This image shows off the impressive imaging capabilities of the new CCD detectors in the Mosaic-1.1 camera on the Mayall 4-m telescope at Kitt Peak National Observatory. The image is of Sharpless 2-188 (Sh2-188), an unusual planetary nebula located in the constellation Cassiopeia. The image was generated with deep observations in the Hydrogen alpha filter (red) and the Oxygen [O III] filter (cyan). In this image, north is up and east is to the left.

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1 NOAO DIVISIONS

1.1 NOAO SOUTH

1.1.1 Cerro Tololo Inter-American Observatory

Program Highlights

The fiscal year 2011 (FY11) began with the arrival of the first major pieces of the Dark Energy Camera (DECam) system. The crated f/8 handling system arrived in October from Fermilab in Chicago. This is one of the larger shipments, containing the large metal structural pieces that, when assembled, will form a stable platform for mounting and dismounting the delicate f/8 mirror from the Blanco 4-m telescope once DECam is installed. In December, the pieces were unpacked and laid out in preparation for construction of the platform in the Blanco dome (see image). Work continued on the infrastructure needed to support DECam operations, including the upgrade to the Blanco cooling infrastructure and the upgrade to the Blanco computer and control room. By the end of this quarter, the control room was mostly complete, with new raised (computer-room style) flooring that will allow for improved support of the many workstations, monitors, and other equipment needed to monitor and control DECam.

The SOAR Adaptive-optics Module (SAM) continued to make solid progress toward commissioning. Work in the laboratories on the main module was completed in October, and the module, together with the new SAM optical imager (SAMI), was delivered to the SOAR telescope in November while lab work continued on the laser guide star systems. In November and December, the module was “commissioned” in Natural Guide Star (NGS) mode. While SAM will not be offered to the astronomical community in NGS mode, these tests were critical to confirm the performance of the
By the end of this quarter, the final components of the laser system were being integrated and tested in the La Serena labs for delivery to the telescope in January 2011.

During this quarter, the Education and Public Outreach South (EPO-S) team carried out a series of education and integration sessions for the NOAO-S staff and their families as part of the program “Teaching with the Galileoscope.” More than 250 people associated with the NOAO South facilities were active participants in the series of sessions. In November, the EPO-S co-organized and sponsored the “XIII International Congress of Amateur Astronomers,” held this year in Vicuña. This annual conference included the participation of more than 200 enthusiastic amateur astronomers from all regions of Chile and neighboring countries. In addition, the EPO-S team participated in many community events in collaboration with Explora-CONICYT, a program of the Chilean equivalent of the NSF, as part of the national effort to promote science and as part of the NOAO effort to promote both astronomy and the protection of the region’s dark skies.

### Status of FY11 Milestones

- Assemble and install the DECam and associated structures, including a new f/8 handling station, a new filter changing station, and a large-scale cooling system to cool the camera.

  **Status:** The f/8 handling system arrived in October and was prepared for its January installation. Significant progress was made in plans to upgrade the Blanco cooling infrastructure to support the DECam cooling system.

- Complete commissioning of the Natural Guide Star mode of the SOAR Adaptive Module (SAM) on the SOAR 4.1-m telescope, including commissioning of the SAM Imager (SAMI).

  **Status:** SAM was reinstalled on the SOAR telescope in November, together with the SAM Imager (SAMI). The Natural Guide Star (NGS) mode and SAMI were tested extensively during on-the-sky engineering nights in both November and December. The NGS commissioning is considered complete. SAMI performed well, but some final tuning of the electronics and software is needed before the imager’s commissioning is completed.

- Complete the infrastructure improvements necessary for installation and operations of the Dark Energy Camera (DECam), including expansion of the control and computer rooms in the Blanco building, and the upgrade and modernization of the Blanco Environmental Control System.

  **Status:** Work on the upgraded Blanco control room is close to completion, with the new walks, raised floor, and ceiling installed. When the room structure is complete, furnishings will be put in place. Finally, the wiring for telescope control will be moved over during the telescope shutdown in March 2011. The design and fabrication for the Blanco mirror cooling system, the centerpiece of the Blanco Environmental Control System, is complete and awaiting the telescope shutdown for installation.
1.1.2 NOAO South Facilities Operations

**Program Highlights**

The first quarter of FY11 was highlighted by extensive work on contracts for two infrastructure repair and modernization projects funded by the American Recovery and Reinvestment Act of 2009 (ARRA): Cerro Pachón kitchen/dining room facility and Cerro Tololo dormitories repair/renovation. Final plans for the new Pachón kitchen/dining room facility ARRA project were completed and sent out for bid. Bids and contract negotiations within the limited project budgets have been complicated by Chile’s extremely favorable economic landscape, which includes rising copper prices, a falling dollar against the peso, and the significant impact of reconstruction necessitated by the February 2010 earthquake. An agreement on the contract for the Pachón kitchen/dining room was reached in late December and is pending NSF approval to finalize the contract and begin construction. Plans for elements of the work on the Tololo dormitories ARRA project were completed this quarter, specifically those for repairs to the roofs of all three dormitories. Work should begin in February 2011.

The NOAO South Administrative Services group continued to focus on integration with the systems of NOAO North in Tucson. While the NOAO North Central Administrative Services (CAS) group worked on the computing and software infrastructure, the NOAO South group advanced the integration of budget tracking and reporting across all activities in Chile, including those of CTIO.

The Facilities group completed the installation of the electric backup generator (an ARRA-funded project) for the shared facilities (e.g., dormitory, kitchen, and support facilities) on Cerro Pachón. This new generator will provide much needed power during commercial power outages, particularly a concern during the winter months when staff must stay in the dormitories in adverse conditions. The Facilities group also reinstalled the rebuilt frequency converter (also an ARRA-funded project) in the Cerro Tololo power house. This is one of the most critical components of the CTIO electric grid, one which was damaged in August 2009 and had required operations using the backup converter, and occasionally the generator, for more than a year.

**Status of FY11 Milestones**

- Remove the gasoline pump facility in La Serena; replace the gas and diesel pump station on Cerro Tololo to meet new safety and environmental regulations.

  **Status:** The installation of a new gas and diesel pump station on Cerro Tololo, which supports operations on both Tololo and Cerro Pachón, is well underway, with the two 22,000-liter tanks already buried and ready for the last connections into the Tololo power house. Due to conflicting certification requirements represented by Chilean government inspectors, the final phase of the work was halted to seek clarification about outstanding requirements. The clarification was issued and the installation should be completed in the second quarter of FY11.

- Begin operations of an upgraded network connection of 1 Gbps to Santiago and to the continental US network infrastructure (Internet2 and National Lambda Rail systems).

  **Status:** The infrastructure for the La Serena-to-Santiago segment of the new 1-Gbps link was completed during this quarter. This link is being provided by REUNA (the Chilean equivalent of Internet2). The infrastructure included the purchase of network equipment by AURA/NOAO to be used in completing the network connections. REUNA is now testing the national segment. The international segment from Santiago to Miami is still under development. In the mean time, an agreement was completed with National Radio Astronomy Observatory/Associated Universities Inc. for their use of this link in support of Atacama Large Millimeter Array data distribution and archive operations.
1.2 NOAO NORTH

1.2.1 Kitt Peak National Observatory

Program Highlights

The Large Science Proposal and the BigBOSS project

In response to the Large Science Program opportunity announced previously for the Mayall 4-m telescope, the BigBOSS collaboration submitted their proposal to equip the Mayall with a highly multiplexed, wide-field multi-object spectrograph and to undertake a large spectroscopic survey that aims to measure the expansion history of the universe and to constrain cosmological parameters. The proposed facility instrument will be available to the community through the NOAO open-access process. An external nonadvocate review by 11 experts chaired by Dr. Brian Schmidt conducted a detailed and critical review of the proposal and provided NOAO with a report responding to many specific questions regarding the project’s technical and scientific feasibility and management plan. The report was forwarded to the proposal team, as well as to NSF MPS Astronomy and the Department of Energy (DOE) Office of Science. The report asserts that “…if BigBOSS achieves [sic] its stated scientific goals, it will be a highly effective use of the Mayall Telescope in the period of 2016-2020, and the resulting survey would be one of the telescope’s major scientific contributions during its lifetime.” They went on to say that “…the BigBOSS spectrograph, potentially, provides a compelling new capability, enabling a wide range of front-line scientific investigations for the general user community.” This is high praise indeed, given the membership of the Schmidt committee and the history and scientific achievements of the Mayall telescope! However, while the level of detail presented in the proposal was impressive, the careful and thorough review by the Schmidt committee identified several areas of scientific, technical and management risk that need to be addressed before the project can proceed to a Conceptual Design Review. Therefore, the Schmidt committee recommended that NOAO conditionally accept the proposal subject to the satisfactory mitigation of identified risks and the successful conclusion of a Memorandum of Understanding with the project team, which NOAO has accepted.

Mosaic-1.1

The refurbished Mosaic-1 camera (now renamed Mosaic-1.1), refitted with e2v CCD44-82 CCD’s and a modern MONSOON controller, was deployed at the prime focus of the Mayall 4-m telescope and saw first light on schedule at the end of October 2010. The new detectors have much higher dynamic range (full well ~210,000 electrons), higher quantum efficiency (QE), lower read-noise, and more than a factor of seven shorter readout time (now 22 seconds). The instrument has the same physical footprint of 36 arcmin square on the sky as before, with the same pixel scale. All of the existing filters for Mosaic-1 are usable on the refurbished instrument. The final phases of commissioning will continue into January 2011, but the instrument has been used very successfully in shared risk mode for acquiring science data for several projects.

The associated data handling system provides users with a quick-look display for full-field images and is integrated with the NOAO data archive to automatically save backup images for retrieval by program principle investigators (PIs). The data pipeline was updated as well to allow data reduction of the new Mosaic-1.1 data format. The images below are some of the first on-sky images taken during the commissioning of Mosaic-1.1.
WIYN One Degree Imager

At the request of the WIYN Board, NOAO took over leadership of development of the One Degree Imager (ODI) for the WIYN telescope. Although the opto-mechanical fabrication of ODI is nearly complete, the project has been impeded by the difficulty of producing the necessary detectors for the instrument’s focal plane. The current phase, which will include continued work on the development of the detectors, exploration of remaining risks, and creation of a reliable budget and schedule for completion, will last through the rest of FY11.

Kitt Peak Visitor Center

The table to the right summarizes the number of visitors who participated in paid groups/programs at Kitt Peak during this quarter. The total of such visitors this quarter was an almost 44% increase over the same period last fiscal year. Significant increases were seen in all areas except the Nightly Observing Program, which had an 8% decrease over the same period last year.

Status of FY11 Milestones

- Complete the upgrade of the Mosaic-1 optical imager for the Mayall 4-m telescope, including commissioning tests.
  
  *Status: Completed.*

- Conduct and complete a proposal review for a Large Science Project for the Mayall 4-m telescope.
  
  *Status: Completed.*
1.2.2 NOAO North Facilities Operations

1.2.2.1 Central Facilities Operations

Program Highlights

During this quarter, the facilities staff focused their efforts on a wide variety of engineering and building maintenance/renovation efforts. With the final engineering design work completed on the projects funded by the American Reinvestment and Recovery Act of 2009 (ARRA), bids were obtained and contracts awarded on the Tucson electrical and computer room cooling ARRA-funded projects. In addition, two pre-bid meetings were held on the ARRA-funded Kitt Peak water plant project; the contractor bids are due early in the second quarter.

Other projects worked on this quarter included those funded with NOAO base funds. Contractors completed the FY10 main sprinkler valve replacement and La Quinta Americans with Disabilities Act of 1990 (ADA) ramp projects, and staff began the interior renovations to the La Quinta restroom and kitchen areas. Contractors also completed the replacement of the leaking irrigation system at the La Quinta area. Efforts were directed to the development of bid specifications to obtain contractor bids or proposals for replacement of a primary building chiller and the PBX system for the Tucson headquarters. Space renovation was done in several areas and a primary heating system boiler was replaced when the heat exchanger was found to be cracked. Reviews were done to evaluate the potential impact of the proposed Tucson streetcar project on the operation of the Tucson facility.

Status of FY11 Milestones

- Pursue replacement of an approximately 30-year-old primary building chiller to reduce costs and maintain building cooling requirements.

  Status: The project was put out to bid and several contractors reviewed the work requirements and submitted bids. A contractor was selected and the work is scheduled to begin in the second quarter.

- Complete renovations to La Quinta Conference room, begun in FY10, to provide restroom and kitchen areas compliant with the Americans with Disabilities Act of 1990 (ADA).

  Status: The contractor completed the installation of the new access ramp, and staff did the interior renovations to the restroom and kitchen areas. The primary renovation efforts were completed at the end of this quarter, and the space was made available for use. Minor wall finishes will be completed and pictures updated early in the second quarter of FY11.

- Initiate a program to replace the outdated PBX phone system with a new Voice-over-IP (VoIP) telephone system.

  Status: A general scope of work was prepared, and requests for proposals were issued during the quarter. Several vendors submitted proposals near the end of the quarter, and staff are currently evaluating them.

- Continue the program to update meeting spaces and video conferencing systems.

  Status: Staff are currently working with the administrative assistants and various committee members to prepare documentation and pursue equipment upgrades.
• Continue to support the implementation of the projects at KPNO and Tucson facilities funded by the American Recovery and Reinvestment Act of 2009 (ARRA).

**Status:** Significant efforts were made on the ARRA projects as the various engineering firms finalized the designs. Bids were obtained and contracts put in place on the Tucson Headquarters primary electrical refurbishment and computer room cooling renovation. Two pre-bid meetings that attracted 15 contractors were held on the Kitt Peak water plant renovation with contractor bids due early in the second quarter of FY11.

• Continue to make targeted renovation and building modifications at NOAO North to address building and meeting space needs.

**Status:** Staff renovated a basement lab area after completion of a main sprinkler valve replacement. Several offices also were renovated to accommodate staffing needs.

### 1.2.2.2 Computer Infrastructure Services

**Program Highlights**

The computer infrastructure Services group is responsible for maintaining and improving the Tucson facility network and for providing a secure connection for the facility network to the Internet. The first quarter of FY11 included the following activities to accomplish those tasks:

- A new “backbone” Ethernet switch was installed on Kitt Peak and links from the switch to the 4-m, 2.1-m and WIYN telescope domes were upgraded from 100 Mbps to 1 Gbps.

- A newer Ethernet switch was installed in the top floor of offices of the Tucson complex to enable newer features. Unfortunately, this switch turned out to be uncomfortably loud and will be replaced early in the second quarter of FY11 with a more complex, but silent, set of switches.

**Status of FY11 Milestones**

- Continue the effort to improve the cooling and power systems in the NOAO-N computer lab.

**Status:** Underway. A third computer room air conditioner unit was installed in the NOAO North (NOAO-N) computer lab. Work began on the removal and replacement of the building cooling unit that supplies cooling to the lab. This work will be completed early in the second quarter of FY11.

- Upgrade the NOAO-N Web server to improve speed and reliability.

**Status:** Underway. Hardware was ordered and configuration was begun on a new hardware version of the NOAO-N Web server [www.noao.edu](http://www.noao.edu).

### 1.2.2.3 Safety Report

The NOAO report on site safety and risk management for the first quarter of FY11 follows:

- A Kitt Peak NSO employee suffered a laceration to the right index finger requiring sutures while attempting to raise a floor cover plate in the service area of the FTS instrument on November 12. The cover plate requires two people to remove them in their current configuration. This case is considered an OSHA recordable.
• The Kitt Peak to Sells shuttle vehicle #126 struck a deer that jumped off a steep slope into the path of the vehicle on Highway 386. The shuttle was on its way to Sells on November 16. No one was injured but the vehicle sustained damage. It is determined that there was no way to avoid this accident.

• This October we identified an unfortunate situation regarding the alley exit at the Tucson main parking lot. We discovered that employee vehicles that have exited from this South exit might have incurred right side tire damage. When we discovered this problem, we made a portion of the tire spikes inoperative to prevent further damage. After finding no AURA insurance remedies, an internal claims procedure was set up.

• The Tucson West basement sprinkler valve and sprinkler head replacement was completed this quarter.

• Chuck Gessner worked in Maui the week of November 8 assessing safety risks and emergency response capabilities for the ATST Project. The project team is preparing for an independent project safety review that will be held on January 25-27, 2011.

1.3 NOAO SYSTEM SCIENCE CENTER

1.3.1 System User Support

Program Highlights

System User Support (SUS) aims to help users make excellent use of the optical/infrared (O/IR) system (System) capabilities to which NOAO provides access. SUS staff members advertise the System capabilities available to the US community, field technical questions and provide proposal technical reviews for the large majority of System capabilities, represent the US community through the Gemini International Time Allocation Committee, guide proposers through the Gemini Phase II process, help users of all System facilities prepare for their observing runs, and provide support to users seeking help with their data reduction and analysis. The ultimate test of the success of these efforts is the quality of the scientific results derived from System facility observations that appear in the published literature. Two recent results are highlighted here.

Bayliss et al. (2011, ApJL, 727, L26) used the Gemini Multi Object Spectrograph (GMOS) on Gemini North to measure the redshift distribution of a sample of 28 giant gravitational lens arcs. The team used the nod-and-shuffle capability of GMOS-N, which allowed them to perform Poisson noise-limited sky subtraction and to tailor the slits to follow the shape of the lens arcs, both of which maximized the signal-to-noise of the resultant spectra. The team found that the majority of the sources of the arcs reside at high redshift, with a median source redshift of \( z = 1.821 \). This discovery is important, as it provides a partial solution to the “giant arc problem” identified by Bartelmann et al. (1998), who found that only an open cosmology without dark energy agreed with the observed arc statistics. The result thus brings gravitational lens arc statistics into better agreement with our current concordance cosmology. The result also opens a path to using giant lens arcs to study the properties of galaxies at high redshift.

Vogt et al. (2010, ApJ, 723, 954) used time on Keck I granted by NOAO and other sources to study the planetary system around the star Gliese 581. The team used data from the High Resolution Echelle Spectrometer (HIRES), obtained over a period of 11 years, to confirm the existence of four planets discovered by others, and to announce the exciting discovery of two new planets. The four previously known planets have noteworthy properties: in particular, one is a Neptune-mass (msini) planet orbiting close to the star, two are on eccentric orbits with periods of 13 and 67 days and with
minimum masses that categorize them as “super-Earths,” and one is a short-period planet orbiting inside the Neptune-mass planet with a minimum mass twice that of Earth. The newly discovered planets present even more exciting possibilities, as one has msini of 7 Earth masses in a period of 433 days, while the other, GJ 581g, has msini of 3.1 Earth masses and a period of 37 days. The period of GJ 581g places it in the middle of the predicted habitable zone of the parent star, making it the first Earth-mass planet with the potential for liquid water and life. Moreover, Vogt et al. argue that the discovery of a potentially habitable planet early in the history of planet studies means that the fraction of stars with at least one habitable planet must be substantial, giving hope to the future prospect of discovering life on other planets.

**Status of FY11 Milestones**

- Expand the level of expertise and user support within NSSC/SUS for an increasingly broad and varied array of non-NOAO/non-Gemini facilities.
  
  **Status:** SUS staff were assigned to be contacts for the non-NOAO/non-Gemini facilities Keck, Magellan, MMT, Hale, and Center for High Angular Resolution Astronomy (CHARA). SUS continued to perform technical reviews for the Hale, CHARA, Magellan Inamori Kyocera Echelle, and Keck High Resolution Echelle Spectrometer proposals.

- A shared mission with NSSC/SCD is to work with the user community to advertise, advocate, and advise for the continuing evolution of the System.
  
  **Status:** SUS staff also participated in the Keck Science meeting in October 2010. SUS staff participated in the ReSTAR-2 meeting held in Tucson in November 2010, which was organized by NOAO. SUS made plans to advertise the System’s capabilities at the January 2011 Winter AAS meeting.

- Foster close communications and a close working relationship with the Gemini Observatory as they pursue their FY11 efforts to investigate and then establish a new operations model, which is driven by the need to account for the upcoming withdrawal of the UK from the partnership.
  
  **Status:** The NSSC director and SUS head of program communicated regularly with Gemini’s deputy director and associate director of science operations to manage the impact of the evolution of Gemini’s operations. SUS staff were closely involved in discussions on this topic. The NSSC director and SUS head of program attended Gemini’s Planning Retreat in October, at which the Gemini Observatory decided to place a heavy focus on instrument commissioning in 2011. Gemini Observatory adopted the NSSC representatives’ suggestion of avoiding queue support on classical observing nights, which will free up resources needed for commissioning. SUS continued to promote visits to the Gemini sites, which help to foster communication between NOAO and Gemini.

- Expand the role of NSSC/SUS in the NOAO TAC system by helping to define a more uniform and streamlined proposal and TAC process, which encompasses the entire NOAO-managed system of telescope access time.
  
  **Status:** The NOAO TAC system was folded into NSSC. As part of the streamlining process, the NSSC director led the writing of an official call for proposals and commissioned the TAC group to describe, in writing, the merging process.

- Work with the community and the relevant committees in supporting the process to procure the next set of new instruments for Gemini.
Status: NSSC is closely monitoring the process for procuring a high-resolution optical spectrograph for Gemini.

- Continue support for US Gemini programs, with the possibility that the US share of Gemini may increase in the next few years.

Status: SUS staff continued to provide support for US Gemini programs through proposal technical reviews, Phase II support, and HelpDesk support. US demand for Gemini time remains healthy, with oversubscription factors of 5.0/2.0 (Gemini North/South) for 2011A, which includes the time requested by Survey proposals. Interest in performing surveys with Gemini is likely to increase with new red-sensitive GMOS-N CCDs and the eventual availability of the second Florida Multi-Object Imaging Near-Infrared Grism Observational Spectrometer (FLAMINGOS-2). SUS recognizes that maintaining or improving the demand for Gemini depends on continuing to develop a strong base of users who see Gemini as critical to their research as well as providing excellent support for all users. SUS thus continued to encourage classical observing on Gemini, with a total of 26 nights (North and South) scheduled as classical observing runs funded by NOAO in 2011A. These nights include the first run of an NOAO Survey program on Gemini South, for which close interaction with the Gemini Observatory will be particularly beneficial.

1.3.2 Science Data Management

Program Highlights

In this quarter, all software components of version 1.6 of the Science Data Management (SDM) End-to-End (E2E) system were completed, tested by quality assurance, and delivered to Operations. Deployment in the production systems will occur in early February 2011. The major additions are: support for the simple image access and cutout Virtual Observatory (VO) services as well as continued improvements to the user interface of the portal. Also included are several upgrades to the archive and portal middleware and upgrades to the hardware on which they run.

Members of SDM continue to support meetings with several Dark Energy Camera working groups including the Survey Image System Process Integration (SISPI) group, the System Interfaces working group, and the Community Pipeline working group. SDM collaborated with the Community Pipeline group at the National Center for Supercomputing Applications (NCSA) to produce a list of milestones and delivery dates for the Community Pipeline in 2011.

The public release of IRAF 2.15 with the 64-bit implementation was made in November 2010. This release is a significant enhancement of the system; not only does it provide internal modernizations to interfaces and a simplified installation for users, but it also allows all existing IRAF packages to operate on the 64-bit platforms that are becoming increasingly standard and are required for dealing with the modern large-format detectors.

Members of SDM supported the upgraded Mosaic 1.1 instrument installation on the Mayall 4-m telescope by developing a Data Handling System for it and updating the Mosaic Science Pipeline for the instrument changes.

Significant effort was made by members of SDM for the Virtual Astronomical Observatory (VAO) in the areas of operations, user support, and product development. SDM members contributed to the development of the VAO Project Execution Plan, the Standards and Guidelines for Testing, and the Standards and Guidelines for the Documentation Plan. Members also published a draft of VOEvent 2.0 and planned an exhibit for the VAO at the Seattle AAS to be held in January 2011.
**Status of FY11 Milestones**

- Continued operation of a functionally complete version of the end-to-end (E2E) data management system, including data capture, transport, archiving, pipeline processing (Mosaic and NEWFIRM), and user access.

  **Status:** The E2E v1.5 continues to function well. The components of the E2E v1.6 system were delivered to Operations at the end of December. Deployment of E2E v1.6 is anticipated in early February 2011. The major features include support for VO services (simple image access and cutout services), co-observer access to data, and more improvements to the portal interface.

- Purchase and deploy the DECam Community Pipeline computer system needed to incorporate and test the DECam Community Pipeline software within the E2E system.

  **Status:** Members of SDM worked with the DECam Community Pipeline group to establish a timeline for the Community Pipeline. SDM will receive the hardware requirements for the pipeline in mid-February 2011, and the purchasing process will begin immediately afterwards.

- Provide support for the SDM Data Transport System that will be used for transporting DECam data from CTIO to NCSA and Tucson.

  **Status:** Numerous tests have been made of the Data Transport System to measure its performance with the current network. Tests were also performed by the SISPI group to satisfy their data transport milestone in mid-October 2010.

- Continue support for the current NOAO science pipelines (Mosaic and NEWFIRM). Modify the Mosaic Science Pipeline as needed to adapt to changes that resulted from the Mosaic instrument upgrade to Mosaic 1.1.

  **Status:** The NEWFIRM science pipeline was enhanced to provide better sky subtraction, and data are currently being reprocessed. The Mosaic science pipeline was modified to support the upgraded Mosaic 1.1 instrument.

- Ingest and pipeline-process the Data Capture Initiative (DCI) backlog of raw Mosaic data (semesters 2004B–2007B) and archive the reduced data products. Develop a plan to read and recover Mosaic data from the Save-the-Bits tape holdings for archive and potential pipeline processing.

  **Status:** All Mosaic data from semesters 2004B–2007B (approximately 80,000 files) were converted from gzip to FITS tile compression (on average, the new files were 20% smaller) and verified. During the second quarter of FY11 the files will be ingested into the archive and pipeline processed.

- Develop and publish the standards and guidelines for the Virtual Astronomical Observatory (VAO) software testing and documentation. Deploy an operation help desk and ticket tracking system. Work with the VAO community and members of the International Virtual Alliance (IVOA) to adopt the VOEvent 2.0 standard. (Supported by the VAO grant)

  **Status:** The VAO Standards and Guidelines for Testing and the VAO Standards and Guidelines for Documentation were completed on schedule and delivered to the project management in late December. A JIRA license was purchased and a prototype help and ticket system were deployed. A VAO exhibit was also organized for the January 2011 Seattle AAS conference.
1.3.3 System Community Development

Program Highlights
Following the release of a draft solicitation for community collaborators to participate in NOAO’s ReSTAR Phase 2 proposal, a pre-selection meeting was held in Tucson. Discussions at this well-attended meeting covered a wide range of possible capabilities, facilities, and themes that could serve as the context for an integrated proposal. The solicitation was revised and a final version was released on December 1.

LSST Science
NOAO again organized the selection of new LSST science collaborations and new members for existing LSST science collaborations. No proposals for new science collaborations were received. A panel of experts evaluated proposals from individual investigators. There were twenty-eight proposals of which fourteen were approved for membership.

NOAO scientists continued development of a characterization of the variable sky, as well as plans for on-sky experiments to test follow-up observation strategies.

GSMT/ELT Science
Following the release of the Astro2010 decadal survey report, the NSF instructed AURA and NOAO to withdraw from any official interactions with the GSMT projects.

Optical Interferometry Science
During this quarter, Optical Interferometry (OI) staff worked with NOAO telescope allocation process and Georgia State University to support review of proposals for community access to the CHARA Interferometric Array, with three proposals recommended for approval and accepted; there was an oversubscription rate of 4.5. Meetings were held with staff at the US Naval Observatory, Naval Research Laboratory, and Flagstaff on the preparation of a plan for the Navy Prototype Optical Interferometer (NPOI) to offer a trial community access program. This proposal is currently in review by the NPOI consortium.

Status of FY11 Milestones

- Solicit and conduct the review of proposals for membership in the LSST Science Collaboration groups and for the forming of new LSST Science Collaboration groups.
  
  Status: Completed. For details, see the LSST Science section above.

- Develop a white paper defining a path toward increased community access to ground-based interferometry, reflecting demonstrated community demand, and consistent with guidance from the Astro2010 decadal review and with needs and objectives of optical array facilities.
  
  Status: Completed. The white paper was submitted to NSF/AST.

- Complete the development of a proposal for Phase 2 of the NOAO program to address the recommendations of the ReSTAR committee. This will include soliciting community involvement and selecting partners for the proposal.
  
  Status: A draft solicitation was released, a community meeting for discussion was held, and the final solicitation was released. Community proposals are due by February 1.
1.4 NOAO SYSTEM TECHNOLOGY CENTER

1.4.1 System Instrumentation

Program Highlights

The primary management event during the first quarter of FY11 was the completion of three personnel actions during October; these layoffs among the technical staff were unfortunately necessary to bring the System Instrumentation (SI) program’s labor costs into balance with the expected base budget support for FY11. All affected personnel were given severance benefits in accordance with AURA policies and current best practices. The SI group is now better able to efficiently meet the needs of the broader NOAO program without risk of running over budget.

In addition to the progress on milestones noted below, SI also completed fabrication on the CHIRON spectrograph for the CTIO 1.5-m telescope. This project is the subject of a Major Research Instrumentation (MRI) award to Dr. Debra Fischer; SI activities are largely being paid for under a contract with San Francisco State University, which is administering the award. NOAO SI is one of several subcontractors involved, and it is responsible for mechanical fabrication, supply of a detector controller, and integration of the spectrograph including the CCD and MONSOON/TORRENT controller. Commissioning is scheduled to occur in the second quarter of FY11.

Status of FY11 Milestones

- Complete on-telescope integration and testing of the entire SOAR Adaptive Optics Module (SAM) system, including the Main Module, the Laser Guide Star system, and the integrated CCD imager.

  Status: Substantial progress was made during this quarter. Integration of the Main Module with the Laser Wavefront Sensor, the laser-compatible version of the Turbulence Simulator, the Atmospheric Dispersion Compensator and the tip-tilt guide probes was completed in the laboratory early in the quarter. The complete Main Module was returned to the SOAR telescope and integrated there during November 2010. On-sky testing of the Main Module and its subsystems was carried out during engineering runs in late November and late December 2010. The individual components of the Laser Guide Star system were fully tested in the lab, and laboratory integration was nearly complete as of the end of this quarter. Installation on the SOAR telescope is scheduled for mid-January 2011, with first laser illumination expected during the late January engineering run.

- Fabricate, test, and deliver the TORRENT version of the MONSOON controller for all ReSTAR instrument development programs and external instrument collaborators as appropriate.

  Status: Progressing on schedule. During this quarter, the TORRENT project team modified the prototype design to address the concerns raised by the review panel in August 2010. Testing of the modified prototype was proceeding satisfactorily as the quarter ended.

1.4.2 ReSTAR Instrumentation

Program Highlights

In addition to the technical achievements discussed below, during this quarter the NOAO System Technology Center (NSTC) completed and submitted to NOAO’s NSF program officer a Program Execution Plan for the second year of ReSTAR funding. This plan described in detail how NSTC
would complete the construction and commissioning of two new instruments, both for the CTIO Blanco 4-m telescope: Cerro Tololo Ohio State Multi-Object Spectrograph (COSMOS), which is an optical spectrograph and a duplicate of Kitt Peak Ohio State Multi-Object Spectrograph (KOSMOS), and TripleSpec 4, a near-infrared moderate-resolution spectrograph.

**Status of FY11 Milestones**

- **Mosaic-1 CCD and Controller Upgrade:** Complete commissioning of the upgraded instrument on the KPNO Mayall 4-m telescope.
  
  **Status:** Completed. The upgraded instrument was recommissioned during engineering time in late October 2010, and the first scheduled science use occurred almost immediately thereafter. Performance improved as expected: readout times dropped from 150 seconds to 18 seconds, with less than 5 electrons of readout noise. Quantum efficiency is better across the entire passband. The new instrument control software, which is modeled on the successful NEWFIRM control system, was very well received by early users. Finally, the reliability of the MONSOON controller significantly reduced the amount of technical downtime.

- **KOSMOS:** Deliver the assembled instrument to KPNO and begin integration and commissioning on the Mayall 4-m telescope.
  
  **Status:** Progressing on schedule. The e2v CCD was ordered and received. The Lawrence Berkeley National Laboratory (LBNL) red-optimized CCD was ordered and is underway. Fabrication of the mechanical parts is well underway in the NOAO instrument shop. Bids for optics fabrication were received and evaluated, and a contract was let with the low bidder, which also happens to be the vendor that successfully built the optics for the original OSMOS instrument.

- **COSMOS:** Execute amendment to partnership agreement with The Ohio State University (OSU) to cover construction of COSMOS.
  
  **Status:** Completed. The amendment was executed in December 2010. OSU had been working with NOAO under a Letter of Authorization since October 2010, in order to allow procurements and fabrication for both KOSMOS and COSMOS to proceed in parallel.

- **COSMOS:** Complete fabrication or purchase of all components and begin assembly in The Ohio State University (OSU) instrument lab.
  
  **Status:** Progressing on schedule. The e2v CCD was ordered and received. The LBNL red-optimized CCD was ordered and is underway. Fabrication of the mechanical parts is well underway in the NOAO instrument shop. Bids for optics fabrication were received and evaluated, and a contract was let with the low bidder, which also happens to be the vendor that successfully built the optics for the original OSMOS instrument.

- **CTIO-Hydra CCD and Controller Upgrade:** purchase a new CCD and the components for a new TORRENT controller.
  
  **Status:** Progressing on schedule. A contract was issued to LBNL for the fabrication of the CCD during the fourth quarter of FY10. LBNL has issued regular progress reports indicating that the fabrication of this device, in its new four-side-butttable package, is progressing satisfactorily. Delivery of the CCD is expected by the end of the second quarter of FY11.
1.4.3 Telescope System Instrumentation Program

Program Highlights

The Telescope System Instrumentation Project (TSIP) 2010 proposals were reviewed by an external review panel in early FY11. The panel met in Tucson and chose two proposals for funding. These are the Keck Cosmic Web Imager (detailed design) and the optical spectrograph Binospec for the MMT (Smithsonian Astrophysical Observatory-SAO, final construction). The panel report was presented to NSF in December. Execution of Memoranda of Understanding (MOU) and contract negotiations will take place in the second quarter of FY11.

The TSIP program office continued close monitoring of the existing awards:

- One Degree Imager (ODI): program is under WIYN review
- Large Binocular Telescope Multi-Object Double Spectrograph 2 (LBT MODS2): MODS1 is in commissioning phase
- Keck Next Generation Adaptive Optics: preliminary design is complete
- MMT and Magellan Infrared Spectrograph (MMIRS), SAO: the spectrograph was delivered and the final report is awaited
- Magellan Adaptive Secondary, Steward Observatory: the adaptive shell is being readied for test
- Keck Cosmic Web Imager: the preliminary design award is nearing completion
- Magellan Inamori-Magellan Areal Camera and Spectrograph (IMACS) camera upgrade, Carnegie: in fabrication
- Multi-Object Spectrograph for Infrared Exploration (MOSFIRE), Keck: the spectrograph is nearing final delivery

Status of FY11 Milestones

- Complete an external review of FY10 TSIP proposals and negotiate sub-awards with successful proposers.
  
  **Status:** The review was completed and presented to NSF in December 2010. The awards were announced to the proposers.

- Establish an oversight process for FY10 TSIP sub-awards.
  
  **Status:** Awaiting MOU and contract negotiations.

- Organize a call for proposals for FY11 and organize a review.
  
  **Status:** Awaiting NSF approval for FY11 announcement.

- Conclude the remaining sub-awards under the Adaptive Optics Development Program (AODP) and close out the program.
  
  **Status:** All AODP sub-awards have been closed except for C33002T to California Association for Research in Astronomy (CARA), for development of specialized CCDs for wavefront sensing. CARA’s reports show that, as of the end of the first quarter of FY11, the final run of detector wafers has been through more than two-thirds of the processing steps, with completion of the wafer processing expected by 31 January 2011. Warm-probing, packaging, and cold-testing will
follow, with project completion now expected in June 2011. AURA and CARA are in the process of issuing another no-cost extension so that the sub-award will conclude on 31 July 2011, after testing is completed.

1.4.4 LSST Technology Program

Program Highlights

The LSST effort this quarter had a strong focus on project planning and continuing design details, particularly for the summit facility and dome design. Discussions with the NSF program officer for LSST early this quarter and a fresh review of the MREFC process changed the outlook for an LSST construction start to FY14. The project focused much of this quarter on planning the project for this new proposed start date and developing a new LSST Construction proposal to replace the now outdated 2006 original proposal. The revised proposal is due to be submitted in January 2011 and will be complete with a refined but consistent technical approach and pricing with a 2011 US dollar basis. Technical developments also continued this quarter: highlighted by the continued development of the summit facility, new features and approaches to the dome, advances in wide-field survey pipelines, updated interfaces and a full update of the telescope solid and finite element models.

Status of FY11 Milestones

- Facility and Site: support the completion of the phase 1 summit support design effort, which is contracted with ARCADIS in Santiago.

  Status: Bi-weekly interface meetings continued throughout this period. The La Serena-based LSST Project Architect continued to visit twice a month with the Architecture team in Santiago and included Tucson-based engineers in many of these meetings through remote connections.

- Facility and Site: conduct a review of the 90% completion Summit Facility design package.

  Status: The principle milestone on the road to the 90% design package was reached this quarter. The 50% drawing package was delivered in December for LSST review. Some elements of the deliverable are outstanding but the telescope team began an intensive and detailed review of the package to guide the Summit Facility design and this critical stage.

- Facility and Site: complete the configuration design of the Vertical Reciprocating Lift (VRC), an 80-ton equipment lift, with support of contracted effort.

  Status: The contract with Pflow Industries was put in place this period to provide the configuration design of the VRC and consult with the summit facility architects to develop the building design around the lift. Initial discussions began and a full kick-off to the effort is planned for late January 2011.

- Facility and Site: complete the initial site leveling design and procurement package, and support any early leveling activity pursued with non-federal funds by AURA and LSST Corporation (LSSTC).

  Status: The summit site design was refined this period to match the developing facility design and the associated operational plans. During this period the team supported LSSTC and AURA in bidding the early leveling work and establishing a contract with Rocterra Ltd. LSSTC authorized $1.3M in non-federal funds to do the work package. It is expected to be completed by June 2011.
• Telescope Mount: complete the Preliminary Design Package for the telescope mount, including a requirements document and interface details.

  **Status:** A revised solid model of the telescope mount was completed this period and the finite element model that includes the finest level of design details is nearing completion. Several meetings with potential vendors were held to discuss the design evolution, the plans for procurement, and cost estimates.

• Reflective Optics: collaborate with the LSST primary mirror vendor to evaluate the metrology system and ongoing polishing performance.

  **Status:** The semi-annual review of LSSTC’s primary mirror contract with University of Arizona was held this quarter, and several members of the Telescope team participated to review progress. The primary topic was the successful completion of the facesheet repair. Metrology system plans are continuing to progress, but the full system review is still pending.

• Wavefront Alignment and Calibration: support calibration observing runs to validate calibration plans and filter choices and operate LSST telescope assets to conduct calibration validation experiments.

  **Status:** The LSST prototype camera was removed from Calypso this period and sent back to SLAC for an electronics upgrade. An engineering run was conducted with mechanical instrumentation on the telescope to support the development of upgrade designs. No further calibration tests are planned for the next six months so the facility was put into shut-down and will not be operated for the foreseeable future.

• Wavefront Alignment and Calibration: select the calibration screen projector design through review of prototype performance results, and consult on the development and testing completed by LSST.

  **Status:** The Telescope team continued to collaborate with Harvard University (contracted by LSSTC to support calibration) to review the calibration screen design and data collected on individual element tests. The back-illuminated screen design was updated at NOAO to include a glass Fresnel lens, a small highly uniform diffuser, and only spherical lenses in the projector.

• Software and Controls: develop the Facility environmental control system design and contracting strategy.

  **Status:** Meetings with two potential contractors were held this quarter to discuss the development of the LSST environmental control system. Vendors in Boston and Tucson were evaluated as potential suppliers, and the technical approach for the system was reviewed with each. The interactions supported the potential use of a single vendor to bridge the control gap between the facility-supplied HVAC components and the telescope control system.

• Systems Engineering: finalize the hazard analysis and risk analysis of the telescope and site system.

  **Status:** Hazard and safety analysis meetings continued bi-weekly this period. The Telescope and Site system engineer and the NOAO safety engineer continued to have detailed reviews of specific portions of the summit facility. The meetings include the appropriate engineers developing designs for the facility and equipment in that area to identify specific personnel and equipment hazards.
• Project Management: support the project with participation as the Deputy Project Manager and as an LSST Board member, support the project with oversight of the image simulation efforts, and complete the 2010 inputs for the Project Management Control System.

**Status:** NOAO staff continued to be fully engaged with the LSST project to support the management team and corporate office. Plans were started to host the April 2011 face-to-face Board meeting in La Serena. Budgets for the Simulation effort this year were finalized. The 2010 revision to the Project Management Control System was completed this quarter. The system was updated completely to include the latest construction development plans, and the updated costs were completed to support the revised MREFC proposal.

• Science Mission and Requirements: provide inputs for Chilean operations into the LSST Operations Plan.

**Status:** NOAO South developed new budget tables for La Serena operations and reviewed the current draft operations plan for LSST.

• Operations Simulator: lead the operation simulation group, and develop scientific metrics for analysis operation simulation output.

**Status:** The NOAO-based operations simulation team completed three additional scientific metrics; published a new version of the simulation code, now v2.4; and published a new version of the SSTAR report, v3.7, that generates the standard output analysis for each new simulation.

### 1.4.5 GSMT/ELT Technology Program

**Program Highlights**

In October, NSF issued guidance to AURA stating that NSF would take direct responsibility for formal oversight of the two US-based extremely large telescope (ELT) programs, Thirty Meter Telescope (TMT) and Giant Magellan Telescope (GMT). This action was taken to avoid conflicts of interest—or the appearance thereof—and to ensure that it will be possible for NOAO to have the option of participating in such an ELT project.

The NSF is preparing a solicitation for design and development funding for which the projects could propose. This solicitation, expected by the middle of calendar year 2011, should define the schedule for funding and may define milestones for other NSF decisions related to federal participation in an ELT project.

Although ELT-related activities will continue at a low level within NSTC, the GSMT Program Office will be eliminated as a separate subdivision of NSTC and its personnel absorbed within a more integrated design and development group.

**Status of FY11 Milestones**

• Prepare a technology development action plan in response to Astro2010 recommendations on GSMT. This activity likely requires guidance from the NSF.

**Status:** As indicated above, the NSF decided to assume a direct oversight role and has not asked NOAO to prepare a development plan. Consequently, no activities are expected in this area, unless there are further developments after the NSF design and development solicitation.

• Complete the close-out of the TMT/AURA site survey in Chile.
**Status:** Equipment was removed from the LSST site in December, with maintenance and return of the equipment to the US scheduled for January/February 2011. Once the equipment is shipped to the US, this activity will be complete.
2 NOAO-WIDE PROGRAMS

2.1 CENTRAL ADMINISTRATIVE SERVICES

Program Highlights

During the first quarter of FY11, Central Administrative Services (CAS) engaged in the annual year-end process, which includes oversight and closeout of NOAO activities as well as those of other entities for which CAS provides business services: AURA Corporate, WIYN, SOAR, and LSST Corporation. CAS staff also prepared annual reports required by NSF and other federal and state agencies. This quarter also included preparations for the upcoming calendar year-end processes, such as tax and benefit reporting due in the second quarter.

During this quarter, Human Resources (HR) successfully renewed the benefit packages with no increase in costs to the domestic medical plans, along with the addition of new benefits such as a short-term disability program and healthcare reform modifications. The HR group began the development phase of a new recruitment package to streamline the current recruitment process.

As illustrated in the chart below, the average monthly exchange rate of the US dollar relative to the Chilean peso declined during the quarter. The NOAO FY 2011 Annual Program Plan assumes an exchange rate of 500, while the actual rate over this quarter averaged about 480.

[Chart courtesy of exchange-rates.org.]

Status of FY11 Milestones

- Program Management will continue to refine monthly reports distributed to the Executive Council to assist in their financial oversight of NOAO activity.

  Status: The Work Breakdown Structure (WBS) Report provided to NOAO management was revised to better reflect activity as presented in the Annual Program Plan.

- Human Resources will undertake a review of Human Resources systems, processes, procedures, and policies.

  Status: The review of polices and procedure was begun.
• Human Resources will develop and deliver training programs for staff and managers. It will also promote the health and welfare of the NOAO workforce and establish programs to enhance employee services.

**Status:** Two executive-level leadership training courses were developed and delivered, and a "Coaching" course is in the process of being scheduled. A new health and welfare promotion "Nutrition—Keep it Fresh" will be introduced in early January.

• Procurement will continue editing, updating, and posting on the Web the NOAO Purchasing Policy & Procedures; including the policies related to both domestic and international shipping and receiving.

**Status:** A revised Procurement Policy & Procedure Manual, incorporating new AURA-wide policies, was published and posted on the CAS Web site.

### 2.2 OFFICE OF SCIENCE

**Program Highlights**

The scientific meeting sponsored by the Office of Science (OS), “Massive Galaxies over Cosmic Time 3,” was a success, with rave reviews from the meeting participants. Planning has begun for a scientific meeting in August on DECam and the Dark Energy Survey. The Joint Steward/NOAO colloquium program was enhanced to involve more NOAO staff in the colloquium program. NOAO-invited speakers were hosted by different NOAO staff members, and speakers met with NOAO staff members. The fall series was scientifically exciting and built bridges to other organizations (e.g., Gemini Observatory, NRAO). The Tuesday Science coffee was also successful with an enhanced level of scientific discussion.

The December issue of NOAO’s e-newsletter Currents provided updates to the community on ReSTAR and the Large Science Programs at the Blanco and Mayall telescopes. OS staff reviewed and helped to revise the AURA policy on the Responsible Conduct of Research and reviewed possible training materials. The OS program is on track to recruit a new Goldberg fellow (see FY11 Milestones below).

**Status of FY11 Milestones**

• Develop a program for staff career development.

**Status:** OS is rescoping the program due to limited funds. To assist with this effort, OS staff have taken advantage of the mentoring training program that is being offered by Gemini to learn about mentoring strategies and techniques. Several members of the NOAO South staff attended the mentoring training offered by Gemini in La Serena in the fall of 2010. The OS head will be attending the mentoring training session that will be offered by Gemini in Hilo in late January 2011.

• Recruit a Goldberg Fellow postdoc for an FY11 start.

**Status:** OS is on track to select a new Goldberg postdoctoral fellow. A review committee was formed and charged, and the position was well advertised (via the AAS job register, paper poster mailing, and personal email). Some 60+ applications were received, and interviews are
scheduled for the January AAS meeting and by phone. The broader scientific staff has been invited to provide feedback on the applicants and to help with recruitment once an offer is made.

- Create a scientific visitor program.
  
  **Status:** OS is hosting several scientific visitors on sabbatical this year and will be developing protocols to better anticipate the needs of longer-term visitors.

- Enhance the interaction between scientific staffs at NOAO North and South.
  
  **Status:** Funds are available to encourage staff members who are visiting the other hemisphere for some purpose to either extend their stay in Tucson or La Serena or make a stop there in order to interact with their colleagues. The staff members are aware of these funds and have taken advantage of the program. Thus far, one visit to each hemisphere has been funded.

### 2.3 EDUCATION AND PUBLIC OUTREACH

#### Program Highlights

The EPO undergraduate student cadre supported 31 local events over the first quarter of FY11, which is an event every three days. Events included nine school star parties with hands-on astronomy activities and telescope viewing, three sets of teacher workshops, 17 student-based sessions, and three festival-based events. The topics of these events included Dark Skies Rangers activities, GLOBE at Night, optics education, Galileoscope builds, and Project ASTRO activities. Typical venues included elementary schools like Laura Banks Elementary School between Kitt Peak and Tucson and Great Expectations Academy in Sahuarita, the Jim and Vicki Click Boys & Girls Club, the Cooper Center for Environmental Learning (CCEL), the Girl Scouts, Biosphere 2, Flandrau Science Center, and Indian Day in Sells. Typical numbers of students at the events ranged from 15 per session at the Boys & Girls Club, to 50 at each CCEL session, to 150 at a typical star party. The EPO undergraduate student cadre also built 100 Dark Skies Education Kits and 100 Teaching with Telescopes Kits, which were all sent to Chile. In December, two more EPO undergraduate students joined the existing cadre of six. Another major event was participation in FunFest, a three-day math and science festival at the Tucson Convention Center. Hundreds of students participated in hands-on activities led by NOAO staff and students.

In collaboration with the Astronomical Society of the Pacific (ASP), NOAO completed the NSF-funded Astronomy From the Ground Up program, which trained educators at hundreds of small science and nature centers nationwide. In a continuation of the collaboration with ASP, EPO is involved in a cooperative effort to train park rangers in observational astronomy. NOAO EPO staff presented on telescope optics and observational astronomy at the Sky Rangers workshop at Yosemite National Park 8–12 October 2010 in conjunction with the ASP and the National Park Service.

The AstroBITS program, a teacher professional development program funded by Science Foundation Arizona to encourage technology (especially astronomy) in the classroom, received 18 quali-
fied teacher applications. Only 12 completed the pre-class technical test and began the online course. This course continues to be edited and modified in response to the teacher’s work. EPO staff hosted teachers from previous AstroBITs classes for three nights of observing at the 0.9-m telescope at Kitt Peak in October.

Efforts to offer educational opportunities to students and classes on the Tohono O’odham Nation continue. These included participation in a day-long event at the Sells elementary school at which EPO student workers presented hands-on activities to multiple classes as part of a pre-Thanksgiving Indian Day. A class from the Tohono O’odham Community College toured Kitt Peak, as they have done in previous semesters. EPO staff met with several Tohono O’odham tribal representatives as an outcome from the Native American Indian Education conference in San Diego that was attended in October by an NOAO Diversity advocate and an EPO staff member.

The Science Foundation Arizona Hands-On Optics (HOO) program continued at 10 sites around the state this fall. Tucson programs were run by NOAO students at the Jim and Vicki Click Boys & Girls Club. The program funding ends this summer. As part of this program NOAO conducted star parties in cities that host the HOO-Arizona program.

This fall NOAO led efforts with the Flagstaff Unified School District and Lowell Observatory to hold a large Flagstaff star party. NOAO provided professional development to nearly all fifth grade teachers on standards-based optics activities using the NOAO-developed optics kit. NOAO helped Flagstaff fifth grade students build 400 Galileoscopes with other students in Flagstaff. The star party was held on October 15 and was attended by 400 students and their families. The Moon, Jupiter, M31, M13, and various double stars and clusters were observed.

In collaboration with the American Astronomical Society (AAS), ASP, and National Earth Science Teacher’s Association (NESTA), NOAO designed a program to organize the distribution of 15,000 Galileoscopes donated to US teachers at all grade levels. Through the Project ASTRO network, telescopes went to elementary teachers, while NESTA mainly distributed the telescopes to middle school earth science teachers. NOAO organized professional development workshops and used the NOAO Teaching with Telescopes Web site to augment these professional development efforts.

In December, NOAO launched the Galileoscope Photo and Sketching contest in partnership with NESTA. Students will submit images taken with their Galileoscopes and sketches made based on their observations with Galileoscopes. The contest runs through the end of April.

The NOAO GLOBE at Night program created a Web application for smart mobile devices, i.e., cell phones and tablets, to accept data entered for GLOBE at Night measurements during the campaign. Invited talks on GLOBE at Night were given in October and November at the Oklahoma-Texas star party, the Four Corners American Physical Society annual meeting, and the Geological Society of America conference. In November, the SPIE Newsroom published a story online about a “global campaign to save energy and fight light pollution” written by EPO staff.

Media Releases

There was one media release during this quarter, Buckyballs Discovered In Another Galaxy, which highlighted the work by NOAO scientist L. Stanghellini and her team showing that these complex molecules can be found in the SMC.

In addition to the media release this quarter, six new images were added to our Web site. One image, the Sh2-188, was taken by the new Mosaic 1.1 imager being used on the Mayall 4-m telescope and demonstrates the imager’s improved CCD capabilities (part of the ReSTAR project funding).
Status of FY11 Milestones

• Lead national efforts related to the Teaching with Telescopes professional development support program, maximizing the educational value of the Galileoscope telescope kit (with 200,000 Galileoscopes now in circulation).

  Status: The Teaching with Telescopes program was used for the Flagstaff star party and in the professional development of the teachers who received the 15,000 Galileoscopes. The Teaching with Telescopes logo was on each of these telescope boxes and a CD with information on the program is in each Galileoscope Teaching Kit. In Chile, programs on the Galileoscope were held at the National School Congress in Antofagasta and the National Congress of Amateur Astronomers in Vicuña. The process to translate some of the materials into Spanish was begun.

• Support a wide-ranging, dark skies awareness program for southern Arizona and Chile, with particular emphasis on the February and March GLOBE at Night campaigns.

  Status: The GLOBE at Night program offered numerous workshops at the Cooper Environmental Center to help Tucson teachers get ready for the GLOBE at Night campaign. The two-week campaign was expanded to encompass two campaigns offered during February and March, an adaptation suggested by NOAO South. Facebook and Twitter pages for GLOBE at Night were created as well. Four out of eight video tutorials for the accompanying Dark Skies Rangers activities were made. In addition, plans for working with the Girl Scouts in the GLOBE at Night campaign were begun. To support the Chilean GLOBE at Night program, 100 Dark Skies Education Kits were made and sent to Chile for CTIO and Centro de Apoyo a la Didáctica de la Astronomia teacher workshops.

• Conduct workshops/programs in coordination with the National Science Teachers Association (NSTA), the American Astronomical Society (AAS), Astronomical Society of the Pacific (ASP), and the Association of Science-Technology Centers (ASTC).

  Status: NOAO staff presented invited talks at the NSTA fall meetings in Nashville and Baltimore and a poster on the use of Galileoscopes at large star parties at the ASTC yearly meeting. Papers were written this quarter for the ASP Proceedings book on the recent Boulder meeting, where EPO staff gave a large number of workshops.

• Support the small nature and science centers in the successful NSF-funded Astronomy From the Ground Up program, which trained educators at hundreds of small science and nature centers nationwide.

  Status: Completed.

• Assist in the support of the teacher researcher participants of the NOAO/NASA Spitzer Teacher and Student Research program and its follow-on program the NASA IPAC Teacher Archive Research Program (NITARP) and the University of California Berkeley WISE Teacher Research program.

  Status: EPO continues to interact with both of these programs. In collaboration with a participating teacher and scientist from NITARP, NOAO presented two posters on the program at the national 2010 Teacher Research Experience Conference in Washington, DC, in October.
2.4 NOAO DIRECTOR’S OFFICE

Program Highlights

The NOAO Annual Program Plan for FY 2011 (APP-11) was completed and submitted to NSF Astronomical Sciences (AST) after approval by the AURA Observatory Council and review by the NSF NOAO Program Review Panel. The NOAO Annual Fiscal Year Report for FY 2010 (AFYR-10) was also completed and submitted to NSF AST. Both reports are available on the public NOAO Web site.

The NOAO director participated in face-to-face Board of Directors meetings for the WIYN and LSST Consortia in New Haven (October) and Tucson (November), respectively.

Along with other NOAO staff personnel, the NOAO director made presentations to NSF Astronomy in Washington, DC (December), the NSF NOAO Program Review Panel in Tucson (October), and the ReSTAR-2 Pre-Solicitation Meeting in Tucson (November).

Weekly videoconference or teleconference meetings continue between the NOAO director and all NOAO associate directors (one-by-one) as well as the NSF program officer for NOAO. The director meets bi-weekly with the NOAO Executive Council as well as the heads of the Office of Science, System Community Development, Central Administrative Services, and Human Resources.

The director and deputy director visited NSF headquarters in December to present the results of the 2010 Telescope System Instrumentation Program review panel. The director presented a briefing on the state of NOAO and its program to NSF AST staff during this visit.

The director visited the NOAO South offices in La Serena twice. The first trip was organized around the visit of the senior NSF Mathematical and Physical Sciences personnel (Seidel, van Citters, Ulvestad) to AURA-managed facilities. The second trip was organized around budget review and planning meetings with NOAO South personnel. The deputy director participated in the second trip (budget meetings) and also chaired the SOAR Telescope Science Advisory Committee meeting in La Serena the same week.

At the request of a group of New York State (NYS) astronomers, the director participated in several discussions of concepts for new, major, astronomical facilities in Chile sponsored by NYS.

The NOAO diversity co-advocates participated in the AURA Workplace & Diversity Committee in Hilo in December. Prior to the meeting, the participants toured Mauna Kea, which included a very interesting presentation by a representative of the local native Hawaiian community. NSF representative Dr. Scott Fischer attended the meeting and outlined NSF goals for broadening participation.

At AURA’s request, two NOAO scientists attended the National Indian Education Association meeting in San Diego in October. NOAO presented material about its several educational outreach tools including Hands-On Optics, the informal science education tool. Perhaps the most valuable aspect of the meeting was the opportunity to engage in meaningful conversations with teachers and educational administrators from tribal schools throughout the nation. A summary of this event was published in SPECTRUM, the newsletter of the AAS Committee on the Status of Minorities in Astronomy.

Status of FY11 Milestones

- As necessary, prepare an action plan in response to recommendations from the Astro2010 decadal survey that affect NOAO.

Status: The NOAO director met several times with AURA and NSF AST senior personnel to discuss Astro2010 recommendations that affect the NOAO program and possible implementation strategies. During this quarter, discussion focused on how NOAO and Gemini might be man-
aged within a common organizational structure and within a rebalanced NSF optical/infrared (O/IR) facilities program. In addition, the relationship between LSST and NOAO during the construction and operations phases was discussed. On their side, NSF AST announced that a “portfolio review” will occur sometime in the next 18–24 months. Details are pending.

- 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:** Numerous efforts to engage the educational community of the Tohono O’odham Nation continued. These included representation by NOAO at “Indian Day” at the local elementary school in Sells (Nov 24), a tour of Kitt Peak for the Tohono O’odham Community College weather and climate class, and discussion about activities for the coming months.

- Review family-friendly policies, particularly maternity/paternity-leave policy, and develop possible alternatives and/or modifications that also include the impacts of Chilean law.

**Status:** As part of the AURA-wide initiative, NOAO implemented a new, more flexible maternity/paternity policy.

- Maintain outreach to schools and programs in southern Arizona and IV Región de Coquimbo (Chile) that serve groups whose representation in science and engineering is less than their representation in the general population, funding permitting.

**Status:** See discussion in “Education and Public Outreach” section 2.3.

- Continue to develop the Office of Compliance Web site to provide a one-stop portal for policy information and training for staff.

**Status:** The Office of Compliance Web site can be found at [www.noao.edu/oc](http://www.noao.edu/oc). New modules for American Recovery and Reinvestment Act of 2009 (ARRA) and Responsible Conduct for Research were added in this first quarter. These sites provide the NOAO Community and staff access to information, reporting, and compliance.

- Develop and provide policy and procedural training to NOAO and other AURA Centers in the areas of federal agency grant and agreement policies, procurement, conflict of interest, integrity in research, American Recovery and Reinvestment Act of 2009 (ARRA) and other pertinent policies or program regulations.

**Status:** Training was provided for NOAO South and is scheduled for NOAO North in the second quarter of FY11. Topics to be covered are procurement policies and procedures, grant and contracts regulations, and conflict of interest.

- Work with the Office of Science to strengthen the Responsible Conduct in Research (RCR) training.

**Status:** An NOAO RCR Training Program was developed and is available on the NOAO Compliance Web site at [www.noao.edu/oc](http://www.noao.edu/oc).
• Review and approve conflict-of-interest (COI) management plans as needed and implement updated AURA COI policies.

  **Status:** The new AURA COI policy was implemented. A Web site was created for staff to obtain information on conflict of interest and includes an electronic COI disclosure form. Annual COI updates will begin in the spring.

### 2.5 ARRA INFRASTRUCTURE RENEWAL

**Program Highlights**

In 2009, NOAO received $5M from NSF to accomplish significant, critical infrastructure maintenance and upgrades in La Serena, Tucson, and on Kitt Peak and Cerro Tololo. NOAO has embarked on a series of such upgrades starting in FY10 and now continuing in FY11. Major projects include water system upgrades on both mountaintops, instrument handling facilities, major equipment purchases (CNC machines, vehicles, an elevator for the Kitt Peak Visitor Center), and lab equipment. Additional details and financial status for these projects are provided in reports submitted to NSF per the requirements of SPO-16 AST-0947035.

**Status of FY11 Milestones**

• Begin to perform the work required to complete the major sub-contracted projects funded by the ARRA at Cerro Tololo, Cerro Pachón, La Serena Base Facility, Kitt Peak, and Tucson Headquarters.

  **Status:** The pre-bid process for the KPNO water renovation was completed. The bids will be reviewed and a choice made in the second quarter of FY11. The Tucson cooling equipment was installed in the computer room and main building. The CTIO converter for main mountain power is back on line. The Blanco coating chamber refurbishment is underway. The Blanco 4-m telescope Console room remodel is complete.

• Begin repairs and renovations at NOAO South to be completed with NOAO South labor, and which include La Serena and CTIO meeting room renovations, and the Blanco instrument handling facilities and cooling system.

  **Status:** The Blanco instrument handling facilities project is 90% complete. The upgrades to the cooling system began and a new chiller is on order. New video equipment and lighting fixtures were installed in the La Serena Main Conference Room.
3 OBSERVING PROPOSAL STATISTICS FOR 2011A

Observing proposal (request) statistics for telescope time awarded through the NOAO telescope time allocation process are published on the NOAO Web site. The statistics for 2011A can be found as follows:

  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, and subscription rates for new programs.

- Request Statistics by Instrument: www.noao.edu/gateway/tac/inst11a.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.
4 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>Date</th>
<th>Retrieved (GB)</th>
<th>Files Retrieved</th>
<th>Unique Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 2010</td>
<td>21.12</td>
<td>272</td>
<td>9</td>
</tr>
<tr>
<td>Nov 2010</td>
<td>200.58</td>
<td>10,730</td>
<td>14</td>
</tr>
<tr>
<td>Dec 2010</td>
<td>139.01</td>
<td>12,527</td>
<td>12</td>
</tr>
<tr>
<td>Total:</td>
<td>360.71</td>
<td>23,529</td>
<td>35</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Bandwidth (GB)</th>
<th>Pages Viewed</th>
<th>Unique Visitors</th>
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</thead>
<tbody>
<tr>
<td>Oct 2010</td>
<td>147.38</td>
<td>6,733</td>
<td>1,049</td>
</tr>
<tr>
<td>Nov 2010</td>
<td>96.58</td>
<td>6,074</td>
<td>807</td>
</tr>
<tr>
<td>Dec 2010</td>
<td>129.87</td>
<td>13,180</td>
<td>742</td>
</tr>
<tr>
<td>Total:</td>
<td>373.83</td>
<td>25,987</td>
<td>2,598</td>
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</table>

The NOAO SkyNode provides access to catalogs and is complementary to the NOAO Science Archive, which provides access to images. SkyNode receives a simple SQL query and passes it to a backend database engine. The result is then passed back through the Web server. The most important number in the table below is “Unique Visitors.”

<table>
<thead>
<tr>
<th>Date</th>
<th>Bandwidth (MB)</th>
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<tr>
<td>Nov 2010</td>
<td>42.42</td>
<td>20,274</td>
<td>383</td>
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<tr>
<td>Dec 2010</td>
<td>19.43</td>
<td>19,022</td>
<td>409</td>
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<tr>
<td>Total:</td>
<td>79.48</td>
<td>42,528</td>
<td>1,019</td>
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</table>

The NOAO Portal provides principal investigators (PIs) access to their raw data from all instruments and to pipeline-reduced products from the Mosaic instruments at the CTIO and KPNO 4-meter telescopes and the NEWFIRM instrument. 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>Date</th>
<th>Bandwidth (MB)</th>
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<th>Unique Visitors</th>
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<td>8,539.17</td>
<td>75,072</td>
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# 5 Grants

The following table lists the grants received by NOAO staff from non-NSF agencies during the first quarter of FY 2011.

<table>
<thead>
<tr>
<th>Principle Investigator</th>
<th>Awarding Agency</th>
<th>Title</th>
<th>Budget Amount</th>
<th>Period of Performance</th>
<th>Year of Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knut Olsen</td>
<td>STScI</td>
<td>A Panchromatic Hubble Andromeda and Triangulum Survey - I</td>
<td>$242,970</td>
<td>10/01/2010–11/30/2013</td>
<td>1 of 3</td>
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<tr>
<td>Buell Jannuzi</td>
<td>STScI</td>
<td>Tracing the Distribution of Gas and Galaxies</td>
<td>$15,859</td>
<td>11/1/2010–10/31/2012</td>
<td>1 of 2</td>
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<tr>
<td>Jeyhan Kartaltepe</td>
<td>JPL</td>
<td>Investigating the Starburst AGN Connection</td>
<td>13,500</td>
<td>11/30/2010–12/01/2012</td>
<td>1 of 2</td>
</tr>
<tr>
<td>Naveen Reddy</td>
<td>JPL</td>
<td>Galaxy Outflows at High Redshift</td>
<td>13,500</td>
<td>12/6/2010–10/01/2012</td>
<td>1 of 2</td>
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<tr>
<td>Verne Smith</td>
<td>JPL</td>
<td>Characterizing the Stellar Metallicity</td>
<td>14,500</td>
<td>12/20/2010–12/31/2012</td>
<td>1 of 2</td>
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<tr>
<td>Lori Allen</td>
<td>JPL</td>
<td>Probing Star &amp; Planet Formation</td>
<td>$5,000</td>
<td>12/21/2010–09/30/2012</td>
<td>1 of 2</td>
</tr>
</tbody>
</table>

**NOTES:**

1 STScI = Space Telescope Science Institute
2 JPL = Jet Propulsion Laboratory