publication. Using the VAO DALServer toolkit, SDM staff also created a demonstration data service for the OGLE catalog on a test virtual machine.
Members of SDM provided input to the DESI team about data management issues as documents were prepared for the DESI CD-1 review with the Department of Energy. The SDM program scientist was a red-team reviewer for sections of the DESI CD-1 review materials.

**Status of FY14 Milestones**

- Continue operation of the NOAO data management system including data capture, transport, archiving, and user access to all NOAO-observed data. Routinely pipeline process and archive all Mosaic, NEWFIRM, and DECam data products.

  **Status:** Operation of the NOAO data management system continued without major issues. With the deployment of version 2.0.2 of the Archive system, proposal co-investigators were given access to their observed data in the NOAO Science Archive automatically. The user portal was expanded to allow users to change their account passwords in the NOAO-based authentication system. The previous authentication system developed for the National Virtual Observatory continues to be supported as an alternate authentication system for users who had already registered with it. With the 2.1.1 release a new download client was introduced (see milestone below).

- Automate, as much as possible, components of the data management system, e.g., data capture, data archive, user administration, system monitoring, and system alerts and the deployment of system upgrades and new releases of system components.

  **Status:** Additional archive system components were brought under the Puppet Configuration Management system for more automatic deployment. Unfortunately, further progress was slowed due to the extended medical leave (six weeks) of the SDM Systems Administrator.

- Update third party infrastructure software to current versions for a more robust system.

  **Status:** An Archive Infrastructure Upgrade Plan and schedule were developed with a completion date of late FY15. The first step in the process, updating the two major third-party systems, the JBoss app server and Mule, to newer versions was completed. The goal is to increase the stability and performance of the Archive and ensure that it can be more easily maintained with a reduced level of effort in the future.

- Continue to migrate the Survey Archive datasets to the NOAO Science Archive (remediating survey data headers as needed) and implement the portal interface changes needed for search and retrieval of Survey data sets.

  **Status:** There was no progress during this reporting period.

- Implement and deploy other Archive and Portal upgrades including a new download client and image previews.

  **Status:** The new download client was well tested by internal staff and external users including members of the NOAO Users Committee. The current download manager uses ftp for file transfer, but the new client will use the integrated Rule-Oriented Data System (iRODS) instead. This will transparently pull data from either the northern or southern mass storage file systems, depending on the user’s location and will substantially speed up data retrieval for astronomers observing in Chile. It will be deployed with the v2.1.1 release in late July.
• Implement a new file-naming convention for all data ingested into the NOAO Science Archive to provide SDM staff and Archive users with an easier means to associate raw data with their associated reduced files.

**Status:** The new file-naming convention was deployed for both raw and reduced data archived in the NOAO Science Archive. The new convention simplifies and rationalizes understanding of file contents. Work to rename the older files in the Archive, as well as converting older files that were compressed with gzip (a total of 3.8 million files) to FITS tile compression for a homogeneous data archive is nearing completion. This will release ~16 TB of disk storage for each copy of the Archive system.

• Develop further the pODI pipeline to include photometric stacking of exposure sequences with sky background matching, cosmic-ray detection and rejection, and replacing the USNO-B reference catalog with the SDSS catalog or Pan-STARRS catalog for improved photometric accuracy.

**Status:** A Python script for determining files that should be stacked based on heuristics was developed to improve automatic stacking results in the pipeline. Work was begun on a routine to remove cosmic rays from the data. Assistance was given to the staff at Pervasive Technologies, Inc (PTI) at Indiana University to determine why the NOAO pODI Science Pipeline (AuCaP) would not operate on their new Data Capacitor System (DC2). When the problems with file management between AuCaP and DC2 were not resolved, calibration processing was moved to the NOAO DECam cluster and the results were transferred to PTI for ingest.

• Upgrade the pODI pipeline to support the 6×6 ODI.

**Status:** Development continued for the WIYN pODI pipeline, with v0.7.4 operating in Q3 of FY14. The removal of instrumental signatures continued to improve, but further improvements are expected in Q4. A plan to upgrade the pODI Science Pipeline was developed and presented at the review for the ODI 5×5 focal plane expansion.

• Continue testing and development of the DECam community pipeline.

**Status:** The DECam pipeline scientist and pipeline operator continued to collaborate with the DECam CP group at NCSA. The pipeline is working well, DECam calibration processing remains on-schedule, and user feedback has been very positive. Further improvements to the CP are expected before the end of FY14. An extensive manual describing the pipeline and its processing was written in support of the DECam chapter of the NOAO Data Handbook.

• Continue the support of IRAF and its users. Develop system-wide support for tabular spectral formats, cataloging tools, scripting language improvements, and new science applications.

**Status:** An IRAF patch (v2.16.1) was released early in Q1. New monitoring routines let SDM track IRAF use. Since late October 2013, there have been more than 8.4 million IRAF session logins from more than 7,000 unique IP addresses. The IRAF group is updating ONEDSPEC and other spectroscopy routines to work with spectra stored as FITS tables, an increasingly popular format, as well as simple text files. Plans under consideration for future IRAF development include top community priorities such as Python bindings and CL enhancements. SPTABLE, the IRAF table spectral-format package, is nearing completion and will be released before the end of FY14.
- Provide support for the Virtual Astronomical Observatory (VAO) during its final year: support the definition of International Virtual Observatory Alliance (IVOA) standards; serve as deputy chair of the IVOA Time Domain Interest Group; add further functionality to the VOClient package; continue building test plans and providing testing support for all VAO tools and services; and provide primary support for the VAO Help Desk.

**Status:** The VAO VOClient package was enhanced and v1.2 is due for release before the end of FY14. SDM staff implemented a local instance of the SciDrive virtual storage system and helped prepare presentations for the ADASS and SPIE meetings. Staff members supported the final VAO Team Meeting and the VAO Closeout review. The VAO Project will conclude at the end of FY14. NOAO continued to help test VAO tools before release and operate the VAO help desk.

- As resources permit, design and implement a test-bed catalog service—to gain experience in development and user interfaces—using relatively small object catalogs that do not require special architectures or computational capabilities.

**Status:** A staff member presented the paper, “The NOAO Data Laboratory: A conceptual overview,” at the SPIE Conference in Montreal. Work continued on testing new functionality for the Data Lab including multiple prototypes for cloud-based collaborative storage. Members of SDM are preparing documents (Operations Requirements – ORD and System Architecture Design – SAD) in preparation for an external Conceptual Design Review (CoDR) early in the next calendar year.

2.3.3 System Community Development

**Program Highlights**

**LSST Science**

In FY13, NOAO hosted a meeting of the chairs of the Large Synoptic Survey Telescope (LSST) Science Collaborations. They identified a clear need for the LSST user community to begin serious discussion on the LSST cadence that best serves the diverse scientific needs of the community. In support of this, NOAO is hosting the “LSST & NOAO Observing Cadences Workshop.” This workshop is scheduled to coincide with the LSST Project and Community Workshop to be held on 11–14 August 2014, in Phoenix, Arizona. Work in Q3 involved finalizing the workshop arrangements and participating in a “dry run” of the plenary presentations and workshop tutorial materials, specifically those related to the Metrics Analysis Framework (MAF). The MAF is LSST Project-developed software that enables the attachment of science-based metrics to LSST Operations Simulator (OpSim) output, and is thus critical for a quantitative evaluation of the LSST Survey’s performance for science.

NOAO staff continued their involvement in and leadership of the OpSim effort in FY14. OpSim passed an external review in February 2014, with major recommendations including turning it into the LSST Scheduler project while continuing a parallel OpSim effort.

In collaboration with the University of Arizona (UA) Computer Science Department, NOAO scientists continued development of a prototype software infrastructure to characterize and distribute events discovered by time-domain surveys. The Arizona-NOAO Temporal Analysis and Response to Events System (ANTARES) was funded with an award to the University of Arizona from the NSF in September 2013 (CISE AST-1344024). NOAO scientists continued support of the program through weekly meetings with members of the UA Computer Science Department to develop the architecture for the prototype time-domain event broker. The grant includes funding for an astronomy postdoctoral position (paid through the UA Computer Science department, but resident at NOAO).
This postdoc position was competed in Q1, with an offer made to and accepted by Dr. Gautham Narayan in Q2. In Q2 and Q3, Dr. Narayan worked on assembling the ancillary data sets needed for the broker.

System Community Development (SCD) scientists, in collaboration with the Science Data Management (SDM) group, continued developing the concept of the NOAO Data Lab. The purpose of the Data Lab will be to help users handle their large Dark Energy Camera (DECam) datasets and catalogs, provide a framework for community access to the eventual Dark Energy Survey (DES) catalog and images, and incorporate tools and technology being developed for LSST data for scientific use with DECam data. The implementation of the Data Lab is being prototyped around the SMASH and Synoptic Bulge Surveys, two DECam programs with heavy involvement by NOAO scientific staff. The Data Lab concept was the subject of an SPIE paper written by Fitzpatrick et al. in Q3, and supported by a Science Use Case document written by Olsen and Beers. Additional work was performed in FY14 on prototype databases and visualization tools.

The current state of NOAO’s work on LSST Science activity can be viewed by visiting ast.noao.edu/facilities/future/lsst/lcsc.

**TMT Community Outreach**

The US Thirty Meter Telescope (TMT) Liaison Office at NOAO is responsible for carrying out many aspects of the NSF-TMT cooperative agreement, including engaging the US community with an eye toward a potential NSF partnership in TMT. The TMT International Observatory, LLC (TIO) was formally incorporated in April 2014, with AURA as an Associate Member. NOAO is executing the responsibilities, privileges, and activities of AURA regarding TMT, representing the US-at-large astronomical community. An SCD staff member assigned to carry out the Liaison Office activities participated in weekly telecons on NSF-TMT community engagement with TMT staff and others involved in the execution of the cooperative agreement. He wrote articles about the TMT Liaison activities for the NOAO Newsletter and the NOAO electronic newsletter Currents.

The NOAO liaison chairs the US TMT Science Working Group (SWG), which is charged with engaging with the US community, informing it about TMT and potential US participation therein, surveying the community’s interests and aspirations, conveying those to the TMT Science Advisory Committee (SAC), Board, and to the TMT project office. The SWG is developing a US TMT Participation Plan for the NSF with a draft of this plan to be ready by the end of calendar year 2014. The SWG holds regular telecons and met face to face in Pasadena for two days in November 2013. It will meet again at the TMT Science Forum in Tucson in July. SWG members have been “interviewing” members of the US community about TMT, and are preparing an on-line community survey to be released during the summer of 2014.

The NOAO Liaison is a member of the TMT SAC and was named chair of the SAC in April 2014. During this reporting period, he attended SAC meetings in Tokyo (October 2013, along with a TMT science and instrumentation workshop), Pasadena (February 2014, by video), and Vancouver (April 2014); he organized and chaired the latter meeting and is organizing the next meeting to be held in Tucson in July 2014. As SAC chair he also attends TIO Board meetings to report on SAC activities. He organized regular telecons of the SAC co-chairs and attended (remotely) a weekly TMT Project meeting.

Along with Michael Bolte (University of California Santa Cruz), the NOAO Liaison organized a TMT Town Hall meeting at the 223rd AAS meeting in January. The event was attended by about 120 people, and the presentation was posted at ast.noao.edu/system/us-tmt-liaison.

The NOAO Liaison and Tommaso Treu (University of California Santa Barbara), another member of the SAC, organized the process of admitting new members to the TMT International Science
Development Teams (ISDTs). Applications were received in January 2014 and evaluated by the ISDT conveners and SAC members in February. The ISDTs are open to participation by all PhD astronomers and are not limited to the TMT partners; the membership opportunity was heavily advertised and attracted more than 100 applications. Roughly 40 astronomers from the US-at-large community are now ISDT members.

NOAO will host the 2014 TMT Science Forum in Tucson, at Loews Ventana Canyon Resort, on July 17–19. The NOAO Liaison chairs the Scientific Organizing Committee for this meeting and was largely responsible for organizing the meeting program, contacting speakers, advertising the meeting (especially to the US-at-large community), and arranging meeting logistics.

**Optical Interferometry Science**

Negotiated access to the CHARA Array continues with 6 nights allocated in 2014.

Georgia State University presented a Preliminary Proposal to the NSF Mid-Scale Innovations Program (MSIP). The proposal includes and budgets for a significant enhancement of the amount of community access time to the CHARA Array for a period of five years. The Preliminary Proposal was accepted, and a Full Proposal was submitted. NOAO staff provided supporting materials ensuring that NOAO is prepared to support NOAO Time Allocation Committee (TAC) review of community proposals to CHARA submitted under this opportunity.

NOAO staff participated in the CHARA annual science and collaborations conference, representing the needs and concerns of community observers in operations support and planning for facility improvements.

Negotiations continued with the Navy and Lowell Observatory to provide community access to the Navy Prototype Optical Interferometer, with interest and support at the local level, but unresolved concerns in the United States Naval Observatory administration.

**The System Roadmap Committee**

No meeting of the System Roadmap Committee is planned for FY14, and no activity occurred in Q1–Q3. The work of the System Roadmap Committee is planned to resume following the implementation of the NSF Portfolio Review through the NOAO Transformation Plan and after the completion of the NOAO Recompetition process.

**Status of FY14 Milestones**

*LSST Science*

- Hold a community workshop, “Optimal Cadences for LSST Science.”

  **Status:** Final arrangements were being made in Q3 for the workshop titled the “LSST & NOAO Observing Cadences Workshop,” to be held 11–14 August 2014 in Phoenix, Arizona.

- Publish benchmark OpSim simulations and candidate observing schedules for evaluation by the community.

  **Status:** Benchmark simulations have been created, and will be distributed publicly in advance of the Observing Cadences Workshop (see previous milestone status).

- Assist community members with studies of the effect of OpSim parameter changes on optimal cadences for their specific LSST science projects.

  **Status:** Work toward this milestone will be part of the Observing Cadences Workshop activity.
• Prepare an integrated report of the statistical predictions of the variable sky expected for deep synoptic surveys, and make this report available to the community.

  **Status:** The report was submitted to the Astrophysical Journal and has been reviewed by the referee. A revised version is being prepared along with a response to the referee report.

• Arrange a discussion of community experts on the features and design of an LSST-scale transient broker.

  **Status:** Completed in Q1, as part of the Hotwired III meeting held in Santa Fe, New Mexico.

• Develop a detailed plan for a prototype LSST-scale transient broker.

  **Status:** The detailed plan exists. The ANTARES postdoc was hired in FY14, and work was begun on collecting data sets needed for broker development. Coordination with the UA Computer Science Department participants continued.

• Conduct data quality analysis of the second LSST DM-reprocessed Stripe 82 data set.

  **Status:** This work was performed internally by the LSST Project. NOAO will concentrate on DECam data for future LSST-related data quality work.

**TMT Community Outreach**

• Lead the activities of the TMT US Science Working Group (SWG). This consists of the TMT Liaison maintaining and updating the SWG membership, helping to set its agenda, and organizing monthly (or as needed) teleconferences and annual face-to-face meetings at the TMT Science Forum and at other opportunities (e.g., AAS) as needed.

  **Status:** These activities and meetings continued as planned, and the SWG is making progress toward developing a US TMT Participation Plan.

• Attend quarterly TMT Science Advisory Committee (SAC) meetings, participate in monthly teleconferences with the TMT SAC co-chair and weekly ones with the TMT-NOAO community engagement group.

  **Status:** The NOAO Liaison attended all SAC meetings and was named chair of the TMT SAC, starting at its April 2014 meeting. He also leads the (nominally) weekly telecons with TMT staff regarding the NSF-TMT community engagement activities.

• Participate in the organization of a TMT Town Hall event at the January 2014 American Astronomical Society (AAS) meeting and the preparation for a subsequent Town Hall in January 2015.

  **Status:** A TMT Town Hall was held at the January 2014 AAS meeting. Another Town Hall event was proposed for January 2015, but due to changes in the AAS Town Hall rules, it is likely to be scheduled as a Special Session instead.

• Participate in the organization of the second TMT Science Forum, nominally to be held sometime in summer 2014. Working with the TMT US Science Working Group (SWG), identify and encourage members of the US community to attend the Forum.

  **Status:** The TMT Science Forum will be held in Tucson on 17-19 July 2014. Roughly 150 scientists have registered for the meeting, with more than half coming from the US-at-large community outside the TMT partners of Caltech and the University of California.
Optical Interferometry Science

- Negotiate for community access to the Center for High Angular Resolution Astronomy (CHARA) Array in 2014 and provide required support to community users and the NOAO time allocation process.

  **Status:** NOAO TAC-recommended visitor programs are scheduled at CHARA in June and November 2014, and limited NOAO support will be available for planning and data reductions.

### 2.3.4 Time Allocation Committee

**Program Highlights**

The Time Allocation Committee (TAC) process for semesters 2014A and 2014B was completed successfully, with planning for semester 2015A in progress and on schedule. Observing semester 2014A began on 1 February 2014 and ended on 31 July 2014. The NOAO TAC processed 389 new proposals for 2014A with total requests for 1193 nights on 15 telescopes located on 6 sites, with 637 nights actually available through NOAO. Semester 2014B saw the user community submit 373 new proposals with total requests for 930 nights on 12 telescopes located on 5 sites, with 433 nights actually available through NOAO. The decrease in numbers of available nights and telescopes for 2014B reflects largely the loss of access to the KPNO 2.1-m telescope and the ending of time available through the Telescope System Instrumentation Project (TSIP) on the Keck I and II telescopes.

NOAO/Tucson managed the first meeting of the Gemini Large Program (GLP) TAC panel, which met in Tucson from 29 April to 1 May 2014, overlapping with the NOAO Survey Science and TAC meeting. The GLP TAC consisted of 10 astronomers from the participating Gemini partners (6 from the US, 2 from Canada, 1 from Australia, and 1 from Argentina), and this group reviewed and ranked 32 large and/or long proposals for the Gemini telescopes.

**Status of FY14 Milestones**

- Work with SUS to issue calls for proposals for regular programs (twice a year) and survey programs (once a year).

  **Status:** The 2014B Call for Proposals (for observing time from 1 July 2014 to 31 January 2015) was issued on 1 March 2014. This call consists of sets of NOAO web pages with links to other relevant observatories, as well as a self-contained, downloadable PDF (portable document format) file that contains all of the necessary information and Web links needed to propose for the observing time managed by NOAO. The Call for Proposals for semester 2015A will be issued on 1 September 2014, with a proposal due date of 25 September 2014 (this call will cover observing time from 1 February 2015 to 31 July 2015).

- Coordinate with SUS and private observatories to provide timely technical reviews of the proposals.

  **Status:** Completed successfully for semesters 2014A and 2014B.

- Convene Time Allocation Committee (TAC) panels twice a year to review the proposals and provide recommendations to the NOAO director.

  **Status:** TAC panels for semester 2014A met in Tucson in November 2013, while the 2014B panels met in Tucson 29 April–1 May 2014 (for the NOAO Survey TAC) and 5–9 May 2014 for the regular NOAO TAC.
• Work with the public and private observatories to prioritize and schedule the approved proposals.

  **Status:** Completed successfully for semesters 2014A and 2014B.

• Publish timely announcements of the results of the time allocation process.

  **Status:** Results of the TAC process were announced on 17 December 2013 for semester 2014A (which began 1 February 2014) and on 16 June 2014 for semester 2014B (which begins on 1 August 2014).

• If agreed to by the Gemini Observatory, implement a Gemini Large Program international TAC panel that would be managed by NOAO as part of the overall time allocation process.

  **Status:** The Gemini Large Program (GLP) TAC met in Tucson 29 April–1 May 2014, in conjunction with the NOAO Survey TAC. The GLP TAC consisted of 6 members from the US, 2 from Canada, and 1 each from Australia and Argentina. Requests for Gemini Large Programs exceeded expectations, with 32 proposals submitted and 1357 hours requested for semester 2014B itself (with comparable amounts of time requested for future semesters). The process was managed by NOAO staff, and a science-ranked list of programs was forwarded to Gemini for them to select and schedule.

2.4  NOAO SYSTEM TECHNOLOGY CENTER

The NOAO System Technology Center (NSTC) incorporates two programs: (1) System Instrumentation (SI), which oversees NOAO’s efforts to build new instruments or enhance the performance of existing instruments for its own telescopes, for the Gemini telescopes, and for other telescopes participating in the System and is supported through NOAO’s base budget and supplemental awards such as ReSTAR; and (2) LSST Technology, which provides scientific, engineering, and management support to the LSST Project and is responsible for telescope mount, enclosure design, and site work within the LSST construction project.

2.4.1  System Instrumentation

**Program Highlights**

As described in the milestone status reports below, NSTC is essentially on schedule to complete all instrument projects under the ReSTAR program. Two of the three remaining ReSTAR projects (KOSMOS and COSMOS) were completed during this reporting period, and the third (Triplespec4) is on target for completion in the second half of FY15.

**Status of FY14 Milestones**

• Commission the Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS), a ReSTAR-supported project, on the Mayall 4-m telescope, and begin community use of KOSMOS on a shared-risk basis.
Status: Completed. By the end of the second quarter (Q2) of FY14, the third and final scheduled commissioning run of KOSMOS had been completed successfully, all functions had been tested, and measurements of all performance parameters were complete. Optical throughput was confirmed to be very high, with total efficiencies at the peaks of the grism blaze functions of 38% for the blue grism and 42% for the red grism. These efficiencies are in line with design predictions and exceed the comparable numbers for the aging Ritchey-Chrétien Spectrograph by a factor of 2. The first community “shared-risk” use of the instrument also occurred during Q2 FY14. KOSMOS was offered to the community in all modes, without restrictions, in the call for proposals for observing semester 2014B.

- Commission the Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS), a ReSTAR-supported project, on the Blanco 4-m telescope, and make COSMOS available for community use on a shared-risk basis.

Status: Completed. By the end of Q3 of FY14, both of the scheduled commissioning runs of COSMOS had been completed on the Blanco telescope, all functions had been tested except for multi-slit spectroscopic observing, which requires recommissioning of the telescope Cassegrain rotator. Recommissioning of the rotator by the CTIO technical staff is underway and expected to be complete by the end of FY14. The COSMOS optical throughput was confirmed to be even higher than that of KOSMOS, with total efficiencies at the peaks of the grism blaze functions of 42% for the blue grism and 44% for the red grism. For both instruments, these numbers include the throughput of the telescope optics, so the higher numbers for COSMOS almost certainly reflect the much newer aluminum coating on the Blanco primary mirror. COSMOS was offered to the community for long-slit spectroscopic observations in shared-risk mode during semester 2014B.

- Complete the detector-controller-software integration tasks for TripleSpec (a ReSTAR-supported) project, and deliver the integrated and optimized detector systems to Cornell University for final integration of the entire instrument.

Status: This will be completed by the end of FY14, except for delivery to Cornell. During FY14, the NOAO South technical team completed the laboratory test station including the cryogenic Dewar, controller, computer, and all the associated cabling and custom-designed circuit boards. The team also successfully finished testing and characterization of the bare multiplexer (both warm and cold) and the engineering-grade H2RG detector that will be used for the slit-viewing imager. In the latter case, the team resolved an issue with erratic performance in two of the 32 readout channels by a slight modification to the detector mounting scheme in the test Dewar to reduce the clamping pressure along the edges of the detector package. Testing and characterization of the science-grade H2RG detector that will be used for the spectrograph itself began late in Q2 of FY14 and is on schedule for completion in Q4 of FY14. Due to minor schedule adjustments in the laboratory integration of the overall instrument, the detector and controller systems are scheduled to be delivered to Cornell in October of 2014.

- Remove the partially populated One Degree Imager (pODI) from WIYN, disassemble it in the Tucson laboratory, and begin integration of the expanded 6 × 6 focal plane into the Dewar.

Status: Superseded. Delays in the foundry runs for the required Orthogonal Transfer Array (OTA) detectors, combined with uncertainties in future WIYN funding, led to a lengthy reconsideration of the plan to expand the focal plane to a 6 × 6 array. Those discussions ultimately led to agreement between NOAO and the remaining WIYN partners on a less ambitious plan to expand the focal plane to a 5 × 5 configuration, which does not require any further foundry runs.
to make detectors. This plan now calls for removal of the instrument from the telescope in November 2014 to begin preparing for the upgrade. Because this work will be carried out entirely by NOAO North Engineering and Technical Services (NN ETS) personnel, this project will shift to the NN ETS work package for FY15.

2.4.2 LSST Technology

Program Highlights

Substantial progress was achieved by the LSST Technology program to advance the overall project to support construction authorization. The LSST Project successfully completed the NSF Final Design Review (FDR) in December 2013 and is included in the approved federal budget with favorable funding profiles. The expectation is to commence construction once official approval is granted (planned for July 2014).

The procurement effort for the summit facility construction was conducted and completed in April 2014, with an award recommendation provided to the LSST Project Office. Initial discussions and “value engineering” efforts were begun with the recommended Chilean contractor to align their bid proposal with all required components, models, and quantities. Early mobilization is planned for late 2014.

The Final Design Review for the rotating enclosure (dome) system was successfully completed in May 2014. The 1.5-day review was held in Tucson and reviewed by a three person external committee along with several potential pre-qualified vendors. All the documentation was well received and the committee report was very positive regarding the work completed (successfully addressing all seven charge items.

The Telescope Mount Assembly (TMA) contract was awarded. The vendor bid proposals were received in late 2013 and reviewed in December 2013. In early January 2014, the TMA bid review committee unanimously recommended award to the LSST Project Office. Initial TMA design activities will focus on review of requirements and interfaces (specifically those within the summit support facility). Moog/CSA Engineering was awarded the contract for the hexapod/rotator systems and began initial design activities in March 2014 and should complete design activities in early October 2014.

The University of Arizona Steward Observatory Mirror Laboratory (SOML) is on schedule to complete polishing of the primary/tertiary (M1M3) mirror in late 2014. The mirror surfaces are near final specification (as of July 2014), and final acceptance test procedures have been developed. The M1M3 shipping/storage container has been delivered and a suitable storage location has been secured in Tucson.

The team successfully completed logistics processes and procedure planning and safely disassembled and removed the Calypso telescope from its site on Kitt Peak to the NOAO high-bay area in Tucson. The mirrors were secured in their shipping boxes and eventually will be cleaned and recoated. The telescope hardware will be inspected for eventual refurbishment and upgrading of the drive and control systems.

Status of FY14 Milestones

- Site and Facility:
  - Support the final review and closeout of the 100% facility design drawing package from ARCADIS in Santiago;
– conduct an open procurement effort to solicit a Chilean general contractor; and
– award the site and facility general contractor contract.

Status: The procurement effort for the summit facility construction was conducted and completed in April 2014, with an award recommendation provided to the LSST Project Office. Initial discussions and “value engineering” efforts were begun with the recommended Chilean contractor to align their bid proposal with all required components, models, and quantities. Additional discussions between the contractor and the LSST A&E firm will aim to reduce the final contract price through identification of efficiencies in construction techniques or design changes. Contractor mobilization on the summit is anticipated in late 2014, with initial activities to focus on civil works (roads, utilities, etc.) and final excavation.

• Dome:
  – Complete the enclosure and the wind/light screen baseline designs and prepare the procurement package for the design and fabrication contract; and
  – award the dome design and fabrication contract.

Status: The wind/light screen system for the rotating enclosure (dome) was completed. The team conducted the Final Design Review for the dome system in May 2014. The 1.5-day design review was held in Tucson and conducted by a three-person external committee along with several potential pre-qualified vendors. All of the design documentation was well received by the committee, and their final panel report was very positive regarding the work completed (successfully addressing all seven charge items). The Request-for-Proposal (RFP) release date for the dome is scheduled for late July 2014, with the plan to select a vendor to fabricate the dome system in early 2015.

• Telescope Mount:
  – Complete the evaluation of vendor bids for the telescope mount;
  – award the telescope design and fabrication contract;
  – commence the initial engineering design activities with the telescope mount vendor; and
  – commence the initial engineering design activities with the hexapod/rotator system vendor.

Status: The Telescope Mount Assembly (TMA) contract was awarded to a Spanish consortium (GHESA/Asturfetto). Final contract negotiations were completed in late June 2014 and initial kick-off meetings also were completed. These initial design activities are focused on review of performance requirements and review of all interfaces (specifically those within the summit support facility). Moog/CSA Engineering in Mountain View, California, was awarded the contract for the hexapod/rotator systems (including the secondary mirror and camera). Moog began initial design activities in March 2014 to complete the strut geometries and rotator component selections and should complete the remaining design activities in early October 2014.

• Reflective Optics:
  – Work with the LSST primary mirror vendor to perform, witness, and complete final acceptance testing of the mirror,
  – develop command software and test the initial prototype of the inner loop controller, and
work with the secondary mirror assembly vendor to perform metrology risk reduction activities.

**Status:** The University of Arizona Steward Observatory Mirror Laboratory (SOML) is on schedule to complete polishing of the primary/tertiary (M1M3) mirror in late 2014. The mirror surfaces are near final specifications (as of July 2014), and final acceptance test procedures have been developed. The M1M3 shipping/storage container has been delivered and a suitable storage location has been secured in Tucson. Upon completion of the optical testing, the M1M3 will be stored until the telescope mirror cell and active support system are fabricated and delivered to Tucson. The Inner Loop Controller (ILC) prototype board assembly was fabricated, delivered, and successfully tested in the LSST lab. This single board provides a common interface to over 1300 inputs that are needed within the M1/M3 cell assembly. Exelis, the secondary mirror (M2) cell assembly vendor, has been performing metrology risk reduction activities. The M2 demonstration hardware has been used to evaluate optical interferometric stitching algorithms that are required to polish and test the M2 prime hardware.

- Wavefront. Alignment and Calibration:
  - Remove the Calypso telescope from its site, evaluate the hardware condition, and formulate a detailed refurbishment plan;
  - support the LSST calibration design review with input and design of instrument and atmospheric calibration equipment.

**Status:** The team successfully completed logistics processes and procedure planning and safely disassembled and removed the Calypso telescope from its site on Kitt Peak to the NOAO high-bay area in Tucson. The mirrors were secured in their shipping boxes and eventually will be cleaned and recoated. The telescope hardware will be inspected for eventual refurbishment and upgrading of the drive and control systems. The telescope team supported the refinement of calibration system performance requirements with the LSST Simulations team. The requirements will drive the eventual acquisition of hardware components to provide instrument photometric calibration and a measure of the atmospheric water vapor content.

- Software and Controls: Continue development of the operations scheduler preliminary design.

**Status:** The teams successfully developed and completed a week-long telescope software workshop. The goal was to review status of software developments that had been completed during the previous design and development tasks, present a software development process to be followed during construction, and assess upcoming work flow and responsibilities. Details of the operational scheduler design were completed, with plans to provide a preliminary design review in late 2014.

- Data Management: Update the data management infrastructure plans, especially as they impact the summit and base facilities in Chile.

**Status:** The LSST software team worked with the data management and camera teams to update infrastructure requirements and plans (summit networks, summit-to-base communications, etc.). These requirements are needed to support the planned design of the summit and base facilities.

- Utility Systems: Update the design for the electrical distribution, grounding, and utility services for the summit facility to be consistent with the 100% summit facility drawing package and any vendor-specific information from the secondary mirror and mount contracts.
**Status:** The 100% summit facility drawing packages were thoroughly reviewed by the lead LSST electrical engineer to ensure compliance with the secondary mirror and mount contracts. In addition, information was provided to the general CTIO community about planned upgrades to utility systems necessary for LSST operations.

- **Systems Engineering:**
  - Coordinate and complete the development of level 2 and 3 telescope and site interface documents;
  - complete the requirements modeling for the telescope and site, as well as the observation control systems; and
  - update the hazard analysis and risk register of the telescope and site system.

**Status:** LSST Systems Engineering personnel continued to refine and update interface documents to support early vendor contractor efforts as well as internal requirements to the camera and data management subsystems. The observatory solid model was updated to reflect the 100% drawing package and recent refinements to the dome subsystem. Additional efforts were completed to increase the use of Confluence and JIRA to provide broad communication and timely response to action items across the Project.

- **Project Management:**
  - Support the project with participation as an LSST Board member and an AURA Management Council for LSST (AMCL) member,
  - complete the 2013 inputs for the updated Project Management Control System, and
  - support and participate in project-wide reviews.

**Status:** Aside from general support to internal reviews, the Telescope team participated in the successful completion of the NSF Final Design Review in December 2013. This week-long meeting was held with 18 reviewers and government representatives. In preparation for the review, all of the Project Management Control System (PMCS) basis of estimates were updated to 2013 base year dollars and refreshed to be no more than six months old. The Project is included in the approved federal budget with favorable funding profiles. The expectation is to commence construction once official approval is granted (planned for July 2014).

- **Operations Simulator:**
  - Support the Operations Simulator (OpSim) group lead and the OpSim group’s principal interface to the LSST Project,
  - develop necessary scientific metrics for the analysis of the OpSim output, and
  - complete and deliver the final design version of the OpSim tool set to support the LSST final design review and the preparation for construction.

**Status:** The team successfully completed an external review of the Operations Simulator (OpSim) in February 2014. The four-person review committee’s final report was very positive regarding the materials presented and the development roadmap plan. The OpSim team is preparing for the transition to construction of the Operational Scheduler, while maintaining the simulation effort within the LSST Systems Engineering group.
• Education and Public Outreach: Provide LSST graphic design assistance and website development to support design reviews and planned procurements.

    **Status:** The telescope team developed and utilized numerous custom website pages and links to support broad communication and information transfer during all of the design reviews and procurement efforts. Additional supporting graphical design materials were used during the NSF FDR to support the review.
3 NOAO-WIDE PROGRAMS

3.1 OFFICE OF SCIENCE

Program Highlights

The Office of Science (OS) developed and ran the program for the 2013-2014 NOAO/Steward Colloquium Series in collaboration with the University of Arizona Steward Observatory. In collaboration with the NOAO postdoctoral researchers, the 2013-2014 program of Friday Lunch talks (FLASHes) and Tuesday coffees was begun and continued into the summer. The OS continued to run a weekly Monday morning coffee for the NOAO Science staff. The OS drafted and distributed three issues of the NOAO electronic newsletter, *Currents*. The Q3 issue informed the US community of astronomers about the favorable review of the proposal for DESI (Dark Energy Spectroscopic Instrument) by the Department of Energy (DOE) P5 panel, the TMT Science Forum in July, and the LSST Cadence workshop in August. Also in Q3, the OS worked on organizing an NOAO-hosted meeting to help inform the community of the present tools available for the analysis of astronomical “big data.” This meeting will be held in March 2015, in Tucson. Lastly, the OS prepared a set of Science Highlights for the September 2014 *NOAO Newsletter*, summarizing recent findings based on NOAO and US-Gemini observational programs.

Status of FY14 Milestones

- Establish a program of monthly informal lunches and actively encourage postdocs to attend NOAO-sponsored science talks and colloquia and scientific staff meetings to improve the integration of the NOAO postdocs into the NOAO science environment.

  Status: *OS will host a discussion in August phased with the start of the new academic year.*

- Continue to develop materials for and implement a retraining program on Responsible Conduct in Research for NOAO scientific staff.

  Status: *No progress during this reporting period.*

- Provide mentoring and career development resources to staff as needed, particularly to postdoctoral researchers.

  Status: *Organized discussions of career development were made a regular part of the Tuesday coffee discussions. These discussions are open to the NOAO staff as well as University of Arizona astronomy staff and postdocs.*

3.2 EDUCATION AND PUBLIC OUTREACH

Program Highlights

The Education and Public Outreach (EPO) staff were involved during this reporting period in the key educational and outreach areas listed below.

Project ASTRO: Project ASTRO continues to actively support teachers and astronomer educational partnerships in Tucson and the surrounding area. NOAO staff and students supported numerous star parties and made several visits to classrooms during this reporting period. The Project ASTRO spring training workshop was held at NOAO on 3 May 2014. The NOAO Project ASTRO coordinator attended the national Project ASTRO Site Leader’s meeting in Traverse City, Michigan,
June 5–7. Planning is currently underway for the fall Project ASTRO workshop, which is scheduled for September 26.

**Colors of Nature:** “Collaborative Research Project STEAM: Integrating Art with Science to Build Science Identities among Girls” is an NSF-funded project designed to advance the understanding of science, technology, engineering, and mathematics (STEM) learning in informal education environments. The project, referred to as “Colors of Nature” (www.colorsfnature.org), is a collaboration of the University of Alaska (Fairbanks, Alaska), NOAO, and the University of Washington-Bothell. The Colors of Nature Summer Academy is a two-week program held in Tucson and Fairbanks each summer, supplemented by science cafés exploring the commonalities of art and science. During the year, three science cafés were held in Arizona: two in Tucson and one in Sells. Applications for the summer 2014 academy were submitted in the spring of 2014, and twice as many fifth- to seventh-grade girls applied for entrance as there were available spots. Twenty-nine girls attended the two-week academy in Tucson, 9–20 June 2014. Six of the participants were from the Tohono O’odham Nation. The second 2014 academy will take place July 7–18 at the University of Alaska, Fairbanks Museum of the North with 28 participants.

**Teaching With Telescopes:** The Teaching With Telescopes website was updated with a new observing guide for 2014. NOAO staff presented a four-hour workshop on teaching with Galileoscopes at the national meeting of the National Science Teachers Association in Boston, Massachusetts on 5 April 2014. Preparations are underway for the fall programs with Galileoscopes in Flagstaff and Casa Grande, Arizona. NOAO will support teaching activities with telescopes that have been proposed for the International Year of Light 2015.

**Undergraduate Mentoring and Outreach Program:** For the first three quarters of FY14, the EPO student cadre continued to support a variety of EPO activities. There was an average of two programs per week throughout the quarter. These programs included 17 Dark Skies student sessions at a Tucson environmental teaching center (Cooper Center for Environmental Learning), more than a dozen star parties (four of which were on the Tohono O’odham Nation), five classroom visits (one to the Tohono O’odham Nation), four camps (one on the Nation), four other events on the Tohono O’odham Nation (e.g., Indian Day in Sells), eight festivals and family nights (e.g., USA Science and Engineering Fest, Tucson Festival of Books), and three events on the University of Arizona campus. The programs also included several workshops and the final professional development session using Google+ Hangout for the International Astronomical Union (IAU) Dark Skies Africa project. Undergraduate students are progressing in their studies with students pursuing research projects this summer. One is at the University of Arizona pursuing a neuroscience research project; one is at the Very Large Array participating in the National Radio Astronomy Observatory’s for Research Education for Undergraduates (REU) program; and a third is pursuing a Kepler-oriented research project using NOAO and Steward Observatory telescopes, in collaboration with talented Tucson High School students.

**Dark Skies Education Programs:** During the first two quarters of FY14, six talks, five posters, and a workshop were given on behalf of four NOAO Dark Skies programs: Dark Skies Africa, Dark Skies Yuma, the Globe at Night citizen-science campaign, and an REU night sky brightness study. In addition, NOAO EPO staff organized a splinter session on light pollution at the January 2014 meeting of the American Astronomical Society (AAS). The session was sponsored by NOAO; the AAS Committee on Light Pollution, RFI, and Space Debris; IAU Commission 50; and the International Dark-Sky Association. NOAO organized poster and oral sessions at the American Geophysical Union meeting on teacher professional development programs doing authentic research in the classroom, and on Citizen Science. A “Dark Skies and Energy Education” workshop was held at NOAO for local teachers.
In Q3 of FY14, during April’s Global Astronomy Month, Dark Skies Awareness programs were offered through Globe at Night, International Dark-Sky Week, and the international Earth and Sky Photo Contest. The photo contest received over 1000 photos from 55 countries. The 10 winners and 70 honorable mentions can be found at TWANight.org/contest.

At the June AAS meeting, NOAO EPO staff gave for the first time a well-received workshop on citizen-science in the college classroom as well as a talk on the upcoming International Year of Light. NOAO EPO staff trained local amateur astronomers on issues surrounding light pollution at their “Fundamentals” class. NOAO EPO staff also mentored research projects on outdoor lighting audits, which were presented at the University of Arizona by students from various Native American nations in Arizona in a program sponsored by the American Indian Science and Engineering Society (AISES).

Globe at Night: During the first two quarters of FY14, the Globe at Night 2014 campaign expanded from five days each month to 10 days at the end of each month. The Globe at Night website was redesigned, and NOAO staff presented at a Night Sky Network teleconference on Globe at Night to 70 amateur astronomers across the country. An NOAO EPO student wrote six issues of the Globe at Night electronic newsletter. Three podcasts on Globe at Night and light pollution issues were written and recorded by the NOAO EPO students for 365DaysofAstronomy.org.

For Q3, Globe at Night highlights included a Cosmoquest Google+ Hangout session on Globe at Night by NOAO EPO and International Dark Sky Association staff and a Globe at Night workshop held at the National Science Teachers Association conference. For the campaign, this year to date, 14,452 observations had been submitted from 70 countries and 45 US states. Of those observations, 4,371 (30.24%) were submitted via mobile devices (smart phones and tablets). There were 2,839 (19.64%) observations that included Sky Quality Meter (SQM) readings.

Two research interns this summer, one from the CalPoly STAR teachers program and the other from a Native American REU program at the University of Arizona’s College of Optical Sciences, are working as a team on a night sky brightness measurement project. At various locations around town and observatory mountaintops during Globe at Night in June, they have taken images using digital single lens reflex (DSLR) cameras as well as sky brightness measurements with SQMs. They have also made visual limiting magnitude estimates and used the “Loss of the Night” and “Dark Sky Meter” cell phone applications to make additional measurements. The objective of the project is to see how the night sky brightness measurements compare using the different methods. A second intern from the STAR teachers programs is working on astronomical DSLR photometry with the EPO staff.

International Year of Light 2015: As part of an IAU Working Group, NOAO EPO staff continued their involvement in the planning for the Cosmic Light cornerstone of the International Year of Light (IYL) 2015. EPO staff submitted an IAU proposal for an IYL quality lighting education kit. Should the proposed program be approved, the project would begin in late FY14 and extend through FY15.

KPNO REU: Each of the six 2013 KPNO REU (NSF AST-1262829) students were the presenting authors of six posters at the 223rd AAS meeting, which was held near Washington, D.C., on 5–9 January 2014.

The 2014 KPNO REU program received a total of 132 complete applications with an additional 36 incomplete applications. Six students were selected; there are three women and three men. One of the men was a Native American, and one of the women was an African American.

On June 2, all six of the 2014 KPNO REU students (Samantha Brunker, Jamison Burke, Belinda Cheeseboro, Kyle Lackey, Marcus Lee, Anna Payne) were working on their various research pro-
jects at NOAO North with their respective mentors (Jayadev Rajagopal and Susan Ridgway, Chuck Claver, Dara Norman, Jay Elias, Gautham Narayan, and Hanae Inami).

The 2014 REU Summer Lecture Series started on June 12 with an introduction to NOAO by its director, David Silva. NOAO astronomer Abhijit Saha gave the second lecture on June 19 on the topic of “Pulsating Variable Stars.” Frank Hill, a senior scientist at the National Solar Observatory, will give an introduction to helioseismology as the third lecture on June 26.

**NOAO South Education & Outreach:** The EPO-South team continued to work with its community collaborators in different joint projects aimed toward bringing science to the region’s students and general public. On October 2013, the most relevant collaboration was with Explora-CONICYT in organizing the local “Week of Science” with events such as visits to CTIO labs and telescope sites by outstanding students; through participation in public fairs in La Serena, Coquimbo; and through other activities. Another important collaboration was with the local office of the Environmental Ministry, leading to the first “Sustainable Neighborhood” project developed in the San Ramón neighborhood of Coquimbo. This project created a complete set of activities to teach neighbors about environment protection and energy savings. It was designed to build awareness of how light pollution can be controlled.

In January 2014, EPO staff traveled to Concepción, in the south of Chile, to participate in the University of Concepción’s summer school, with the particular goal of promoting the 2014 Globe at Night campaign.

![Figure 9: Educators in Illapel, Chile, April 2014.](image)

NOAO continued their work with CEAZA, The Center for Advanced Studies in Arid Zones, in the joint project “Science, Education and Sustainability for the Touristic Development of the Region of Coquimbo.” The project, which ends this September, has performed training to develop science-related competencies (including astronomy) in the residents of Punta Choros and Caleta Hornos, in order to encourage sustainable tourism in the region. Another EPO program is with the University Santo Tomás of La Serena and involves the professional development of preschool teachers. The training includes workshops on basic astronomy, spectroscopy, and light pollution control. The third cycle of training was carried out in the first semester of 2014. It involved 75 preschool teachers and 15 students, with more than 48 hours of training provided. In Q3 of FY14, NOAO staff started another joint collaboration with CEAZA to train science teachers and students at ten municipal schools of La Serena (Figure 9). The program emphasizes science inquiry and astronomy teaching/learning. This project will work with ten teachers and around 100 students.
In Q3 of FY14, a total of 43 different educational events were performed by EPO South. In summary, during the nine months involving this report, a total of 121 events were held by the South team, with a total reach of 16,328 people.

**Media Releases**

- PR1401: 19 February 2014 NOAO: “Astronomers at the National Observatory Continue to Watch Sn2014j”
- PR1402: 2 April 2014 NOAO/Gemini: “Sakurai’s Object: Stellar Evolution in Real Time”
- PR1403: 16 April 2014 NOAO: “A Sharp Eye on Southern Binary Stars”

Additional items of interest were posted on the NOAO homepage, including notice about the posting of the NOAO Newsletter, ongoing observing of a supernova in M82, new public images produced by Travis Rector, and notices about new instruments.

**Status of FY14 Milestones**

- Support the strategic plan for NOAO South outreach and the Centro de Apoyo a la Didáctica de la Astronomía (CADIAS) astronomy teaching center in Chile. This includes programs involving dark skies education and teaching with Galileoscopes.
  
  **Status:** Programs in the area of dark skies and teaching with Galileoscopes are ongoing. The materials in the CADIAS teaching center are being reorganized to create room for new exhibits and programs.

- Execute a wide-ranging, dark skies awareness program for Chile and Arizona, including the national/international citizen science program, Globe at Night, started and run by NOAO.
  
  **Status:** Globe at Night is running vigorously in Chile and Arizona and is accompanied by a host of synergistic supporting activities.

- Work with the Tohono O’odham Nation to support an astronomy program at the Tohono O’odham Community College and to support a science fair program in the Tohono O’odham high schools.
  
  **Status:** EPO staff continued to work with the Tohono O’odham Community College (TOCC). NOAO staff are currently scheduled to teach introductory astronomy in a four-credit class again in the upcoming fall semester at the college. One of the TOCC students from the fall 2013 course is currently an REU student at NOAO. Another is an REU student under the sponsorship of the University of Arizona College of Optical Sciences and doing a night brightness research project at NOAO. NOAO staff served as science fair judges at several schools in January–
February. Four Tohono O’odham students were recruited to apply to the University of Arizona astronomy camp that took place at Kitt Peak; all four received scholarships from NOAO.

- Support the Teaching with Telescopes program in Arizona and Chile with teacher professional development on telescope and optics concepts, making use of Galileoscopes. Support to the extent possible the current Galileoscope star party programs in Yuma, Globe, Safford, and Flagstaff. Maintain the national Teaching with Telescopes teacher support website.

  **Status:** Professional development around this program continued with preparation for Arizona star parties in Tucson, Flagstaff, and Casa Grande. Formal support from Science Foundation Arizona for the program in Yuma, Globe, and Safford ended, but NOAO continues to support and encourage efforts at these sites.

- Conduct professional development workshops and programs for formal and informal science educators in coordination with professional organizations such as the National Science Teachers Association (NSTA), the American Astronomical Society (AAS), the Astronomical Society of the Pacific (ASP), the American Geophysical Union, and the Association of Science-Technology Centers (ASTC).

  **Status:** Workshops were conducted at the national NSTA meeting and the AAS meetings at National Harbor and Boston, and workshops are planned for the ASP meeting in August. Conference posters and oral sessions on Teacher Professional Development for Research and on Citizen Science have been proposed by NOAO EPO staff for the American Geophysical Union (AGU) meeting in December. These sessions are among the longest-running education sessions at the AGU meeting.

- Support the training of guides and provide support for astronomy programs for the public at the major municipal and touristic observatories in northern Chile.

  **Status:** NOAO continued to work with the tourist observatory and their guides. During Q3 of FY14, NOAO worked most closely with the Observatorio Cruz del Sur in guide support and training and program development. NOAO is investigating offering another formal course for guides to begin the training cycle again.

- Support dark skies education programs in northern Chile with El Centro de Estudios Avanzados en Zonas Áridas (CEAZA).

  **Status:** The CEAZA project activities north of La Serena have been numerous. A summary of activities was given above in the Program Highlights section.

- Maintain an active southern Arizona Project ASTRO teacher/scientist partnership program with professional development activities held at least twice a year.

  **Status:** NOAO’s Project ASTRO director left NOAO for a position at the University of Arizona and was replaced by a current EPO staff member. A Project ASTRO workshop was conducted in May and the fall workshop is being scheduled.


  **Status:** A very successful program was delivered in Tucson with the culminating projects displayed at the University of Arizona College of Optical Sciences on June 20. Planning for the
program that begins July 7 at the University of Alaska Museum of the North was completed and it is anticipated to be another successful program.

3.3 NOAO DIRECTOR’S OFFICE

Program Highlights

The NOAO Director’s Office (NDO) began the fiscal year by organizing NOAO’s plan for a potential Federal government shutdown. The government did shut down, and NOAO began executing a contingency plan in response. All NOAO actions were done in collaboration with the AURA Central Administrative Services and Human Resources (HR) groups. Thanks to good preparation on all sides, NOAO was able to maintain normal operations throughout the entire shutdown without undue interruption.

NDO completed and delivered three major documents during Q1: the “NOAO Transformation Plan FY 2016,” the “NOAO Annual Program Plan FY 2014,” and the “NOAO Fiscal Year Annual Report FY 2013.” The first two documents were reviewed by the NSF Program Review Panel as part of a meeting held at NSF Headquarters in November. The NOAO director and deputy director attended that meeting. During Q2 and Q3, transformation planning continued with particular emphasis on NOAO-wide personnel planning and KPNO restructuring. During Q2, the NOAO director held a series of internal town halls. Meeting with groups of roughly 20–30 NOAO employees, the director repeated his January AAS presentation (see below) and then answered questions. These sessions typically lasted 90 minutes and were held on Kitt Peak and Cerro Tololo as well as twice in La Serena and five times in Tucson. The goal was to make sure all NOAO employees had a chance to interact with the director as NOAO heads into a time of great change. This process will be repeated in early 2015.

The director and deputy director attended the AAS meetings in January (National Harbor, Maryland) and May (Boston, Massachusetts). At the January meeting, the director conducted the annual NOAO Town Hall, where he presented an update about the NOAO program and answered questions from the audience. During the rest of the January and May meetings, the director and deputy director spent most of their time at the NOAO booth to interact with conference attendees and answer their questions one on one.

The director and deputy director both attended various sessions of the LSST Final Design Review in early December. The director, deputy director, and the three NOAO associate directors participated in the February meeting of the AURA Observatory Council in Washington, D.C. Program update presentations were given as well as a status update on the transformation planning.

The director participated in meetings of the LSST Board of Directors, TMT Collaborative Board of Directors, LSST Joint Operations Working Group, Joint DES–LSST Workshop and the AURA Management Council for LSST. The director also participated in the 12th Kavli Futures Symposium that focused on the topic “Future U.S. Ground-Based Astronomy in the Global Context,” at which he took part in a lively and frank two-day discussion with other community leaders. At the invitation of the NASA Program Officer, the director was a member of the review board for the Kepler prime mission close-out review. As president of IAU Division B, the director attended the IAU Executive Council meeting during Q3.

The director made presentations to the AURA Board of Directors, AURA Member Representatives (at their annual meeting, which the deputy director also attended), AURA Observatory Council (where the deputy director and the three associate directors presented as well), the NOAO Users
Committee (where the deputy director and the three associate directors also presented) and the NSF NOAO Program Review Panel (where the deputy director presented as well).

The deputy director attended a Giant Magellan Telescope (GMT) Science Advisory Committee meeting in Pasadena in October and the Dark Energy Spectroscopic Instrument (DESI) Collaboration meeting in May and the DESI Lab Director’s Review in November, which were both at Lawrence Berkeley National Laboratory. The deputy director also attended the GMT Preliminary Design Review in January and the GMT GMACS optical spectrograph workshop/Science Advisory Committee meeting in April hosted at Texas A&M University in College Station, Texas. The deputy director participated in several sessions with the EPO external advisory panel during their annual meeting in Tucson in April. The deputy director also participated in the SOAR “Futures Workshop” in Chapel Hill in May as a SOAR Board member for NOAO.

Status of FY14 Milestones

Observatory Management

- Develop an annual program plan for FY14, to be delivered during the first quarter of FY14.
  
  Status: Completed during the first quarter of FY14.

- Deliver detailed transformation plans covering FY14–FY16, to be executed in FY15, per NSF directives.
  
  Status: On-going. See discussion in the Program Highlights section.

- Deliver scientific quarterly and annual progress reports as required by NSF under the terms of their cooperative agreement with AURA for the management and operations of NOAO.
  
  Status: The scientific quarterly reports for the first and second quarters of FY14 were completed and submitted to the NSF on time.

- Facilitate on-going management training for the NOAO senior management team.
  
  Status: The AURA Human Resources group has partnered with CD2 Leadership to offer an online management training course that combines on-line study with group discussion sessions. During the third quarter of FY14, the AURA senior management team (director, deputy director, and three associate directors) started this course. After they complete the course, a new cohort consisting of the next management level is expected to complete the course.

- Continue to work on ways to improve communication between NOAO staff at all levels.
  
  Status: On-going. During Q2, the director held a series of small, group meetings with all NOAO employees in Arizona and Chile. During Q3, he restarted his internal blog. Throughout this period, the director held monthly meetings with the NOAO scientific staff where he presented status reports on various projects and enabled in-depth discussion on key topics.

- As necessary, support AURA with NSF-mandated reviews (e.g., Business Service Review and Mid-Term Management Review).
  
  Status: There were no such reviews related to the current cooperative agreement during this reporting period.
Diversity Program

- The diversity advocate will maintain a national presence on issues related to diversity and use the information gathered to inform diversity activities at NOAO.

**Status:** The diversity advocate continued as a member of the AAS demographics committee, participating in an analysis of national survey data. She continued as the AAS council liaison to the Committee on the Status of Minorities in Astronomy (CSMA) supporting pipeline-building efforts of the society. She organized a mentoring session with several minority students in attendance at the AAS meeting in January. She was the principal representative of the National Society of Black Physicists (NSBP) on the Carl Albert Rouse Fellowship Selection Committee to send minority undergraduate students to Caltech for summer research experiences. She participated as a panelist at the University of Arizona in a discussion of challenges and strategies for balancing family and a career in the science, technology, engineering, and mathematics (STEM) areas.

- The diversity advocate will insure that procedures and practices in hiring, promotion, tenure, workplace climate, etc. incorporate diversity best practices, in collaboration with the AURA HR group.

**Status:** The diversity advocate continued to make presentations and provide information to committees on unconscious bias and its possible effect in various aspects of the NOAO mission. She convened and chairs a working group of Chilean AURA employees to discuss the role of diversity and broadening participation among the AURA workforce in Chile. A draft white paper presenting concerns, ideas, and suggestions from the working group was circulated for comment and was presented to the AURA Workforce and Diversity Committee at their May meeting.

- Insure that procedures for hiring are outlined clearly.

**Status:** The diversity advocate worked with AURA HR on hiring best practices. However, the long-term assurance that these procedures are followed is more appropriately handled through AURA HR.

- Work with the NOAO associate directors to help minority staff feel more included in the NOAO mission.

**Status:** Gender differences in responses to questions on the NOAO climate survey were presented by the diversity advocate at an NOAO Executive Council meeting, which was attended by the NOAO associate directors. Suggestions were given for improving the overall climate for women on staff.

- Continue, in coordination with AURA, to work on broadening participation in the NSF science enterprise by engaging individuals, institutions, and geographical areas “...that do not participate in NSF research programs at rates comparable to others.” (Quote from the Executive Summary of Broadening Participation at the National Science Foundation: A Framework for Action, August 2008).

**Status:** A more active role in support of the AURA partnership with the Iowa, Illinois, Nebraska STEM Partnership for Innovation in Research (IINSPIRE) was undertaken by the diversity advocate in an effort to strengthen the opportunity for NOAO to participate in the mentoring of engineering and technical students. NOAO continued the expansion of its relationship with the Tohono O'odham Nation. Activities included meetings with the Nation’s leaders and teaching
courses at the Tohono O'odham Community College. Two students from Iowa State University were accepted, and one will participate with a mentor from LSST. However, as they will share NOAO office space and equipment with the NOAO REU students, the NOAO diversity advocate has been actively involved in facilitating the program.

Safety Program

- With the coordination of the NOAO North Engineering & Technical Services manager, continue to enhance safety control measures for the Kitt Peak annual maintenance efforts during operational shutdown periods.

**Status:** Completed in Q3. Before starting summer shutdown, a review and safety walk-through of procedures was held, with the focus on safety issues during the removal, re-aluminizing, and replacing of the primary mirror for the Mayall 4-m telescope. A renewed effort to better document shutdown maintenance procedures is underway.
## 4 FY14 BUDGET SUMMARY

### NATIONAL OPTICAL ASTRONOMY OBSERVATORY

**BUDGET SUMMARY REPORT FOR AST-0809409**

**FY 2014 as of 6/30/2014**

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<th>Y-T-D Expenditures &amp; Encumbrances</th>
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<td>- 6,644,604 6,644,604</td>
<td>4,564,771 2,079,833</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOAO System Science Center (NSSC)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System User Support</td>
<td>- 830,182 830,182</td>
<td>700,880 129,302</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Data Management</td>
<td>76,800 1,892,478 1,969,278</td>
<td>1,231,452 737,826</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Community Development</td>
<td>- 698,198 698,198</td>
<td>536,792 161,406</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Allocation Committee</td>
<td>- 400,182 400,182</td>
<td>250,391 149,791</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>NSSC Subtotal</strong></td>
<td>76,800 3,821,040 3,897,840</td>
<td>2,719,515 1,178,325</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOAO System Technology Center (NSTC)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Instrumentation</td>
<td>- 64,979 64,979</td>
<td>133,924 (68,945)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ReSTAR instrumentation</td>
<td>- 517,749 517,749</td>
<td>465,348 52,401</td>
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<td></td>
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</tr>
<tr>
<td>LSST Technology</td>
<td>- 1,500,000 1,500,000</td>
<td>819,538 680,462</td>
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</tr>
<tr>
<td><strong>NSTC Subtotal</strong></td>
<td>- 2,082,728 2,082,728</td>
<td>1,418,810 663,918</td>
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<td></td>
</tr>
<tr>
<td><strong>Office of Science (OS)</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 816,851 816,851</td>
<td>385,747 431,104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education and Public Outreach (EPO)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 890,330 890,330</td>
<td>667,261 223,069</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOAO Director's Office (NDO)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 894,799 894,799</td>
<td>367,171 527,628</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOAO Director's Reserve</strong></td>
<td>1,712,988 83,848 1,796,836</td>
<td>(130,034) 1,926,870</td>
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<td></td>
</tr>
<tr>
<td><strong>AURA Services &amp; Fees</strong></td>
<td>- 2,454,095 2,454,095</td>
<td>1,647,575 806,520</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total NOAO Base Programs</strong></td>
<td>1,789,788 25,500,000 27,289,788</td>
<td>16,893,689 10,396,099</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>TSIP</strong></td>
<td>54,797 - - 1,955 52,842</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ARRA Infrastructure Renewal</strong></td>
<td>- - - - -</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total NOAO Programs</strong></td>
<td>1,844,585 25,500,000 27,344,585</td>
<td>16,895,644 10,448,941</td>
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<td></td>
</tr>
</tbody>
</table>
5 OBSERVING PROPOSAL STATISTICS FOR 2014B

Observing proposal (request) statistics for telescope time awarded through the NOAO telescope time allocation process (TAC) are published on the NOAO Web site. The 2014B proposal statistics are for the 373 new proposals (standard and survey) submitted to the 2014B NOAO TAC and are published as follows:

- Request Statistics by Telescope: [http://www.noao.edu/gateway/tac/obsreqs14b_s.html](http://www.noao.edu/gateway/tac/obsreqs14b_s.html)

  The statistics provided are broken down first by observatory and then by telescope and include the number of requests (proposals), nights requested, nights allocated, nights scheduled for new programs (standard and survey), and subscription rates for new programs (standard and survey).

- Request Statistics by Instrument: [http://www.noao.edu/gateway/tac/inst14b_s.html](http://www.noao.edu/gateway/tac/inst14b_s.html)

  The statistics provided are broken down first by observatory, then by telescope and instrument with totals by telescope and include the number of proposals, “runs,” total nights and dark nights; the percentage of dark nights; and the average nights/run.
6 USAGE OF ARCHIVED DATA

The first two tables below illustrate access to and usage of reduced data in the NOAO Science Archive (R2) from NOAO Survey programs. The table on the left shows the data download volume in gigabytes, the number of files retrieved and the number of unique visitors (for that month) who downloaded archive data through the ftp site. The table on the right shows the Web activity logged from the NOAO Science Archive Web site. It includes users (visitors) collecting additional information before or after downloading data, as well as visualization of the data online.

<table>
<thead>
<tr>
<th>Archive Data Retrieval Activity (ftp)</th>
<th>NOAO Science Archive Web Site Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Retrieved (GB)</td>
</tr>
<tr>
<td>Oct 2013</td>
<td>84.35</td>
</tr>
<tr>
<td>Nov 2013</td>
<td>309.66</td>
</tr>
<tr>
<td>Dec 2013</td>
<td>6.28</td>
</tr>
<tr>
<td>Jan 2014</td>
<td>132.87</td>
</tr>
<tr>
<td>Feb 2014</td>
<td>8.87</td>
</tr>
<tr>
<td>Mar 2014</td>
<td>58.02</td>
</tr>
<tr>
<td>Apr 2014</td>
<td>2.18</td>
</tr>
<tr>
<td>May 2014</td>
<td>11.77</td>
</tr>
<tr>
<td>Jun 2014</td>
<td>8.24</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>622.24</strong></td>
</tr>
</tbody>
</table>

The NOAO Portal provides principal investigators (PIs) and their co-investigators access to their raw data from all instruments and to pipeline-reduced products from the Mosaic, NEWFIRM, and DECam instruments at NOAO telescopes. The metadata are stored in a searchable Archive, which allows discovery and retrieval from the NOAO Portal (portal-nvo.noao.edu). After the requisite proprietary period (usually 18 months), the data become accessible to the general public.

<table>
<thead>
<tr>
<th>Portal Data Retrieval Activity (ftp)</th>
<th>NVO Portal Data Retrieval Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Bandwidth (GB)</td>
</tr>
<tr>
<td>Oct 2013</td>
<td>2,270.51</td>
</tr>
<tr>
<td>Nov 2013</td>
<td>876.99</td>
</tr>
<tr>
<td>Dec 2013</td>
<td>1,253.38</td>
</tr>
<tr>
<td>Jan 2014</td>
<td>650.15</td>
</tr>
<tr>
<td>Feb 2014</td>
<td>6.56</td>
</tr>
<tr>
<td>Mar 2014</td>
<td>2,942.18</td>
</tr>
<tr>
<td>Apr 2014</td>
<td>1,492.93</td>
</tr>
<tr>
<td>Date</td>
<td>Bandwidth (GB)</td>
</tr>
<tr>
<td>Oct 2013</td>
<td>2.75</td>
</tr>
<tr>
<td>Nov 2013</td>
<td>0.25</td>
</tr>
<tr>
<td>Dec 2013</td>
<td>1.26</td>
</tr>
<tr>
<td>Jan 2014</td>
<td>793.17</td>
</tr>
<tr>
<td>Feb 2014</td>
<td>1,177.60</td>
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<tr>
<td>Mar 2014</td>
<td>8,929.28</td>
</tr>
<tr>
<td>Apr 2014</td>
<td>2.33</td>
</tr>
</tbody>
</table>
### Portal Data Retrieval Activity (ftp)

<table>
<thead>
<tr>
<th>Date</th>
<th>Bandwidth (GB)</th>
<th>Pages Viewed</th>
<th>Unique Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2014</td>
<td>6,891.65</td>
<td>94,896</td>
<td>185</td>
</tr>
<tr>
<td>Jun 2014</td>
<td>1,366.89</td>
<td>27,700</td>
<td>99</td>
</tr>
<tr>
<td>Total:</td>
<td>17,751.24</td>
<td>312,159</td>
<td>883</td>
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</tbody>
</table>

### NVO Portal Data Retrieval Activity

<table>
<thead>
<tr>
<th>Date</th>
<th>Bandwidth (GB)</th>
<th>Pages Viewed</th>
<th>Unique Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2014</td>
<td>0.38</td>
<td>11,449</td>
<td>146</td>
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<tr>
<td>Jun 2014</td>
<td>0.08</td>
<td>8,017</td>
<td>87</td>
</tr>
<tr>
<td>Total:</td>
<td>10,907.10</td>
<td>561,811</td>
<td>3,249</td>
</tr>
</tbody>
</table>
7 GRANTS

The following table lists the grants received by NOAO staff from non-NSF agencies during the first nine months of FY14. There were no new grants received during the third quarter of FY14.

<table>
<thead>
<tr>
<th>Principle Investigator</th>
<th>Awarding Agency</th>
<th>Title</th>
<th>Budget Amount</th>
<th>Period of Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colette Salyk</td>
<td>USRA</td>
<td>A Search for Warm Methane in Protoplanetary Disks</td>
<td>$2,000</td>
<td>12/01/2013–11/30/2015</td>
</tr>
<tr>
<td>Arjun Dey</td>
<td>JPL</td>
<td>A Protocluster at Z = 3.78</td>
<td>$12,750</td>
<td>01/27/2014–09/30/2015</td>
</tr>
<tr>
<td>Mark Dickinson</td>
<td>JPL</td>
<td>The Distant Dusty Universe, Spectroscopic Confirmation</td>
<td>$12,750</td>
<td>02/04/2014–09/30/2015</td>
</tr>
<tr>
<td>Jay Elias</td>
<td>TMT Observatory Corporation</td>
<td>Support on the Development of the TMT Tertiary Mirror “M3”</td>
<td>$14,300</td>
<td>03/10/2014–09/30/2014</td>
</tr>
</tbody>
</table>

Acronyms used in table:

USRA – Universities Space Research Association
NASA – National Aeronautics and Space Administration
TAC – Time Allocation Committee
JPL – Jet Propulsion Laboratory
TMT – Thirty Meter Telescope
8 NOAO SAFETY REPORT FOR Q3

8.1 SOUTH

No accidents were reported during the third quarter of FY14. A leak in the gas heating system for the TelOps building on Cerro Tololo was detected, investigated, and promptly repaired in April 2014.

The regular biannual inspection carried out in May of the areas of the Blanco building where exposed asbestos was found and encapsulated two years ago revealed the need for repeated remedial action in some areas. Access to these areas was immediately restricted. Quotations are being obtained for the work of encapsulation, or removal of asbestos in these areas, along with monitoring of levels of airborne asbestos.

In response to the report of the external safety review carried out last year, the reporting structure was changed so that the clinics on Cerro Tololo and Cerro Pachón now fall under the direct supervision of the NOAO South safety and environmental engineer, rather than being part of NOAO South Facilities Operations. Steps are being taken to transfer operation of the clinics to an external contractor.

The NOAO South safety and environmental engineer carried out a variety of preventive and coordination activities, which are summarized below:

- She, along with the AURA Observatory (AURA-O) safety manager, updated the 2014 “Winter Preparedness Plan” and an associated summary brochure for distribution to staff and visitors. She also prepared a guide to installing “Snow Chains,” which will be distributed to staff and put in each observatory vehicle, and a document that defines the “Communication Protocol” to be followed by Observer Support staff with the purpose of communicating information about adverse weather conditions occurring during the night to the facilities manager to allow better coordination of a daytime response by facilities staff. All these documents were posted on the CTIO Safety website.

- She, together with the NOAO South director or deputy director, carried out safety inspections of the La Serena laboratories and workshops, the Blanco telescope and TelOps building, and the facilities workshops and warehouse on Cerro Tololo.

- She worked with a supplier of mine safety appliances in the evaluation, installation, and revision of fixed lifelines in various areas inside and outside the Blanco telescope building.

- She, in coordination with the AURA-O safety manager and Gemini safety officer, assisted in the preparation of a 26-point checklist to help verify that contractors are in compliance with all legal safety requirements before they begin work at AURA Chile.

- She participated in monthly meetings with representatives of the Cerro Pachón paramedic contractor, ESACHS, and received their new service proposal. She also worked in the preparation of the technical basis for the bidding of the mountains’ polyclinics.

- She carried out routine inspections of work areas; purchased, checked, and issued personal protective equipment to the staff; supervised the safety of larger maintenance tasks and engineering shut-downs at the telescopes carried out by observatory staff or by external contractors; participated in regular meetings of the Comité Paritario de Higiene y Seguridad (Chilean workers safety committee); investigated incidents; and gave talks on several safety topics.
8.2 NORTH

The new NOAO safety manager, Ms. Tammie Lavoie, started work in June 2014. Her first major task was to oversee on-site safety during the summer maintenance shutdown on Kitt Peak. She will be developing new safety procedures as needed for the installation and operation of DESI.

Reactions from visiting observers and from NOAO staff have been positive regarding the new Kitt Peak observer safety information poster deployed in FY13. The “Observing at Kitt Peak” web page, a resource for both visiting observers and staff, was updated to include the latest National Weather Service information on lightning safety, always a concern during the summer months on Kitt Peak.