CTIO staff doing a checkout of the NEWFIRM instrument and a filter change in the newly completed Blanco cleanroom facility. The new facility was designed to handle the larger instruments (NEWFIRM and DECam) coming to CTIO.

Image credit: Ron Probst/NOAO/AURA/NSF

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1 NOAO DIVISIONS

1.1 NOAO SOUTH

1.1.1 Cerro Tololo Inter-American Observatory

Program Highlights
At the Cerro Tololo Inter-American Observatory (CTIO), the highlight of the third quarter was the initiation of observations with the NEWFIRM wide-field infrared imager on the Blanco 4-m telescope. The instrument was carefully unpacked, partially pulled apart to be checked out in the new cleanroom (see milestone below), and then reassembled, a process that took approximately six weeks. First light on the telescope was achieved on 14 May 2009, although much of that light was used for calibration tests. Those calibrations led into the first scientific verification observations and then into the first scientific observing run by L. Allen, of the NOAO Scientific Staff. Her observations of NGC 6334 were reduced through the automated NEWFIRM science pipeline (an important milestone in the process of commissioning NEWFIRM on the Blanco). This led to the striking image at right, a composite of J, H, and Ks exposure sequences combined into a color image showing the infrared structure of this striking nebula (also known as the Cat’s Paw Nebula from its optical emission).

Status of FY10 Milestones

- Install NEWFIRM on the Blanco 4-m telescope.

  **Status:** Completed. NEWFIRM arrived at CTIO on April 1. After a thorough checkout, it was installed on the Blanco 4-m telescope on May 11 and had its first night on the sky on May 14. By May 24 it was in use taking scientific data. Demand for NEWFIRM on the Blanco has proven to be extremely high, and it has been heavily scheduled through the rest of calendar year 2010.

- Install the SOAR Adaptive Module with laser guide-star and commence commissioning of the SOAR 4.1-m telescope SIFS.

  **Status:** Work on the SOAR Adaptive Module (SAM) continues in the La Serena instrument shops and laboratories, with efforts on schedule for installation of the instrument late in the fourth quarter of FY10. The SOAR Integral Field Spectrograph (SIFS) obtained its first spectrum of an astronomical object on the night of 28 April 2010. This instrument was delivered to SOAR by the National Laboratory of Astrophysics of Brazil and was installed and commissioned with the help of CTIO staff. It is expected that commissioning will continue through at least the first quarter of FY11, but the initial results have been quite promising for this important addition to the SOAR instrument complement.
Complete the Blanco 4-m Telescope Control System upgrade.

**Status:** The Blanco Telescope Control System project completed development of all of the core hardware and software components, and testing of the integrated system began. There are still auxiliary software components to be developed and extensive testing to be done before the system is complete (planned by fourth quarter of FY10) and can enter its commissioning phase (first and second quarters of FY11).

Complete installation of the support equipment and infrastructure for NEWFIRM and DECam.

**Status:** The needed infrastructure for NEWFIRM, in the new instrument maintenance facility in the Coudé room of the Blanco 4-m and on the telescope, was installed, tested, and put into use. This included completion of the new cleanroom structure and testing of the new cooling system components (compressors, He lines). Much of this infrastructure is the same as that needed for DECam. Additional work on the cleanroom and cooling systems is planned in the next quarter for DECam support.

Complete engineering and design work for the DECam installation.

**Status:** The draft installation plan for DECam was revised with input from local engineers and DECam project members from Fermilab. In addition, the installation schedule was revised to adapt to delays in the expected delivery of DECam. Detailed engineering and design work for the installation of DECam awaits the effort of a dedicated mechanical engineer. The search for a temporary staff hire to fill this role was begun, and several candidates were identified. The selection process should be completed next quarter.

1.1.2 NOAO South Operations

**Program Highlights**

The Administration and Facilities (A&F) group continued to focus efforts on the two activities related to integration into NOAO: support for new facilities on Cerro Tololo and Cerro Pachón, and ongoing stimulus projects. The integration efforts during this quarter focused largely on accounting systems, particularly in support of the FY11 budget development. Two key NOAO North administrative staff visited La Serena for more than a week of intense work, and the two leading NOAO South staff traveled to Tucson for further discussions. Additional travel and intense training is planned for next quarter.

On Cerro Tololo, final grounding and other detailed work was completed for the foundations of the three 1.0-m telescopes and other structures for the Las Cumbres Observatory Global Telescope Network (LCOGTN) telescopes. The domes for the 1.0-m telescopes arrived and were assembled, and planning for the arrival of the buildings and the telescopes is well underway. In addition, support was provided for the design of a new telescope structure to house a 0.8-m telescope addition to the Panchromatic Robotic Optical Monitoring and Polarimetry Telescopes (PROMPT) cluster. Design plans were completed and are pending approval from PROMPT to start bids for construction. NOAO South staff also provided fundamental information to prospective new tenants who are investigating bringing three more 1-m-class telescopes to Cerro Pachón, Tololo, or even Cerro Morado.

<table>
<thead>
<tr>
<th>Group/Program</th>
<th># of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>CADIAS Center</td>
<td>559</td>
</tr>
<tr>
<td>CTIO Outreach</td>
<td>1,603</td>
</tr>
<tr>
<td>Tololo Guided Tours</td>
<td>257</td>
</tr>
<tr>
<td>School Groups K-12</td>
<td>162</td>
</tr>
<tr>
<td>Special Tours</td>
<td>35</td>
</tr>
<tr>
<td><strong>Total Visitors</strong></td>
<td><strong>2,616</strong></td>
</tr>
</tbody>
</table>
With funding from ARRA, progress toward a new extension to the Cerro Pachón dormitory was significant, with the second iteration on the floor plan for the third phase completed. This phase provides a permanent kitchen and dining facility for Cerro Pachón to replace the current temporary building. Current plans provide for a request for construction proposals competition to be held late in the fourth quarter of FY10 (Q4) and construction to begin early in the first quarter of FY11. Plans for repairs and renovation of the dormitories and dining facility on Tololo are progressing, and work should begin in Q4. Emergency generator systems for both Pachón and Tololo were purchased and will be installed in Q4. These will provide an important element of safety, powering not only sensitive equipment but also heating systems in the dorms during extremely cold winter nights in the not-so-rare cases of power outages.

This quarter was a period of extreme weather conditions on the mountains, with an above average number of severe storms and snowfall. While the facilities in general withstood the storms, the roads suffered significant damage from the water runoff and snowplow activities. Repairing the damage will be a major activity for the next reporting period, as the winter storms subside.

During this third quarter of FY10, the CTIO Education and Public Outreach (EPO) team organized and participated in many community events with two of particular significance: the group traveled in April as part of a huge community delegation that provided educational and general support to Talca, a city in the south of Chile that was highly damaged by the earthquake; in May, the group participated in a dark sky protection activity with the Los Pelambres mining company in a new collaboration effort that will continue during the year. In June during the visit of the NOAO EPO Manager to La Serena, the team signed a symbolic agreement of mutual cooperation with the Observatorio Turístico Cruz del Sur regarding a series of outreach activities that will benefit the observatory, the community, and the promotion of astronomy.

**Status of FY10 Milestones**

- Transition to the AURA-standard human resource and personnel system, UltiPro, including adaptation to allow for local Chilean legal and practical use differences.

  **Status:** The analysis of which capabilities of UltiPro can be adapted for practical use in the Chilean administration processes continued. The expatriate staff of NOAO South gained user access to UltiPro along with the staff of NOAO North. The existing complexities involved in the management of Chilean payroll functions (local laws, mandated withholdings, diverse income tax structures, etc.) would make it extremely difficult to use UltiPro for the purposes of the Chilean payroll activities, but the use of non-payroll capabilities is being explored to provide the Chilean staff with some of the user benefits of the system.

- Transition to the NOAO purchase request system, Reqless, with the appropriate modifications for local Chilean use and communication with other AURA Programs (Gemini, SOAR, LSST, etc.)

  **Status:** The NOAO South administration staff continued analysis of the Reqless system to identify the changes necessary to accept peso transactions, load account structures, and define local signature authority and workflows, while also contributing to analysis of how the Reqless system fits in with the detailed procurement compliance procedures being developed and discussed as AURA-wide policies. Modifications and adaptations to suit local requirements are well underway, and plans for deployment in Chile have been firmed up for the fourth quarter of FY10.
• Transition to the NOAO accounting systems (based on USL) with the appropriate modifications for local Chilean use and communication with other AURA Programs (Gemini, SOAR, LSST, etc.).

Status: The initial ingestion of data from NOAO South into the USL-based Tucson systems was accomplished successfully. Analysis of account mappings and further refinement of ingestion procedures continues into fourth quarter as plans are laid for full USL operations by the first quarter of FY11. A test-bed for the USL-based accounting system was deployed (which included overcoming some important network security issues) to provide a training platform for NOAO South administrative staff. Plans developed for deploying the USL system in Chile will be implemented in the FY10 fourth quarter.

• Complete the transition to Voice-over-IP (VoIP) telephony, including voicemail.

Status: Largely complete, except for the voicemail module. All units of CTIO are now served by VoIP telephone systems, providing significant international long-distance savings as well as better communications (no hesitations to call) between NOAO North and South. Work on completing the voicemail capabilities was moved to FY11 due to higher priority network infrastructure needs.

• Restructure the downtown facility network to provide improved service and security to NOAO South and other AURA Programs, while providing separate, local Internet service to the residents of the AURA Compound.

Status: Ongoing. The integration of the Administration & Facilities group includes integration of this formerly separate group into the NOAO South network structure. Requirements on this integration include not only the necessary security measures to protect the critical accounting and payroll information (as required by auditors), but also measures to support secure connections (a dedicated virtual private network, VPN) from the administrative subnet in La Serena to the similar subnet in Tucson. This secure connection was configured and is now in use, supporting the USL use mentioned above. The residential Internet service changes are awaiting negotiations with the Internet service provider (Entel), which, hopefully, will be undertaken in the fourth quarter of FY10.

• Transition the Web site from a traditional Webmaster-managed system to a content management system (Plone) in order to allow for delegated and more frequent updates to content and improved management of the sites.

Status: Ongoing. The Plone-based Web site structure was developed and opened for broad input from staff. Comments and suggestions will be incorporated in the fourth quarter of FY10 while, in parallel, content from the current Web site will be moved to the new site. During this transition, the information is being reviewed and updated.
1.2 NOAO NORTH

1.2.1 Kitt Peak National Observatory

Program Highlights

Mosaic 1.0 had its last run at the Mayall 4-m telescope in June 2010. It is being refitted with new e2v-made CCDs, which will be run with TORRENT controllers. Commissioning of the refurbished instrument, named Mosaic 1.1, is expected in October 2011, with the first science run in November 2010. Meanwhile, it is apparent that Mosaic 1.0 was still producing important science. For instance, Belokurov et al. reported (ApJ 712, L103) using images obtained with Mosaic 1.0 at the Mayall 4-m telescope to obtain structural characteristics and distances to two stellar over-densities identified in Sloan Digital Sky Survey (SDSS) data. The results from the Mosaic 1.0-based investigations identify them as faint Milky Way satellite galaxies.

While NEWFIRM has departed for an 18-month period to CTIO, results from its use at KPNO continue to arrive. Tilvi et al. (Astro-ph Xarxiv 1006.307, June 2010) announce four candidate Lyman-alpha emitting galaxies at red-shift 7.7. Such objects at these extreme red-shifts probe not only the re-ionization history, but also the galaxy formation and evolution, particularly their very early star formation histories.

One letter of intent was received in March, in response to the announcement for the Large Science Proposal. NOAO/KPNO responded with a request for proposal due 1 October 2010. A non-advocate review is being arranged.

Status of FY10 Milestones

- Begin the upgrade of the Mosaic-1 optical imager for the Mayall 4-m telescope. The refurbished instrument will have new detectors and a modern controller. This project will be completed in FY11.

  **Status:** Mosaic 1.0 was used for the last time on 9 June 2010 and will have its focal plane replaced during the summer, becoming Mosaic 1.1 when the upgrade is completed. The project is on schedule, with commissioning of the upgraded instrument anticipated for October 2010.

- Complete the restructuring of the KPNO/WIYN/NSO User Support Office, including increased automation of tasks currently requiring significant clerical activity, in order to provide improved service to our users at a lower cost (e.g., online payment by visiting observers of room and board fees, rather than manual preparation of invoices and collecting of fees).

  **Status:** B. Cancio, promoted to Administrative Assistant I, will take over the bulk of the Observing Run Preparation processing for KPNO, NSO, and WIYN. A part-time office assistant was hired. N. Bird, administrative assistant to the KPNO director, leads this sub-group of the KPNO Support Office as they support the needs of visiting observers. Online payment was enabled for visiting observers, and a revision of the Observing Run Preparation and Observing Run Evaluation online forms is in progress and on schedule for completion by the end of this year.

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**Kitt Peak Visitor Center**

**Summary of Visitors**

(3 months ending 6/30/10)

<table>
<thead>
<tr>
<th>Group/Program</th>
<th># of Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>General public tours</td>
<td>1,915</td>
</tr>
<tr>
<td>School groups K-12</td>
<td>136</td>
</tr>
<tr>
<td>Special tours</td>
<td>308</td>
</tr>
<tr>
<td>Nightly Obs. Program</td>
<td>2,639</td>
</tr>
<tr>
<td>Advanced Obs. Program</td>
<td>33</td>
</tr>
<tr>
<td><strong>Total Visitors for All Paid Programs</strong></td>
<td><strong>5,031</strong></td>
</tr>
</tbody>
</table>
Successfully hold our summer education programs, including the Tohono O’odham Horse Camp, organized and run by Si Johnson of the Tohono O’odham Nation, and the Astronomy Camps (Beginner and Advanced) organized and run in collaboration with the University of Arizona Alumni Association and Don McCarthy of the University of Arizona.

**Status:** The Horse Camp was held in June and was a success. This year, only the Advanced Astronomy camp was held on Kitt Peak.

### 1.2.2 Central Facilities Operations

**Program Highlights**

During this quarter, the Central Facilities Operations (CFO) staff continued to focus on projects funded by the American Reinvestment and Recovery Act of 2009 (ARRA) and planned renovation/maintenance activities. Contracts were issued to replace deteriorated exterior doors and demolish an unused, dilapidated duplex. Engineering firms were tasked with the design of major building electrical system repairs and the analysis of the structural issues regarding a possible expansion of the east wing portion of the main building. Staff are finalizing plans and bid documents for ARRA-funded efforts to renovate the main computer room cooling system and replace the outdated building energy management system. Plans were finalized for renovation efforts regarding the main sprinkler system and an Americans with Disabilities Act-compliant ramp for La Quinta; bids to complete the work are being obtained. CFO also began implementation of the facility-wide recycling program with new collection containers provided throughout the facility.

**Status of FY10 Milestones**

- Begin to develop a long-range facilities plan to review the needs of the observatory.

  **Status:** CFO staff are working with the NOAO Directors Office regarding future space needs and options to obtain critically needed office space to support various programs. An engineering firm completed a review of the east wing expansion project and provided a report regarding the feasibility options and estimated implementation costs.

- Participate in a review committee to recommend a Web-based work order system that may be used for both NOAO North and South applications; implement the system if time and funding are available.

  **Status:** This project was deferred due to the demands of the ARRA-funded project design efforts. However, CFO is looking at the possibility of creating a limited system that could allow staff to see the status of ongoing work efforts by the department.

- Replace deteriorated, leaking, landscape irrigation systems.

  **Status:** With primary efforts completed around the main headquarters structure, efforts are continuing in the La Quinta area.

- Complete Phase II renovations to La Quinta Conference room to address issues related to the Americans with Disabilities Act and access.

  **Status:** CFO staff provided bid documentation to the contracts office to pursue the phase one efforts to install a new ADA-compliant concrete ramp and entry. Phase two design and documentation is ongoing.
• Make targeted renovation and building modifications at NOAO North to address office and meeting space needs: replace exterior doors.

**Status:** A contract was issued to replace some exterior glass doors with the installation scheduled for July 2010.

• Make targeted renovation and building modifications at NOAO North to address office and meeting space needs: update existing conference and/or meeting rooms including video conferencing systems.

**Status:** The internal committee is finalizing their evaluation of the video conference system options and is preparing recommendations for implementation.

### 1.2.3 Computer Infrastructure Services

#### Program Highlights

Accomplishments of the Computer Infrastructure Services (CIS) group for this quarter included work in the NOAO North computer lab, the CFO building, and between the computer lab and the Engineering building. Several racks of equipment used by Science Data Management in the computer lab were reoriented to improve cooling and allow room for expansion. The processor module in the Cisco 7206 router that connects NOAO-Tucson to the Internet was upgraded. A new rack with servers for ATST/SOLIS projects was installed in the computer lab and support was given to the server installation in that rack. The Ethernet switch in the CFO building was upgraded. The fiber connection (10 Gbit/sec) from the computer lab to the Engineering building was “rung-out” and tested. An Ethernet switch utilizing this connection and providing Gigabit connections for all the existing Ethernet cables was installed.

#### Status of FY10 Milestones

• Revamp the main network rack in the NOAO North computer lab for maintainability and reliability. “Build-out” the backbone Ethernet switch to maximum capacity.

  **Status:** In Progress. Many connections in the rack were consolidated onto fewer, denser switches to create space. What remains is to create a support structure in the space and then to move many connections through that new support structure.

• Upgrade the Ethernet switch in the NOAO North Engineering Building to provide more Gigabit (Gbit) ports and utilize a 10-Gbit backhaul to the backbone switch.

  **Status:** Completed.

### 1.2.4 Safety Report

On May 23, around 8:00 pm, an observing assistant went outside south door of the Kitt Peak 4-m telescope to check the condition of the weather. The employee latched the door open with a chain due to high winds then made weather observations. When the employee returned to the door, a gust of wind forced the door loose from the chain, and the door struck the employee causing a serious blow to the head that required sutures and medical observation. In addition, the employee suffered bruises and strains to the neck, shoulder, and elbow. As a result of the injuries, the employee required time off from work and returned to work on June 7.

Large Synoptic Survey Telescope (LSST) staff engineers and the NOAO risk manager met a number of times this quarter to review and determine the methodology for the LSST hazard analysis. A determination was made to use a slightly modified Mil- STD -882c, similar to methodologies of
the Advanced Technology Solar Telescope (ATST) and SLAC. Risk assessments were conducted for the LSST main floor control room, mechanical areas, and maintenance areas with good results.

Staff representing CFO and Kitt Peak and the NOAO risk manager attended the NSF Large Facilities Workshop held in San Diego the week of May 3. The risk manager represented NOAO during the safety sessions and presented “Thoughts of a Safety Guy.”

The NOAO risk manager provided risk management expertise to the NSO ATST Telescope Mount Assembly (TMA) Contractor Selection Group during the month of June. The group reviewed the preliminary contractor ratings including the contractors’ safety performance on June 10. After this meeting, the contractors were asked for further clarification of safety management and control issues. The group met again on June 29 to finalize the selection of the TMA contractor based on a wide range of ratings including safety and risk management.

Draft revisions were made to the CTIO/SOAR Laser Safety Policy that include maintenance and operation on the telescope and for future laser operation. Revisions were made to the Laser Safety Briefing for the SOAR telescope area. A risk management inspection for the SOAR telescope facility was completed in June.

The NOAO South Safety Engineer Selection Committee interviewed five candidates in La Serena, Chile, between June 21 and June 23. The Committee members included staff from NOAO South, NOAO North, and LSST. The Committee submitted its selection to the NOAO South associate director for his approval.

1.3 NOAO SYSTEM SCIENCE CENTER

Program Highlights

The NOAO System Science Center (NSSC) consists of System User Support (SUS), Science Data Management (SDM), and System Community Development (SCD). Their respective program highlights and the status of FY10 milestones are discussed separately within each of the three sections following the NSSC highlights.

During the third quarter of FY10, NSSC participated in the NOAO Users Committee meeting, as well as organized and hosted the NOAO US Gemini Science Advisory Committee (SAC). Attendees of the SAC meeting included substantial fractions of the US membership on the Gemini Science Committee and the Gemini Board, representatives from the NSF, and the Gemini Associate Director of Science. Some of the important topics covered included discussion of a Gemini Observatory proposal to the Gemini Board to change their operations model, which is being driven by the future departure of the UK from the Gemini partnership. Another item was a discussion on defining the science and technical requirements for the next new Gemini instrument, a high-resolution optical echelle spectrometer.

Science highlights published recently and derived from System facility observations are noted in the Program Highlights section of System User Support (immediately below).

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 Gemini’s 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.

Low-Density Sub-Saturn Mass Planet Transiting a Metal-Poor K Dwarf”) used NOAO-assigned
time on the Keck I telescope with the High Resolution Echelle Spectrometer (HIRES) to
characterize an unusual transiting extrasolar planet. The radial velocities obtained with HIRES show
that the planet has a mass smaller than that of Saturn. Moreover, modeling of the photometric
observations led the observers to conclude that HAT-P-12b has low density compared to other
planets of similar mass, leading to a suggestion that it is composed primarily of hydrogen and
helium, as well as a low core mass. The HIRES spectra also were used to characterize the host star,
which was found to be moderately metal-poor. This last discovery establishes a promising
correlation between planetary core mass and metallicity of the host star, which may lead to
understanding of how extrasolar planets form.

Vilardell et al. (2010, Astronomy & Astrophysics, 509, A70, “The Distance to the Andromeda
Galaxy from Eclipsing Binaries”) used the Gemini Multi Object Spectrograph (GMOS) on Gemini
North to measure the distance to M31. The team used GMOS to establish radial velocity curves of
eclipsing binary stars discovered in M31. When combined with photometric measurements, these
radial velocities allowed for the direct measurement of the distance to the binary systems, without
appeal to secondary calibrators. M31 is an important galaxy for establishing the cosmic distance
scale, as it is the nearest large spiral galaxy to the Milky Way, and can be used to calibrate many
other important distance measures. The Large Magellanic Cloud has typically been used as one of
the first steps in the distance ladder, but owing to its peculiar properties, that method has been
historically fraught with hidden systematic errors. The GMOS observations resulted in a distance to
M31 of 744 kiloparsecs, with an error of only four percent.

Status of FY10 Milestones

• Work with the community-at-large to advertise, advocate, and advise for the broad range of
  System capabilities, including old and new.

Status: SUS advertised, advocated, and advised for the System’s capabilities through several
channels in FY10. SUS maintained its strong presence at both the winter and summer meetings
of the American Astronomical Society (AAS), where SUS staff interacted with users of System
capabilities, assisted Gemini users with their Phase II preparation, and advertised the System’s
capabilities to prospective users through personal interactions as well as prepared handouts. At
the January 2010 AAS meeting, NSSC-SUS organized a “US Gemini Town Hall” meeting,
which included presentations by the NSSC director, the Gemini director, and Gemini’s associate
director of development, as well as an open question period, with overall focus on future
instrumentation for the Gemini telescopes. The NSSC-SUS presentation included results from a
survey of the US community, conducted by NSSC-SUS, of desired future capabilities for Gemini.
As of March 2010, SUS’s contributions to the NOAO Newsletter now appear in a single section
titled “System Science Capabilities”, which includes all of the capabilities for KPNO/WIYN,
CTIO/SOAR, Gemini (including Subaru time exchange), Keck, MMT, Magellan, and
Palomar/Hale. This reorganization enables a clear view of the System’s capabilities for
potential users. SUS completed plans to hold a Gemini Data Reduction Workshop during July
19–22 in Tucson. The workshop, which will feature presentations and interactive sessions led by
Gemini and SUS staff as well as local experts, is aimed at teaching those basics of data
reduction relevant to the bulk of Gemini’s capabilities, as well as detailed techniques particular
to the most popular Gemini instruments. Finally, SUS represented the needs of the US community in its discussions with the Gemini Observatory regarding the Gemini Transition Plan, which Gemini is formulating in response to the UK withdrawal from the Gemini partnership.

- Ramp up SUS expertise as needed to provide support for all System-wide telescope and instrument access.

**Status:** SUS adjusted staff and responsibilities in order to provide technical support for proposals for Keck HIRES, Magellan Inamori Kyocera Echelle (MIKE), Hale, and Center for High Angular Resolution Astronomy (CHARA), in addition to the fully SUS-supported Gemini capabilities. Additional System capabilities were supported technically by the partner observatories.

- Maintain the historically high level of support for US Gemini programs.

**Status:** US demand for Gemini time remains healthy, with oversubscription factors of 4.3/1.9 (Gemini North/South) for 2010A and 3.5/2.0 (North/South) for 2010B. 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 continues to encourage classical observing on Gemini, with 15–20% of US programs, amounting to 20–30% of US time, scheduled as classical observing runs funded by NOAO in 2010A and 2010B. SUS staff conducted six visits to the Gemini sites during the October 2009 to June 2010 time period, with two of these being month-long visits to Gemini South to allow participation in Flamingos-2 testing and commissioning. These staff visits, coupled with the support of classical observing, point to the dedication of NSSC-SUS towards building and maintaining relationships with both the US community and the Gemini Observatory.

- Organize community input and support for defining the next set of new instruments for Gemini.

**Status:** The NSSC-SUS efforts in organizing community input and support for defining the next set of new instruments for Gemini continue to be guided by the ALTAIR committee report, which called for an improved Gemini instrumentation suite that is more responsive to US needs, with emphasis on rapid deployment. Via an NSSC-SUS survey conducted in the first quarter of FY10, the US community expressed strong support for high resolution optical and infrared spectrographs, and for a medium-resolution spectrograph with broad optical to near-IR wavelength coverage. Gemini recently announced plans to build a high-resolution optical spectrograph for one of its telescopes. NSSC-SUS, along with US representatives on Gemini’s governing and advisory committees, is working to make sure that a broad spectrum of instrument concepts and science use cases will be developed in response to this opportunity.

- Provide user support for community access time at the Palomar 200-inch (5-m) Hale Telescope.

**Status:** NSSC-SUS initiated support for the community access time at the Hale telescope in FY10 by having a staff member visit Palomar and discuss community support issues with Palomar Observatory staff and by providing technical reviews of Hale proposals submitted to NOAO for semesters 2010A and 2010B.
1.3.2 Science Data Management

Program Highlights

All components of the Science Data Management (SDM) End-to-End (E2E) v1.5 system were completed, tested by Quality Assurance, and delivered to Operations this quarter for deployment early in the next quarter. The major internal change was the replacement of the file management system (Storage Resource Broker, SRB) with its next generation system, IRODS. The most significant external change was the reorganization of the Portal Web pages to provide a new and simpler form-based query interface to principal investigators (PIs) and general users similar to those used by other astronomical archives. In a future release of the E2E system, it is planned to streamline the presentation of search results and the process of retrieving the desired data.

Members of SDM continued to support meetings with several Dark Energy Camera working groups including the instrument control (SISPI) group, the System Interfaces Working Group, and the Community Pipeline Working Group. A DECam to E2E Interface Control Document is being written by SDM for review by the Community Pipeline Team at NCSA. The completed document will be presented for review early in the next quarter.

Members of SDM supported Program Management and Technical meetings for the One Degree Imager (ODI) Pipeline and Archive System. SDM has been collaborating with WIYN and Pervasive Technologies, Inc (PTI) on the development of a detailed archive and pipeline proposal for ODI. Work also continued in the exploration of the optimal method of interfacing the NOAO High Performance Pipeline System (NHPPS) and pipeline modules to the Open Grid Computer Environment (OGCE) on the Indiana University Teragrid.

SDM staff assisted with the relocation of the NEWFIRM instrument to CTIO by supporting the deployment of the Data Handling System and the NEWFIRM Quick Reduce Pipeline with the updates required by the instrument’s new location.

Along with other members of the VAO, SDM staff worked to develop a VAO Program Plan and contributed largely in the areas of User Support and Product Development.

Status of FY10 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 v1.4 system continues to function well. It is anticipated that the E2E v1.5 system will be deployed in July 2010 with a new Portal interface for the user that was designed by the Program Scientist and the Portal developer. The E2E v1.5 system also includes major hardware upgrades where portions of the Apple XSan clients are being replaced with 64-bit Linux clients.

- Develop a 64-bit implementation of IRAF for support of large-format images (greater than 2 Gigabytes) and compatibility with 64-bit operating systems.

  **Status:** Two releases of the 64-bit IRAF implementation were made this quarter to address reported bugs, and a porting guide for external packages was written and distributed to STScI. A beta release is anticipated in the next quarter followed by a final release of IRAF v2.15 shortly afterwards.

- Test operation of Mosaic science pipeline modules using the NOAO High-Performance Pipeline System within the Open Grid Computing Environment (OGCE) on the Indiana University Teragrid. Develop prototype science pipeline for the WIYN One Degree Imager (ODI).
Status: A basic calibration workflow was defined and many changes were made to the NHPPS to support this workflow. These changes were consolidated in the master NOAO code base and tested. The document, “PL019 – Transforming NHPPS Pipeline Applications into Grid Applications,” was written and distributed to members of WIYN and PTI.

1.3.3 System Community Development

Program Highlights

The ReSTAR committee held two telecons and requested material to support their upcoming meeting, which is aimed at providing an update to their original report and recommendations for priorities in the second phase of NOAO’s ReSTAR program. This material, including reports on telescope oversubscription rates and status and plans for instrumentation at a number of facilities in the 2- to 5-m aperture range, has been collected in preparation for their meeting in mid-July.

A review of the NOAO Survey Program was organized and will take place in July.

LSST Science

Members of the NOAO LSST Science Working Group continued a previous discussion of an end-to-end LSST simulation experiment. The focus was on the software infrastructure necessary to characterize and distribute events discovered by time-domain surveys. This led to a proposal submitted to the NSF Software Infrastructure for Sustained Innovation program that would enable the development of a software tool to process time-domain alerts. The goal is for this tool to act as a broker for time-domain events that will aggregate information from time-domain surveys and existing databases, characterize the distinguishing elements of the events, provide an interface for humans and machines to select interesting events, and generate an objective estimate of the follow-up capacity necessary for time-domain surveys.

NSSC staff reduced the spectroscopic data from the KPNO 2.1-m telescope that were taken during calibration tests in coordination with the Calypto telescope in January and February 2010 as part of the ongoing support of LSST calibration programs.

GSMT/ELT Science

During this quarter, no GSMT-related science activities took place.

Optical Interferometry Science

NOAO staff worked with the chairs of the SPIE conference “Optical and IR Interferometry” to organize a 90-minute special session on interferometry and the community, with workshop-format discussion of international planning, future meetings, and the development of interferometric imaging. NOAO also worked through the International Astronomical Union Commission 54, Optical and Infrared Interferometry; the Mount Wilson Institute; and the Observatoire de la Cote d’Azur to introduce two new prizes: the Michelson Prize and the Fizeau Prize. These prizes are offered with the intent to “provide recognition within the interferometry community, as well as in the broader science community...and to assist...with engaging the community in promoting the future of optical interferometry.” In June, the first Fizeau Prize was awarded to Professor Antoine Labeyrie and the first Michelson Prize was awarded to Dr Michael Shao, in each case, for lifetime contributions to the field.

There was continued planning with New Mexico Tech for a workshop on “Science with Optical Interferometry.” A Science Organizing Committee was formed, in part, from volunteers responding to an open invitation in the NOAO electronic newsletter Currents.
**Status of FY10 Milestones**

- Undertake a study of the NOAO Survey Program, with the intent of recommending changes that would improve its effectiveness at providing useful data sets to the community. Based on these recommendations implement changes in the survey program before the next call for proposals.

  **Status:** The review will take place at NOAO North in July 2010.

- Establish channels of communication with existing optical interferometry organizations and work with them to prepare for stronger visitor programs.

  **Status:** Facility-community liaison activities continued through the SPIE conference and planning for a “Science with Optical Interferometry” workshop to be held in 2011.

### 1.4 NOAO SYSTEM TECHNOLOGY CENTER

#### 1.4.1 System Instrumentation

**Program Highlights**

System Instrumentation (SI) supported the successful integration, test, and recommissioning of the NEWFIRM wide-field infrared imager at the Blanco 4-m telescope on Cerro Tololo. SI staff oversaw the unpacking and reassembly of the instrument; led the change of filters in the cryogenic filter wheel; integrated the instrument observation control software with the CTIO telescope control system; and provided in-depth training to CTIO staff on routine maintenance, support, and troubleshooting. At the end of this quarter, NEWFIRM was in regular scientific use by scheduled observers.

**Status of FY10 Milestones**

- MONSOON development: complete successful Production Readiness Review for the miniaturized, energy-efficient TORRENT version.

  **Status:** Progressing. The Production Readiness Review is scheduled for 20 August 2010.

- MONSOON development: complete a student engineering clinic project to design, develop, and test firmware implementing an ultra-low-noise CCD front-end for MONSOON-type controllers, in collaboration with students and faculty at Harvey Mudd College.

  **Status:** Completed. The student clinic team made a site visit to NOAO offices in Tucson beginning 10 May 2010 to test and demonstrate their firmware running on a modified prototype CCD acquisition board in one of NOAO’s TORRENT prototype controllers. The demonstration successfully proved the concept of noise reduction through statistical oversampling. The team also enjoyed an evening visit to Kitt Peak to see the start of a night’s observing and watch CCD controllers in scientific use. The final report from the clinic project was delivered on 1 June 2010.
1.4.2  ReSTAR Instrumentation

Program Highlights
A careful review of workload and available resources at NOAO South led to a decision to defer further work on the detector and controller upgrade for the CTIO-Hydra spectrograph until after the majority of work for integration of the Dark Energy Camera (DECam) is completed. The high workloads associated with completing and commissioning the SOAR Adaptive Optics Module (SAM) and integrating the DECam will consume all available personnel during the period originally planned for the work on the CTIO-Hydra upgrade. Given the very high institutional priorities assigned to SAM and DECam, the decision was made to defer work on the CTIO-Hydra upgrade.

Status of FY10 Milestones

- KOSMOS: complete a successful Critical Design Review.
  Status: Progressing. The Design review is scheduled for 2–3 August 2010 in Columbus, Ohio.

- Mosaic-1 CCD and Controller Upgrade: purchase new CCDs and integrate with TORRENT controllers, to be ready for commissioning early in FY11.
  Status: Progressing, but suffered a technical setback. The new CCDs were received from the vendor in the prior quarter. During testing of the devices in Tucson, one of the science-grade CCDs was severely damaged while being installed in the test dewar. After a scientific and programmatic review on the impact of using the spare engineering device in Mosaic I, it was decided to purchase a replacement CCD. This order has been made with the vendor.

- CTIO-Hydra CCD and Controller Upgrade: complete a successful Design Review for the planned upgrade.
  Status: Deferred. Due to the higher priority and heavy workloads associated with SAM and DECam, further work on this upgrade has been deferred until early in FY12.

1.4.3  Telescope System Instrumentation Program

Program Highlights
NOAO continued its oversight of the ongoing Telescope System Instrumentation Program (TSIP) projects:

- Keck Multi-Object Spectrograph for Infrared Exploration (MOSFIRE),
- Keck Next-Generation Adaptive Optics (NGAO),
- Large Binocular Telescope Multi-Object Double Spectrograph (MODS),
- Magellan Adaptive Secondary Mirror,
- MMT System Access, and
- WIYN One Degree Imager (ODI).

Contract negotiations were completed with Keck for new sub-awards for NGAO and the Keck Cosmic Web Imager (KCWI). In addition, Memoranda of Understanding (MOU) were executed between NOAO and Keck and NOAO and Carnegie for the new programs that specify the number and timing of nights to be allocated to the community as well as the award amounts in each case.
The FY10 call for proposals was made in April and NOAO received five letters of intent for new system improvement projects. Full proposals are due in September 2010.

Mark Trueblood and David Sprayberry attended the NGAO Preliminary Design Review in June in California.

**Status of FY10 Milestones**

- Complete an external review of FY09 TSIP proposals and negotiate sub-awards with successful proposers.
  
  **Status:** Completed. Contracts are in place for all new awards.

- Organize a call for proposals for FY10 and hold a review.
  
  **Status:** A call for proposals was made and letters of intent were due June 30. NOAO received five letters of intent for FY10 proposals (due in September 2010).

- Conclude the remaining sub-awards under AODP and close out the program.
  
  **Status:** C33002T, CARA: The vendor was granted another no-cost extension through 31 March 2011 to give contingency time on their planned wafer run.

  C33003T, LLNL: The final report was received from LLNL in April; the contract was closed.

  C33005T, LMCT: The revised version of the final report was received on April 5 and accepted by NOAO a couple of days later. The final invoice was received in early May and paid in the normal process. The contract was closed.

### 1.4.4 LSST Technology Program

**Program Highlights**

Support of the LSST project continued this quarter with very good progress. The technical effort was focused on the Architectural and Engineering Services for the Summit Facility, initiation of contractor activities, the detailed interface requirements for the summit facility, and the finishing of many subsystem preliminary designs. Prototype testing led to the initial selection of mirror support hardware.

A significant effort also was applied to the publishing of many technical manuscripts for the SPIE Large Telescopes Conference in San Diego, which was held the last week of June. The following papers were submitted to the conference:

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Number</th>
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</thead>
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<tr>
<td>LSST Primary / Tertiary Mirror Thermal Control System</td>
<td>D. Neill</td>
<td>AS10-AS103-149</td>
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<tr>
<td>LSST Telescope Primary / Tertiary Mirror Cell Assembly</td>
<td>D. Neill</td>
<td>AS10-AS103-150</td>
</tr>
<tr>
<td>LSST Telescope Mount &amp; Pier Design Overview</td>
<td>D. Neill</td>
<td>AS10-AS103-151</td>
</tr>
<tr>
<td>The Large Synoptic Survey Telescope Preliminary Design</td>
<td>V. Krabbendam</td>
<td>AS10-AS103-196</td>
</tr>
<tr>
<td>LSST Telescope Guider Loop Requirements Analysis, and Predicted Performance</td>
<td>M. Warner</td>
<td>AS10-AS103-215</td>
</tr>
<tr>
<td>LSST All-Sky IR Camera Cloud Monitoring Test Results</td>
<td>J. Sebag</td>
<td>AS10-AS103-27</td>
</tr>
<tr>
<td>The Large Synoptic Survey Telescope OCS and TCS Models</td>
<td>G. Schumacher</td>
<td>AS10-AS108-50</td>
</tr>
</tbody>
</table>
Status of FY10 Milestones

- Site and Facility: upon delivery, install and test the updated IR all-sky camera

  **Status:** The updated infrared (IR) all-sky camera (ASIVA) was received after a successful final acceptance test at the vendor facility. The camera was installed for a temporary commissioning run at the Calypso telescope where comparisons with optical imaging were started.

- Site and Facility: complete the site and building CFD analysis to support the facility A&E effort

  **Status:** An updated model of the facility was completed and new baseline runs show consistent performance to early concept models. The effort will now focus on parametric studies to guide the facility design decisions.

- Dome: complete the initial Dome-Facility Interface Control Document.

  **Status:** During this period the Dome-Facility interface design was updated to provide load and dimensional detail for the facility designers. The facility interface continues to allow some flexibility in the final dome design details, but gives the facility designers the necessary interface information.

- Reflective Optics: collaborate with the LSST primary mirror vendor to evaluate the front surface optical processing readiness

  **Status:** During this period NOAO supported a biannual review of the primary mirror optical fabrication status, which included a metrology design review. Both surfaces of the M1M3 mirror were generated, and the mirror continues to progress on schedule. The metrology design continues to mature but is not yet completed. NOAO and the University of Arizona continue to discuss the details of the design, focusing on proven approaches and redundant measurements.

  Late in this period (June 24), during preparation for the final front surface edge operation, a mishap occurred where the LOG spindle contacted the glass, puncturing a hole in the front faceplate. The damage is localized to a region roughly 5 centimeters in diameter which represents approximately 0.01% of the tertiary mirror area. The fractures are being stabilized. A full repair plan is being developed but the damage is expected to be repaired by plugging the hole with similar methods that have been used in the past on other large mirrors. Once repaired, the normal mirror front surface processing will resume with loose abrasive grinding and polishing.

- Primary Mirror: continue the prototype testing and design work for the primary and secondary mirror support hardware.

  **Status:** The electro-mechanical primary mirror axial actuator was assembled this period and testing begun. The pneumatic cylinder tests for the baseline axial actuator design led to the...
selection of a primary candidate, and the testing of the pneumatic valves also led to the selection of a baseline model.

- **WFS Alignment and Calibration**: operate LSST telescope assets to conduct calibration validation experiments
  
  **Status**: The Calypso telescope operation continued this period. The LSST 4K × 4K camera was removed temporarily for a few minor adjustments and reinstalled. The new Y3 and Y4 filters were delivered by the Large Synoptic Survey Telescope Corporation’s (LSSTC’s) partner, SLAC National Accelerator Center, and installed. Testing was completed to commission the camera, determine its detailed operating characteristics, and measure the calibration characteristics of the two different Y filters. The observing run late in this period compared the optical imaging results with a co-pointed IR camera and the new ASIVA all sky camera. Data reduction will follow.

- **WFS Alignment and Calibration**: complete designs for prototype calibration screen projectors and consult on the development and testing completed by LSST
  
  **Status**: Additional scaled down designs that use smaller, off-the-shelf optics for two versions of a projection system were completed this period, and the hardware for the prototype testing was acquired. The hardware is being assembled at LSSTC’s partner and collaborator, Harvard University, to further test and evaluate the components and design performance.

- **WFS Alignment and Calibration**: continue the AOS curvature algorithm development and reconstruction algorithm testing
  
  **Status**: On May 12 and 13, a Wavefront Sensing and Reconstruction workshop was held at Purdue University. This successful meeting was organized to review the progress of various design and testing efforts throughout the LSST project, organize plans to continue development, and explore new collaborations with the Purdue Team.

- **Utility Systems**: develop the detailed designs for the telescope system electronics layout and the summit facility electrical distribution.
  
  **Status**: The detailed analysis of the AURA electrical power distribution system reported on last period was presented to AURA, CTIO, Gemini, and SOAR representatives at meetings in La Serena on May 25. Additionally, the details of the plan and the existing constraints were discussed with the architect and engineering firm.

- **System Engineering**: develop and implement the hazard analysis process
  
  **Status**: During this period, a draft Hazard Analysis Process was developed for use in the project. It follows standard Military Specification approaches and processes used at other LSST partner institutions working within the Department of Energy complex. Tools to implement the process were evaluated, and biweekly Hazard meetings have been started to initiate the process and refine the plan.

- **System Engineering**: complete the first phase of telescope system modeling in SysML
  
  **Status**: Members of the Telescope and Site Team participated in an LSST Systems Engineering meeting held on April 20–23 at SLAC to review the development of the SysML model and the plans for completion.
1.4.5 GSMT/ELT Technology Program

Program Highlights

NOAO staff continued to monitor progress on the two US-based extremely large telescope (ELT) projects, the Thirty Meter Telescope (TMT) and the Giant Magellan Telescope (GMT). They attended project meetings and reviews (by invitation), as well as the June 2010 SPIE conference on astronomical telescopes and instrumentation in San Diego, where the two projects presented many papers.

Status of FY10 Milestones

- Prepare a technology development action plan in response to Astro2010 recommendations on GSMT.
  
  *Status*: On hold until the Astro2010 report is made public later in the year.

- Complete the close-out of the site survey in Chile.
  
  *Status*: One set of test equipment is on loan to LSST. Close-out of site testing will occur once LSST no longer needs the equipment; at that time the equipment will be inspected, maintained, and returned to TMT.
2 NOAO-WIDE PROGRAMS

2.1 CENTRAL ADMINISTRATIVE SERVICES

Program Highlights

A review of the workload and staffing needs of CAS resulted in the creation of and hiring for one new position, an Accounting Specialist. This was necessitated after NOAO negotiated an MOU with Gemini Observatory to assume responsibility for Gemini’s payroll processing. As a result of the additional workload, an additional position was required to cover accounts payable duties previously performed by payroll staff.

Progress toward the integration of AURA Observatory Support Services (AOSS) into NOAO South was achieved when the NOAO South Head Accountant spent two weeks in Tucson working on accounting software integration.

Working with representatives from AURA Corporate and the Large Synoptic Survey Telescope Corporation (LSSTC), CAS managers reviewed and assisted in drafting a revised Business Service Agreement between AURA/NOAO and LSSTC. The final document was forwarded to NSF for review and approval. CAS managers assisted National Solar Observatory/Advanced Technology Solar Telescope (ATST) staff in compiling data for a Defense Contract Audit Agency (DCAA) review of the ATST construction proposal. The review is being conducted by DCAA at the request of NSF. CAS staff spent one week with a DCAA auditor covering the accounting systems review portion of the audit.

As illustrated in the chart below, the average monthly exchange rate of the US dollar relative to the Chilean peso increased during the third quarter. The FY10 Program Plan assumes an exchange rate of 500, while the average rate by the end of this quarter was approximately 520. Below is a one-year chart showing the exchange rate trend.

Status of FY10 Milestones

- CAS will review and upgrade procedures by expanding its current electronic manual to a full Web-based, CAS-wide procedural manual, thus meeting the demands due to increased
regulations, the new cooperative agreement (effective 1 October 2009) provisions, integration of AOSS, and providing Web-accessible information.

**Status:** The review and upgrade of procedural manuals began in this quarter and will continue through the remainder of the fiscal year.

- CAS Business IT will focus on making revisions to the newly created Web-based budget system (WEBUD), the new AURA–wide Web-based human resources and payroll system (UltiPro), as well as expanding the current requisition system (Reqless), the grants management system, and document storage systems. This will be especially important as CTIO reintegrates the observatory services support operations formally known as AOSS.

  **Status:** A revised version of WEBUD was released for use in preliminary planning for the FY11 budget. New modules for Reqless were released: Travel Requests and Shipping Memos. Work continued on the integration of AOSS accounting systems with the North. A revised version of Reqless is being prepared for use by NOAO South Administration.

- CASNET (Central Administrative Services Network interface) will be expanded to develop additional, customized, user-friendly management reports that mirror the new NOAO structure and work packages.

  **Status:** Programming for the requested changes was started and will continue through the remainder of the fiscal year.

- Human Resources will focus on training and development of information support networks to improve the climate, culture, and overall workforce productivity. These activities will include formal training workshops, Webinars, informational Web pages, and updating and clarifying our current processes and procedures in order to make them more accessible and user friendly.

  **Status:** The process of identifying training curriculum and vendors continues. AURA Anti-Harassment Web-based training was rolled out this quarter and over 80% of employees have completed the program. Senior Management participated in a one-day leadership program. A review of current processes and procedures continues.

- General Administration and Accounting will continue to work with NOAO South operations to develop a streamlined cross-NOAO accounting and reporting system. Property reporting, tracking, and disposal operations have been transferred to Central Facilities Operations allowing for integration of operations between NOAO North and South.

  **Status:** Members of both North and South staffs visited each other’s sites to coordinate the transition. New hardware and software for NOAO South Administration were ordered. Once delivered, CAS staff will configure the new system and ship to CTIO

2.2 OFFICE OF SCIENCE

**Program Highlights**

The Office of Science (OS) continued to support and encourage research by the NOAO scientific staff by providing resources (e.g., equipment and funding) and supporting programs (e.g., colloquia, science workshops, and coffees) that foster a scientifically productive environment. The OS also continued to support and encourage research by the US community of astronomers through the NOAO Time Allocation process.
During this reporting period (1 May 2010), Joan Najita took over from the retiring George Jacoby as the Head of the OS.

### Status of FY10 Milestones

- **Initiate a new mentoring program for staff career development.**

  **Status:** Various career development models used in business, undergraduate colleges, and in other contexts were reviewed. A new model is being developed for NOAO in order to address the issues and concerns that arise in a scientific research and service organization such as NOAO. This new model will be tested this fall.

- **Recruit a Goldberg Fellow postdoc for an FY11 start.**

  **Status:** Many excellent applications were received, but, ultimately, the search was unsuccessful in attracting the top candidates to NOAO. A new committee was formed, and the search will be renewed this fall.

### 2.3 EDUCATION AND PUBLIC OUTREACH

#### Program Highlights

NOAO Education and Public Outreach (EPO) staff and undergraduate EPO students supported 35 local and regional outreach events in this quarter. This included five dark skies educational sessions with an average of 50 fourth- to eighth-grade students per session, held at the Cooper Center for Environmental Learning. Classroom visits included Baboquivari High School in Topawa, an Earth Camp session on Dark Skies Rangers activities at the Arizona-Sonora Desert Museum (ASDM), and a videoconference between Chilean and Tucson students on results from GLOBE at Night and their school outdoor lighting audit.

The EPO students and staff supported several telescope viewing events for the Tohono O’odham on Kitt Peak. These included Schuk Toak Day, an event for a Baboquivari High School class, two Youth Group Overnights, and Horse Camp. There were also Project ASTRO activities at an astronomy camp at the Sells Recreation Center and at the “Truck of Love” camp in Pisinemo. EPO students prepared and led two weekly Boys & Girls Club sessions on astronomy at the Jim and Vicki Click Clubhouse in South Tucson, as well as three sessions on optics. The students and staff conducted Project ASTRO-type activities, often including telescope viewing, at events for Yuri’s Night, Whipple Observatory, Mission View Elementary School, Ventana Vista Elementary School, Astro Day at the University of Arizona (UA), “Sun Day” on the UA campus, and the ASDM Family Night.

Galileoscopes were built by 27 fourth-to sixth-grade students and 16 older students from the UA Native American Science and Engineering Program in late June. The EPO students and staff worked with fourth-grade students on astronomy activities during career day in May at a school in Sahuarita and assisted with an Educators’ Fair in disseminating informational materials on NOAO EPO programs.

### Public Outreach Information Requests & Inquiries

(3 months ending 6/30/10)

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<thead>
<tr>
<th>Type/Origin of Request</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information requests/inquiries about astronomy/science (phone calls, e-mails, and walk-ins/requests for posters, bookmarks, brochures, etc.)</td>
<td>92</td>
</tr>
<tr>
<td>Requests and inquiries for use of NOAO images</td>
<td>220</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>312</strong></td>
</tr>
</tbody>
</table>
The AstroBITS project, a teacher education program funded by Science Foundation Arizona, developed an NOAO Web page with the online course material. Teachers must complete a pre-course technical assignment, found at www.noao.edu/education/astrobits/bits-course.php. If they are able to handle the computer requirement, they are invited into the course, found at www.noao.edu/education/astrobits/course-outline.php. The online class has been completed by two cohorts of teachers. The most recent class was held in April and May, while a third class began in June with 12 teachers enrolled. The course will be presented in a poster at the Astronomical Society of the Pacific meeting in August.

Tohono O’odham outreach is a critical part of the EPO mission. There have been an increasing number of requests from school groups from the Tohono O’odham Nation to visit Kitt Peak. EPO was requested to provide, on relatively short notice, a week-long astronomy camp at the Sells Recreation Center. EPO staff publicized the camp, which included inserting a colorful ad in the Nation’s local newspaper, The Runner, producing flyers that were distributed by Kitt Peak and Recreation Center staff, and providing announcements to the local radio station. The program was led by EPO and UA staff and consisted of four mornings of activities, a community star party, and a trip to Kitt Peak for a daytime tour. The camp was only possible with the help of several of the NOAO EPO student workers. Every morning 20 to 30 children, most between the ages of six and eight, were treated to a different theme: the Sun, the planets, the meteors and comets, and the moon formed the week’s emphasis. The many activities included using a solar oven to cook apples, investigating ultraviolet beads, launching water rockets, making a dry ice comet, using moon balls to model lunar phases, and looking at the daytime moon. NOAO was asked to repeat a program like this in the fall.

The NOAO EPO group hired two additional students at the end of May 2010 and started a five-day training session for the entire cadre of NOAO EPO students. The students were trained on activities for Boys & Girls Clubs, using a Galileoscope and larger outreach telescopes, teaching dark skies activities, building teaching kits, managing the kit storeroom, and the history of Kitt Peak and the Tohono O’odham. The EPO Student Cadre is composed of undergraduate students with two majoring in astronomy and physics, one in optical sciences, one in aerospace engineering, one in chemical engineering, and one in science education at the UA. The majority of the students are female.

Dark skies awareness programs are being conducted locally in collaboration with the Tucson Unified School District’s Cooper Center for Environmental Learning. An EPO staff member wrote an article in the May 2010 issue of Sky and Telescope on the successful outcomes of the Dark Skies Awareness programs for the International Year of Astronomy. Other activities included an interview about GLOBE at Night on radio station WAMU, an invited talk on the future of dark skies education at the joint Astronomical League and International Dark-Sky Association (IDA) conference, a chapter on dark skies education for an IDA book, and chairing the IDA education committee. Project work was begun with an student in the KPNO Research Experiences for Undergraduates program who is using GLOBE at Night data to research the affect of light pollution on bats. Tutorial videos are being created on the Dark Skies Rangers activities. A paper on approaches to dark skies education was accepted for the SPIE-San Diego meeting in August.

An international videoconference was held with Tucson sixth- and seventh-grade classes and middle school students from four schools in Chile: Colegio Algarrobito, Colegio San Francisco de Borja, Colegio Manantiales de Elqui, and Colegio Raul Silva Henriquez. The Tucson students reported on an outdoor lighting audit of their school, calculating the cost and energy expended before and after changing to economical, energy-saving bulbs. The Chilean students presented their results from the citizen-science dark skies campaign, GLOBE at Night.

The Hands-On Optics Arizona program (funded by Science Foundation Arizona) held training programs at the Boys & Girls Club in Bisbee; Discovery Park at Safford, Arizona; the Boys & Girls
Club of Yuma, the Safford Boys & Girls Club, and Lowell Observatory. The Hands-On Optics programs are continuing at the Tucson Boys & Girls Club. Sessions were held at the club every Friday in the spring of 2010 and the summer 2010 program started June 11.

EPO staff are developing a “Teaching With Telescopes” Web site (teachingwithtelescopes.org) to support teaching with the Galileoscope. This NOAO Web site will provide support for Galileoscope users in Arizona and around the country. The Web site contains resources for teachers to learn how to build and use the Galileoscope, teach optics with the Galileoscope, and host observing sessions and star parties. Teachers can download a free teacher’s guide and observing guide for the Galileoscope. Links are provided to the best Galileoscope materials developed by other groups as well. The Adaptive Optics Module underwent additional classroom testing this quarter and was revised. A paper on the adaptive optics program was accepted for the SPIE-San Diego meeting in August.

The NOAO optics test tower will be decorated with information banners in July. Three banners were designed during this quarter to showcase NOAO. The banners represent both hemispheres of NOAO, with one banner showing the Kitt Peak Mayall 4-m telescope, the second showing the CTIO Blanco 4-m telescope, and the third banner with the text “Discover your Universe, discover Kitt Peak” to highlight visiting Kitt Peak. The banner rigging system was installed and the banners will be installed in July 2010.

An EPO staff member continued as the NOAO Co-diversity Advocate with activities that included proposing and organizing a special interest group on the subject of broadening diversity for the summer meeting of the Astronomical Society of the Pacific.

Media Releases

During this quarter, nine new images related to the 50th anniversary of the National Observatory and to NEWFIRM new science were posted on the NOAO home page. NOAO issued a media release on 19 May 2010 titled “Unique Eclipsing Binary Star System Discovered by UCSB/NOAO Team.”

Status of FY10 Milestones

- Lead national efforts related to the International Year of Astronomy (IYA), particularly program coordination with the American Astronomical Society (AAS), Astronomical Society of the Pacific (ASP), and the Association of Science-Technology Centers (ASTC). Take full advantage of related IYA opportunities in Chile.

  Status: Completed. IYA2009 was a great success with two cornerstone programs led by NOAO (Dark Skies Education and Galileoscope). NOAO also led the coordinating project office. The Galileoscope Project received the Mani Bhaumik Prize for Excellence in Astronomy Education and Public Outreach Second Runner-Up award.

- Provide support to programs related to maximizing the educational value of the Galileoscope telescope kit (with over 100,000 Galileoscopes now in circulation) and related optics education.

  Status: Activities were conducted with the AAS for donation of 15,000 Galileoscopes to teachers. About two thirds of these telescopes have been distributed to Project ASTRO sites and to teacher professional development leaders at the National Earth Science Teachers Association. NOAO created a “Teaching With Telescopes” support Web site and revised the observing guide for the Galileoscope. NOAO conducted a large number of local, regional, and national workshops to train EPO leaders, museum educators, and teachers how to use the Galileoscopes in a variety of educational settings.
• Create a wide-ranging, dark skies awareness program for southern Arizona and Chile. Provide support to the IYA Dark Skies Education program developed at NOAO.

**Status:** A very active program was conducted at the Cooper Center for Environmental Learning in Tucson and by CTIO and Centro de Apoyo a la Didáctica de la Astronomía in Chile. The GLOBE at Night Program was moved to NOAO and remains an exemplary citizen science program.

• Assist in NOAO’s overall celebration of the 50th anniversary of Kitt Peak National Observatory, in concert with the Tohono O’odham Nation and other interested stakeholders.

**Status:** Completed. EPO personnel played a key role in the planning and execution of the anniversary celebration and in the high level of involvement of the Tohono O’odham Nation.

• Successfully conclude the “Astronomy From the Ground Up” program, training educators at hundreds of small science and nature centers.

**Status:** The NOAO role was successfully carried out. Due to a no-cost extension, the program will continue for a few more months. Work continues to provide a sensible level of long-term support to the over 300 small, science and nature centers in the project.

• Assist in the transition of the very successful joint NOAO/NASA Spitzer Teacher and Student Research program into a new program, the NASA IPAC Teacher Archive Research Program (NITARP)

**Status:** Completed.

• Continue to grow outreach activity and programs with the Tohono O’odham, including participation in Kitt Peak Astronomy Camps.

**Status:** Programs have been offered whenever requested by the schools and other organizations on the Tohono O’odham Nation, and activities have been suggested that might interest them. Working with the Kitt Peak Visitor Center, EPO facilitated three youth group overnight stays at Kitt Peak involving middle and high school students. One of these resulted from an EPO visit to the Baboquivari High School Math, Engineering, and Science Achievement club, another was requested by a teacher who participated in the AstroBITS program. There were two Head Start group daytime visits to Kitt Peak. Since the beginning astronomy camp is not returning to Kitt Peak this summer, recruiting for it has been difficult, although a Tohono O’odham student who attended last year will be a returning camper, with an NOAO scholarship. There seems to be interest on the part of other Tohono O’odham students in attending astronomy camp, but the challenge is to get students and their parents to complete the necessary application. A full week’s program was conducted for K-6 students, including a community star party.

• Continue our support for Hands-On Optics teaching centers in Arizona (and across the nation as funding permits) established under the original NSF informal science grant.

**Status:** The Hands-On Optics (HOO) teaching centers in Arizona (supported by Science Foundation Arizona) are being run successfully. EPO continues at a minimal level of support for HOO sites nationally. EPO is merging the HOO national support effort with the Teaching With Telescopes program to support key parts of HOO (especially Module 3 on Telescopes).

• Create a cohesive vision and strategic plan for CTIO outreach and the Centro de Apoyo a la Didáctica de la Astronomía (CADIAS) astronomy teaching center in Chile.
**Status:** The NOAO EPO manager visited CTIO in June to improve coordination and conduct strategic planning. Work continues to create memoranda of understanding with the public tourist observatories near CTIO. The EPO review committee had the highest praise for the NOAO South education effort, including their overall productivity, vision, direction, and integration with their communities.

### 2.4 NOAO DIRECTOR’S OFFICE

**Program Highlights**

The NOAO Director’s Office (NDO) appointed Dr. Abi Saha as the interim NOAO Associate Director of KPNO in place of Dr. Buell Jannuzi who resigned his directorship during this quarter. An international search for a new associate director for KPNO was initiated in coordination with the AURA Observatory Council.

The NDO organized the annual external review of the NOAO Education and Public Outreach (EPO) program, as required by Cooperative Agreement AST-0809409. The committee’s report was forwarded to NSF for their information. NDO also organized and held the annual NOAO User’s Committee meeting. That report also will be forwarded to NSF when completed.

The director and deputy director of NOAO participated in the semi-annual, face-to-face WIYN Board of Directors (BOD) meeting, the annual AURA member representatives meeting, and the semi-annual NSF NOAO Program Review Panel (PRP) meeting. They also attended the summer AAS meeting in Miami. The director participated in the semi-annual face-to-face meeting of the LSST BOD as well as the April AURA BOD meeting (there are three AURA BOD meetings per year). The director also visited NSF headquarters for his annual mid-year presentation and discussion with the Astronomy Division.

The director attended the SPIE symposium on astronomical telescopes and instrumentation. As part of that symposium, the director co-organized the three-day conference, “Observatory Operations: Strategies, Processes, and Systems, III.”

**Status of FY10 Milestones**

- Deliver a revised Long-Range Plan by the end of the second quarter in FY10.
  
  **Status:** With permission of NSF Astronomy, the delivery deadline was extended to mid-July 2010. In progress.

- With the associate director of Administration and Facilities, develop a training program for the NOAO senior management team.
  
  **Status:** Arrangements were made for a workshop on coaching, mentoring, and team building to be held in July 2010.

- Commission an internal review of the entire NOAO complement of engineering and technical staff and then re-assess head counts and skill mix needed to support mountain operations as well as future technology development activities.
  
  **Status:** The internal review was completed by the Head of the NOAO Science Technology Center during this quarter. The collected data are being analyzed and used for resource planning across NOAO for FY11 and beyond.
• 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: On-going. For specific activities, see section 2.7.

2.5 ARRA INFRASTRUCTURE RENEWAL

Program Highlights
Good progress continued to be made on the projects in Chile and Arizona funded by the American Reinvestment and Recovery Act of 2009 (ARRA). Most major capital purchases have been made or orders placed, and planning is proceeding on larger projects.

Status of FY10 Milestones

• Complete the design specifications and request for proposals to perform the work required to complete the major sub-contracted projects funded by the ARRA (see work package descriptions below).

Status: CTIO ARRA Projects (Year 1): Helium lines and compressors have been installed in the Blanco Coudé room as part of the project to convert it into an instrument handling facility. The new facility was used to prepare NEWFIRM for use on the Blanco 4-m telescope in June.

Preliminary planning on the Cerro Pachón dinning/kitchen facility was begun, including some conceptual layouts. Architectural and engineering drawings and technical specifications were completed, and a Request for Proposal is in progress.

KPNO ARRA Projects (Year 1): KPNO Water System Renovation: the contract for engineering design work was established with a local environmental engineering firm. They completed a general facility review and are working on renovation plans for sub-contracting efforts. KPNO Instrument Handling Facility: the preferred site was established, and site survey documentation was completed. KPNO staff generated a scientific needs document with an initial floor plan, which is undergoing review.

Tucson ARRA Projects (Year 1): The Tucson computer room renovation: the renovation upgrade design was reviewed by a mechanical engineer, and contract documents are being finalized to obtain construction bids for renovation of the heating, ventilating, and air conditioning system. Tucson Electrical Distribution: an electrical engineering contract was issued for the design and contract document preparation. Preliminary reviews were completed, and bid documents are being prepared. Building Energy Management System: implementation specifications and drawings are being finalized and undergoing review.

• Initiate capital purchases under work packages [as described in the NOAO Annual Program Plan FY 2010], including vehicle replacement for La Serena, UPS and generators for Cerro Tololo and Cerro Pachón, and two CNC machines.

Status: CTIO ARRA Projects (Year 1): A UPS was ordered for the CTIO Blanco 4-m telescope, and a backup generator for the Cerro Pachón dormitory was purchased and delivered to Chile.
La Serena ARRA Projects (Year 1): A CNC machine was purchased for Chile. The CTIO operator obtained training in California for its use, and the machine is en route to Chile via Tucson. Vehicles were purchased and arrived in La Serena.

- Complete the Blanco coating chamber repair.
  
  **Status:** Pumps and control valves were purchased.

### 2.6 OFFICE OF COMPLIANCE

#### Program Highlights

The Office of Compliance continues to serve as the main administrative interface between NOAO and NSF on all matters related to compliance with federal directives. The Chief Compliance Officer (CCO) has high-level compliance oversight across all of NOAO with a focus on compliance with regulations at the federal, state, and local level. In conjunction with AURA Corporate Administration, the CCO is continuing to develop policies, procedures, and training for NOAO and other AURA Center staff.

During the third quarter, the Office of Compliance completed the first investigation and review of a possible conflict of interest and approved an acceptable management plan. The conflict was successfully managed. The conflict-of-interest policy and procedure was modified and will be incorporated into an AURA-wide policy in the fourth quarter of this fiscal year. Furthermore, the CCO developed a new Travel Per Diem policy to be implemented AURA-wide.

The CCO assisted with the audit of the NSO Advanced Technology Solar Telescope proposal by the Office of the Inspector General and the American Recovery and Reinvestment Act of 2009 (ARRA) reporting review, provided support and clarification for several sub-award compliance procedure issues, and provided assistance to AURA corporate on cooperative agreement issues.

In conjunction with policy and compliance representatives from the National Institutes of Health, NSF, NASA, and a major research university, the Chief Compliance Officer represented the NSF federally-funded research and development centers at the annual Western Section of the Society of Research Administrators Panel of Experts Forum in June 2010. Compliance questions from the research administration community were discussed and addressed.

After a successful procurement retreat, AURA established general procurement policies developed by the Office of Compliance. Specifically, a policy for the Professional Conduct and Business Ethics for Buyers was approved. Among other policies and training under development and revision are Travel Reimbursement Per Diem, Conflict of Interest for AURA Centers, and a Responsible Conduct for Research training.

#### Status of FY10 Milestones

- Revise and update the current conflict of interest policy and review current conflict resolution management plans to ensure compliance.

  **Status:** The conflict of interest policy was updated and is under review by AURA Corporate and the other AURA Centers. The policy will be incorporated into the new Web site after review by AURA Corporate Administration. A management plan for a current conflict was reviewed and approved during this quarter.

- Develop an NOAO/AURA Compliance Web site.
Status: A draft Web site was started and implementation will begin this summer. The site is expected to be operational by the end of this fiscal year.

- As assigned by the AURA vice president for administration, facilitate and plan a procurement staff training and policy retreat for all AURA Centers on federal cost and administrative circulars, grant administration, and allowable costs. In addition, arrange for a workshop by senior procurement staff to develop AURA policy standards for procurements and sub-contracts/sub-awards.

Status: The final draft of policies was circulated for final review by the AURA Centers.

- Review the new AURA cooperative agreement terms and conditions and work with the NSF contracts administrator to clarify any outstanding issues. Work with NOAO Central Administrative Services on defining clear policies and procedures for approvals, requests for funding, and proposal submissions to NSF.

Status: A review of policies and procedures for CAS is continuing.

- Monitor and ensure that ARRA compliance regulations, policies, and procedures are established and instituted. Monitor that quarterly reporting is timely and accepted by the federal Web site recovery.gov and NSF.

Status: The CCO serves in conjunction with the AURA vice president for administration as the institutional oversight for ARRA reporting. Three quarterly reports have been successfully submitted by NOAO, NSO, and ATST, and the next required report is due July 14. Compliance has been monitored, and issues, while minor, have been corrected and accepted by NSF and recovery.gov. A review of current projects is ongoing.

2.7 BROADENING PARTICIPATION

Program Highlights

The NOAO Diversity Co-advocates attended the AURA Annual meeting April 21–24. This included a report by the Chair of AURA Workforce and Diversity Committee (WDC) to AURA member representatives, meeting with other AURA Diversity Advocates (DAs), and discussions of numerous issues including possible contributions by AURA Centers, the election of Vanderbilt/Fisk as an AURA member, and possible Center internship programs.

The DAs produced a more detailed description of the possible implementation of an engineering/instrumentation internship in consultation with David Sprayberry (Head of System Instrumentation). This internship program would be designed to best match the needs and meet the mission of NOAO while encouraging participation of underrepresented minorities in the astronomy enterprise.

Status of FY10 Milestones


Status: The DAs participated in organizational telecons to discuss current activities and future strategies. This included receiving word of the acceptance of a January 2011 AAS Special
Session on “Strategies for Dealing with Harassment.” This session is jointly sponsored by the CSMA and CSWA, and an NOAO DA is the organizer.

- Promote awareness of the obstacles faced by women and underrepresented minorities through participation in and initiation of conferences and workshops.

  **Status:** An NOAO DA gave a talk at the University of Texas, Austin on her original research on “Women Giving Colloquia” in astronomy. The DAs continued planning, with the other AURA DAs, for workshops at the December AURA Workforce and Diversity Committee meeting on topics of interest in workplace diversity.

- Work with the NOAO Education and Public Outreach (EPO) staff on pipeline diversity issues, including Tohono O’odham outreach.

  **Status:** An NOAO DA sponsored several visits by schools from the Tohono O’odham Nation to the Kitt Peak National Observatory evening program and organized “astronomy week” at the Sells Recreation Center.
3 OBSERVING PROPOSAL STATISTICS FOR 2010B

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 2010B can be found as follows:

- **Request Statistics by Telescope:** [www.noao.edu/gateway/tac/obsreqs10b.html](http://www.noao.edu/gateway/tac/obsreqs10b.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, and subscription rates for new programs.

- **Request Statistics by Instrument:** [www.noao.edu/gateway/tac/inst10b.html](http://www.noao.edu/gateway/tac/inst10b.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>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>------</td>
<td>----------------</td>
</tr>
<tr>
<td>Apr 2010</td>
<td>126.38</td>
</tr>
<tr>
<td>May 2010</td>
<td>104.81</td>
</tr>
<tr>
<td>Jun 2010</td>
<td>16.64</td>
</tr>
<tr>
<td>Total:</td>
<td>247.83</td>
</tr>
</tbody>
</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>Tucson NOAO SkyNode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Apr 2010</td>
</tr>
<tr>
<td>May 2010</td>
</tr>
<tr>
<td>Jun 2010</td>
</tr>
<tr>
<td>Total:</td>
</tr>
</tbody>
</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>Portal Data Retrieval Activity (ftp)</th>
<th>NVO Portal Data Retrieval Activity</th>
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</thead>
<tbody>
<tr>
<td>Date</td>
<td>Bandwidth (GB)</td>
</tr>
<tr>
<td>------</td>
<td>----------------</td>
</tr>
<tr>
<td>Apr 2010</td>
<td>166.91</td>
</tr>
<tr>
<td>May 2010</td>
<td>188.08</td>
</tr>
<tr>
<td>Jun 2010</td>
<td>18.88</td>
</tr>
<tr>
<td>Total:</td>
<td>373.87</td>
</tr>
</tbody>
</table>
The following table lists the grants received by NOAO staff from non-NSF agencies during the third quarter of FY10.

<table>
<thead>
<tr>
<th>Principle Investigator</th>
<th>Awarding Agency</th>
<th>Title</th>
<th>Budget Amount</th>
<th>Period of Performance</th>
<th>Funding Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert Swaters</td>
<td>JPL</td>
<td>Star Formation in the Low Surface Brightness Gallery</td>
<td>$9,522</td>
<td>06/28/2010–09/30/2011</td>
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<tr>
<td>Greg Doppmann</td>
<td>NASA</td>
<td>Benchmarking the Evolutionary State of Young Stars with Photometric Observations</td>
<td>$14,000</td>
<td>1/1/2010–12/31/2012</td>
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<tr>
<td>Will Goble</td>
<td>Dartmouth College</td>
<td>Aluminizing Agreement</td>
<td>$10,000</td>
<td>4/26/2010–8/31/2010</td>
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</tr>
<tr>
<td>Will Goble</td>
<td>L3 Communications</td>
<td>Aluminizing M1, M2, M3</td>
<td>$31,000</td>
<td>6/11/2010–8/27/2010</td>
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</tr>
</tbody>
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