



# ARRA Infrastructure Improvements at the National Optical Astronomy Observatory

## Annual Project Report

## for

## August 2009 – July 2010

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# 1 OVERVIEW

This report covers progress in the first year of NOAO's NSF-funded three-year proposal to carry out infrastructure, and facility upgrades under the American Reinvestment and Recovery Act of 2009 (ARRA). The NOAO ARRA proposal covers four main sites: base facilities in La Serena and Tucson, and mountaintop facilities at Cerro Tololo Inter-American Observatory (CTIO) and Kitt Peak National Observatory (KPNO). The final proposal for NOAO totals $5.6M in high-priority projects and purchases.

## 1.1 KPNO Infrastructure Renewal

Among the high-priority projects proposed for Kitt Peak is the renovation of the water processing and distribution system that has been in use since the initial development of the National Observatory in 1960. This system provides all treatment, processing and distribution of potable water to all buildings and facilities on the mountain. These facilities include not only those directly operated by KPNO, but also the facilities of over 20 tenant observatories operated by more than 40 institutions. Tenants include the National Solar Observatory, MDM Observatory, Steward Observatory (University of Arizona, Arizona State University, and Northern Arizona University), and the WIYN Observatory. The processing system has not been modified since the original 1959 design and many components need to be modified or replaced to enable continued compliance with current Environmental Protection Agency (EPA) regulations for drinking water.

A modest, but important project planned for Kitt Peak is the replacement of the handicapped-access lift for the Kitt Peak Visitor Center public telescope. The Kitt Peak Visitor Center operates a very popular public observing program and has been able to accommodate handicapped individuals or those requiring a wheelchair through a dedicated access lift. The lift, which has been in use for over 10 years, has broken down several times in the past few years, resulting in temporarily stranded occupants. A modern lift with improved operation and updated lifting mechanisms will be installed to restore safe access for handicapped individuals, allowing everyone to observe through the telescope.

The growth in size, complexity, and cost of modern astronomical instruments presents a significant risk for the observatory when considering repeated travel between Kitt Peak and Tucson to perform maintenance and repair. To minimize potential instrument damage from transport, increasing the lifetime and on-sky use of the instruments, NOAO will construct a facility on Kitt Peak that will provide a safe location for repair and maintenance activities of our most modern operating or planned instruments, including the NOAO wide-field infrared imager NEWFIRM and the One Degree Imager (ODI) currently being built for the WIYN 3.5-m telescope. Both of these instruments require a large, clean space to properly and safely maintain them. ODI has large filters (approximately half a meter) and a focal plane array much larger than anything NOAO has supported in the past. Providing a facility near the telescope in which to service an instrument like ODI is critical to reducing the risk of damage by transport to Tucson.

The facility will be approximately 3,000 square feet, incorporate clean rooms (currently we anticipate two, but options exist for one large room pending final design review), and instrument testing areas. The facility will incorporate cranes for instrument movement and space for specialized tools and instrument support systems including the ability to cool and fully operate the instruments for testing of all functions. The cost of this facility is less than 10% of the total cost for ODI alone.

### 1.2 Tucson Base Facility Renewal

The NOAO proposal for infrastructure renewal in Tucson is about 30% of the amount proposed for Kitt Peak and includes key system replacement/upgrade of the main building electrical system components, energy management systems, and computer room. Demands on the computer room are growing significantly and include hardware to support operations in Chile for the community pipeline of the Dark Energy Camera (DECam) images.

### 1.3 CTIO Infrastructure Renewal

Not surprisingly, some of the same items slated for Kitt peak find a mirror at Cerro Tololo. A major project will be to renew the mountaintop water system. Built in 1976, this system is the source for all water for the observatory installations on both Cerro Tololo and Cerro Pachón. It consists of a deep-well pump, 4.6 kilometers of steel pipe, three pump stations for pumping a water column of 1,200 meters, six water storage tanks, a water treatment plant and chlorinator, a control system, and a pressurized tank for water distribution on the mountain. The proposed work involves replacement of the pumps and major maintenance and renovation of the storage tanks and pipes. This refurbished key infrastructure component will benefit all users of Tololo and Pachón, including those from Gemini, SOAR, and eventually LSST.

Another long-overdue project is the renovation of living space on Cerro Tololo. Cerro Tololo has three dormitory buildings: two for CTIO staff who work a *turno* of seven days on and seven days off, and one for visiting astronomers. One of the staff dormitories has been damaged by storms and is yet to be repaired. The other staff dormitory and the astronomer dormitory are in need of roof and other structural repairs. All three dormitories are in need of interior renovation; the furniture, carpet, and paint have not been replaced in many years, and much of the furniture dates back to the early 1970s. The proposed renovations will provide modern, comfortable living space and energy efficiencies that are important for the quality of the workplace environment for staff and visitors. The Tololo staff, in particular, spends significant time living on the mountain and greatly deserves these long-delayed refurbishments.

Cerro Tololo also has five houses that are used for longer-term project visitors, instrument teams, construction crews, and occasional visitor overflow from the dormitory buildings. At present, three of these houses are out of operation due to storm damage and aging structures, and the other two are in very poor condition. The proposed work includes repair and

renovation of the interiors, including paint, furniture, and appliances. These facilities will be in demand during the commissioning and operations of the Dark Energy Survey, as well as other larger surveys. The renovated space will be available for Gemini and the Large Synoptic Survey Telescope (LSST) instrument and commissioning teams as well.

Operations on Cerro Pachón are growing significantly with the advent of SOAR and Gemini and soon LSST. One project proposed to support this new operations base is a kitchen and dining facility. Currently, a temporary building near the summit serves meals on Cerro Pachón. This building is already used extensively by Gemini, SOAR, and NOAO staff and visitors. Staff typically eat in shifts due to the small amount of available space. With the expectation that the Pachón dining facilities will soon be used by LSST staff, a larger space is needed.

An instrument handling capability analogous to the one at KPNO is proposed for the Blanco 4-m Coudé room. Two new, large instruments will be coming to CTIO in the next two to three years: DECam and NEWFIRM, and two more may arrive soon thereafter (TripleSpec and COSMOS). The improvements will include a system of compressors and of distribution lines to provide high-pressure compressed helium as a working gas to cryocooler cold heads, off-telescope facilities in which the instruments can be operated and tested without interfering with telescope operations, cranes for handling heavy precision instruments both inside and outside of the clean room, ventilation and filtering for the Coudé room air to enable its use as a plenum for the clean room air-processing system. A clean room with excellent electrostatic characteristics, for testing and maintenance of the instruments, has been separately funded (i.e., apart from the ARRA proposal to the NSF) and is under construction in preparation for the arrival of DECam.

A series of upgrades to the observing and maintenance infrastructure at the Blanco are also proposed. These include an expansion of the computing and console room to handle new systems for DECam and NEWFIRM, a repair of the Blanco coating facility, and an upgrade to the Blanco cooling system.

## 1.4 La Serena Base Facility Renewal

A host of modernization, upgrade, and renovation projects are proposed for the facilities in La Serena. Like those for the Tucson facility, these represent a smaller total investment than on the Tololo mountaintop, about 20% of the amount proposed for Chile. A modest but important expansion to the CTIO shop facilities is proposed. This will add space and capacity that is needed to support activities at Gemini, SOAR, and LSST as well as Cerro Tololo. This expansion includes a new medium-sized milling machine.

Other proposed projects include renovation of the AURA *recinto* water system that supplies potable water to all the residents and staff working at Gemini, CTIO, and SOAR; lab equipment modernization and replacement; vehicle replacements for the 1990s era support vehicles; and security fencing.

# 2 CURRENT STATUS

**New Facility Engineer:** A dedicated NOAO North Stimulus Project Engineer (K. Foster) was hired and is working on both the NOAO Tucson and KPNO ARRA projects.

## 2.1 Tucson Infrastructure

**Upgrade Tucson shop CNC capability:** Project Completed. New "Hurco" CNC machine identified, purchased, installed, and placed into operation December 2009.

**Renovate computer room electrical, cooling and fire detection/suppression systems:** General planning and discussion activities are ongoing with affected computer-area staff. Testing was conducted within the area to evaluate current constraints on renovation efforts and the HVAC system changes are being developed. New fire suppression systems and potential generators are also being evaluated.

**Replace and renovate electrical supply/distribution equipment:** The "Engineering Design Scope of Work" was completed; a bid and contract are now in place with a local Engineering firm (Monrad). Meetings are ongoing with NOAO Tucson staff to identify and clarify power issues to finalize the design and prepare the construction documentation.

**Replace 15-year-old building energy management and control system:** Preliminary planning, research, and discussion activities are ongoing with facilities staff to incorporate the needs of the ongoing projects noted above. Documentation regarding design requirements is being assembled for preparation of bid documentation.

## 2.2 KPNO Infrastructure

**Handicapped access lift for Visitor Center public telescope:** Project Completed. The contracted installation effort has been completed by Abbey Elevator Co. The installation was inspected by a reviewing authority and certified for usage in mid April 2010. The new Handicapped Access Lift was released to the Visitor Center for routine usage.

**KPNO water system renovation:** The "Engineering Design Scope of Work" was completed, bid, and a contract put in place with an engineering firm (Environmental Engineering Consultants). Meetings are ongoing with NOAO North staff to identify and clarify the water system issues and develop treatment system design/modification requirements. The engineering firm submitted preliminary design documentation and conceptual costing for review by staff prior to the development of construction documentation. The engineering firm also is reviewing proposed EPA regulations to evaluate the impact on system design and operation.

**Kitt Peak instrument handling facility:** Various locations were evaluated within the Kitt Peak prime lease area, and a preferred site was identified. A site survey also was

completed to identify infrastructure requirements and design constraints. Usage planning, review, and discussion activities are ongoing with NOAO North staff to refine the project scope and begin development and clarification of construction requirements.

## 2.3 CTIO Mountain Infrastructure

**Pachón water system renovation:** Work in progress. Water pumps for ~US$25K were purchased but have not arrived yet. More components will be ordered soon.

**Dormitories repair & renovations:** A Request for Proposal for improving the dormitory heating system is in place.

**Pachón kitchen & dining facility:** A conceptual drawing is done. The preliminary design is in progress.

**Coudé room upgrades/handling new instrument:** All new equipment was purchased. Most of the components were received, installed, and are in use.

**Blanco 4-m computing room & console upgrade for DECam:** Purchases were identified that meet the requirements of NSF. The drawings for the building improvement are done; awaiting competitive bids to carry out the improvements.

**Blanco 4-m mirror coating chamber:** Some parts were purchased and arrived. Some remaining items were purchased, but others have yet to be ordered.

**Blanco 4-m entrance protection:** No work has been done. This work will be carried out together with the computing room & console upgrade.

**Blanco 4-m cooling system upgrade:** Planning is in progress, but no major purchases were made.

**Cerro Tololo UPS upgrade:** The uninterruptible power system (UPS) unit was ordered, but has not arrived yet; awaiting a firm quotation for spare parts.

**Mountain electronic laboratory equipment renewal:** Almost all of the items were received; only one order is outstanding.

**Cerro Pachón dorm emergency generator:** The generator was purchased; awaiting delivery and installation.

**Mountain meeting rooms renovation:** No work was done, but it will follow the computing room & console upgrade.

**Mountain road guardrail installation:** A proposal to move funding from this guardrail installation project to a project to repair the CTIO Frequency Converter (a critical

system that failed recently) and purchase a new stand-by generator has not been approved yet by the NSF.

### 2.4 La Serena Infrastructure

**Machine shop modification & refurbishment:** Preliminary design is in progress. No money has been spent yet.

**La Serena laboratory equipment renewal:** Almost all items have been received; the remaining items are to arrive soon.

**CNC milling machine:** Milling machine was purchased; awaiting delivery.

**OTDR unit:** The optical time domain reflectometer (OTDR) unit was purchased; this project is done.

**La Serena compound water system renovation:** No work has been done yet.

**La Serena meeting rooms renovation:** No work has been done yet; awaiting a decision on the location.

**Repair and renewal of security fencing for La Serena compound gate:** Relocation is in progress.

**Vehicle fleet renewal:** Identification of the vehicles to be replaced was completed. A quotation was received; awaiting a purchase order.

## 3 EXPENDITURES TO DATE

The following table provides a summary of the account, showing cumulative expenditures to date (March 31, 2010) and the total funds remaining.

**SPO-16 ARRA Annual Project Report**
**FY 2010 Expenditures to Date: August 1 through March 31, 2010**

| | Award Amount | Prior Expenses | Q3 Expenses Thru March | Total Expenses | Funds Available |
|---|---|---|---|---|---|
| CTIO El Totoral Facilities | 2,098,000 | 100,109 | 84,763 | 184,872 | 1,913,128 |
| CTIO La Serena Headquarters | 616,500 | 86,889 | 27,096 | 113,985 | 502,515 |
| Tucson Headquarters | 826,243 | 96,162 | 13,977 | 110,139 | 716,104 |
| Kitt Peak Facilities | 2,004,963 | 8,405 | 17,338 | 25,743 | 1,979,220 |
| AURA F&A | 54,294 | 4,749 | 2,320 | 7,069 | 47,225 |
| **Totals** | **5,600,000** | **296,314** | **145,494** | **441,808** | **5,158,192** |