The Renewal of CTIO

Alistair Walker

The NSF Senior Review recommended that Cerro Tololo Inter-American Observatory (CTIO) and Kitt Peak National Observatory (KPNO) attend to essential deferred maintenance issues, as well as modernize our telescopes, instruments, and plant so that operations for at least the next decade can be carried out efficiently and effectively. NOAO has responded to this recommendation by reprogramming of funds that will allow an early start to this process.

Longer-term plans are being developed, in the context of the forthcoming AURA Cooperative Agreement renewal proposal for the operation of NOAO from 2009-2013, and are designed to ensure the long-term effectiveness of the observatories. An essential component will be the restoration of a scientific and technical staff that can provide appropriate support and leadership. Accordingly, we intend to reverse the oft-noted decline in the capabilities of CTIO and KPNO over the last few years.

In this article, I report on some near-term improvements that will take place at CTIO. Many of these will not be immediately apparent to our users, but all are intended to be of direct benefit to observatory operations and ultimately should lead to improvement of the scientific usefulness of CTIO.

1. During 2005 and 2006, the SOAR telescope operation partners (NOAO, Brazil, the University of North Carolina, and Michigan State University) raised over $1,000,000 to fund various telescope and facility repairs. The most important of these was the replacement of the primary mirror passive lateral links by an active system so that the telescope could achieve the high-quality imaging expected of it. This repair was completed early this year, and was completely successful. Although NOAO made crucial contributions to the engineering design, testing, and installation of the new lateral links, it did not meet its financial obligations to the repair funds. In principle, this could have led to a redistribution of observing time between the partners, to the detriment of the NOAO user community. The financial obligation ($350,000) has now been met.

2. The SOAR Board has recommended that the partnership establish an operations reserve fund, which could be tapped in emergency situations. Thus, the partners were asked to contribute to this fund in proportion to their observing time shares. NOAO has now made its contribution to the reserve fund.

Credit: T. Abbott

3. CTIO keeps a good stock of spare parts for telescopes and instruments. Of course we hope that most of these will need to be used at very infrequent intervals. Some of these parts, particularly for the Blanco telescope and associated infrastructure, are difficult to obtain, and sometimes must be fabricated as special orders. Those that are critical to the operation of the telescope have been identified. We plan to purchase spares for the telescope drives and dome shutter drive so that we have these specialized parts on hand in case of breakdown.

4. The Blanco 4-meter telescope elevator control system is a marvel of 1960s-era electro-mechanics. It is of course regularly checked and maintained, and is in excellent condition, but it is now very out of date and parts are becoming difficult to locate. Replacement with a modern control system will increase reliability and simplify maintenance.

5. The Cerro Tololo telescope buildings and their surroundings are in many cases in need of refurbishment. These activities will begin later this year, towards the end of the southern winter. We will also be replacing some furniture and floor coverings, and repainting most of the access paths on the mountaintop. These paths get very warm in the daytime sun, and are a source of heating into the night air in the vicinity of the domes.

6. The road-grader, operated by AURA Observatory Support Services, is of 1960s vintage and a maintenance headache; however, it is an essential piece of equipment needed to maintain the heavily used roads from the Guard House to Cerros Tololo and Pachón. Along with Gemini and SOAR, CTIO will provide the funds for purchase of a new road-grader.

7. In La Serena, we will replace the air conditioning unit that is responsible for cooling the computer room. The present unit is of marginal capacity, and is irreparably failing.

8. The CTIO Engineering and Technical group in La Serena is an essential component, both in day-to-day operations of CTIO and in improvements and developments of telescope systems and instruments. A major activity that this group will be starting immediately is a two-year project to replace the Blanco Telescope Control System, based on the system now in use at SOAR, and under development for the Large Synoptic Survey Telescope. We will also be enhancing tools (such as oscilloscopes and new software packages) and providing more training opportunities to enhance the general effectiveness of the ETS group.

More long-term activities, such as improvements to instruments, are included in our planning. We will also be making some critical scientific and technical hires, and changing some of the ways we operate. Many of our users have made suggestions for improvements, often in their end-of-run reports, and we will be taking action to address many of these that have necessarily been deferred due to lack of staff and/or funding. We will be presenting our plans to our oversight committees, and publicizing them in forums such as future editions of this *Newsletter*. As always, input from our user community is very welcome.

Dark Energy Camera Project Achieves Important Milestone

Alistair Walker

The Dark Energy Camera (DECam) is a facility-class, 500-megapixel CCD imager being built for the CTIO Blanco 4-meter telescope prime focus by a Fermilab-led consortium of more than 110 scientists from 14 institutions. In exchange for providing DECam and a community data pipeline, the consortium will carry out a five-year Dark Energy Survey (DES) to improve our understanding of dark energy.

The complete DES Project was recently reviewed jointly by the National Science Foundation Division of Astronomy (NSF-AST), and the Department of Energy Office of High Energy Physics (DoE-HEP). At the conclusion of the review on May 3, the committee stated that it would recommend to the leadership of DoE-HEP and NSF-AST that DES receives Critical Decision-1 approval. This is an important milestone on the path toward delivery of DECam in 2010.

Since it is rather unusual for the two agencies to jointly review a project, it is worth describing the process in some detail:

The DES collaboration has asked DOE-HEP to provide somewhat more than two-thirds of the cost of DECam; other funding agencies in the United Kingdom, Spain, and Brazil—as well as the US partner institutions—are being sought to provide the remainder of the necessary funds. The collaboration has also asked the NSF-AST for funds to support the DES data management effort at the National Center for Supercomputing Applications. The collaboration has also asked NOAO to develop the infrastructure to support DECam operations for both the DES and community use of DECam. Given the high need for coordinated interagency decision making on this project, NSF-AST and DOE-HEP have jointly developed a process to reach decisions on DES.

In October 2006, the DoE and NSF jointly requested an end-to-end DES project description proposal, with scientific justification, technical realization, and complete schedule and funding planning for the three parts of the project: the camera, the data management system, and the Blanco telescope upgrades being carried out by CTIO.

The DES collaboration submitted this proposal to the agencies in early January 2007. In April 2007, the leadership of NSF-AST and DoE-HEP signed a Record of Agreement that described how DoE-HEP and NSF-AST would review the full DES project. In accordance with that Record of Agreement, the agencies requested that the DoE Office of Project Assessment carry out a full review of all of the components of the DES project, including the science. The agencies agreed that the review would be carried out in two parts between April 30 and May 3 at Fermilab in Batavia, Illinois.

On April 30, NSF conducted a traditional panel review as part one. From May 1–3, the Office of Project Assessment carried out part two in accordance with DoE procedures as adapted to the needs of the joint review. One of the purposes of the second part of the review was to establish whether DES would fulfill the requirements for a DoE "Stage III" ground-based dark energy experiment, including the selection of CTIO as the site for that experiment. This is a necessary step for DOE to execute a Critical Decision-1 (CD-1). (See the Dark Energy Task Force report at *www.nsf.gov/mps/ast/detf.jsp* for a definition of Stage III and related details.)

A Request for Input on the Dark Energy Camera Community Filters

Christopher J. Miller

The Dark Energy Camera (DECam) will be a facility instrument on the CTIO 4-meter Blanco telescope delivered by the Dark Energy Survey (DES) consortium in exchange for 30 percent of the observing time over a five year period. As such, NOAO anticipates that the DECam will be used extensively by the astronomical community during the time allotted through the standard NOAO peer-reviewed time allocation process.

A document outlining community needs was written for this instrument (see the CTIO Web site at *www.ctio.noao.edu*). A major scientific component of this instrument will be the selection of filters available to the community. The cost and complexity of DECam filters will intrinsically limit the number and variety of filters CTIO will support. These filters are very large (greater than 600 millimeters in diameter and a mass of 8 kilograms) and expensive. Thus, CTIO wants to work closely with the community to develop a prioritized list of possible filter purchases in addition to those acquired by the DES.

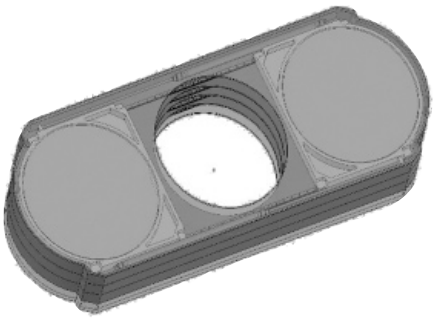

Figure1. A preliminary design of the DECam FIlter Assembly. Each side will hold four filters, which are then moved into the aperture.

In June 2006, the DES collaboration formed a panel to study the choice of filters to be used in the project and for the community

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A Request for Input on the DECam Community Filters continued

DECam instrument. Specifically, the panel was charged with determining whether the default Sloan Digital Sky Survey (SDSS)-like *g,r,i,z* system would suffice for the DES science, and how this choice of filters compares to other large multi-band surveys, as well as what additional filters the community might request. The report will provide input to the design of the filter assembly (see figure 1).

The conclusions of this panel are to move forward with the SDSS *g,r,i,z* filters, or to split the SDSS-like z-band into both a Z-band and Y-band filter to bridge the gap between DES and proposed J, H and K-band VISTA VHS Survey, if approved.

Additionally, a survey of current and past filter-usage statistics was undertaken for the NOAO Mosaic instruments to better understand the needs of the astronomical community. Figures 2 and 3 show the number of exposures and the total exposure time in the different filter groupings over the past eight years. From this usage study, it is clear that there is a demand for the BVRI system filters, as well as wide filters such as V+R and narrow-band filters like H-alpha and OIII.

At the same time, NOAO has held discussions, both internally and through a public session at the January 2007 meeting of the American Astronomical Society, to solicit input on a community filter set. Items discussed included whether the SDSS-like *g,r,i,z* or SDSS-like *g,r,i* plus Z and Y systems can and will replace the Johnson-Cousins UBVRI; whether filters could be removed from the assembly during DES observing periods; and, what other filters the community might want to use.

The DES Filter Panel report indicates the need for eight filter slots in the filter assembly to allow for enough community filter options (i.e., outside of the notional DES *g,r,i,z* or *g,r,i,* Z,Y) during the DES observing periods. This eliminates the need to handle and change the filters from the assembly during the DES survey periods. Likewise, the report lists filters of interest from the community, including

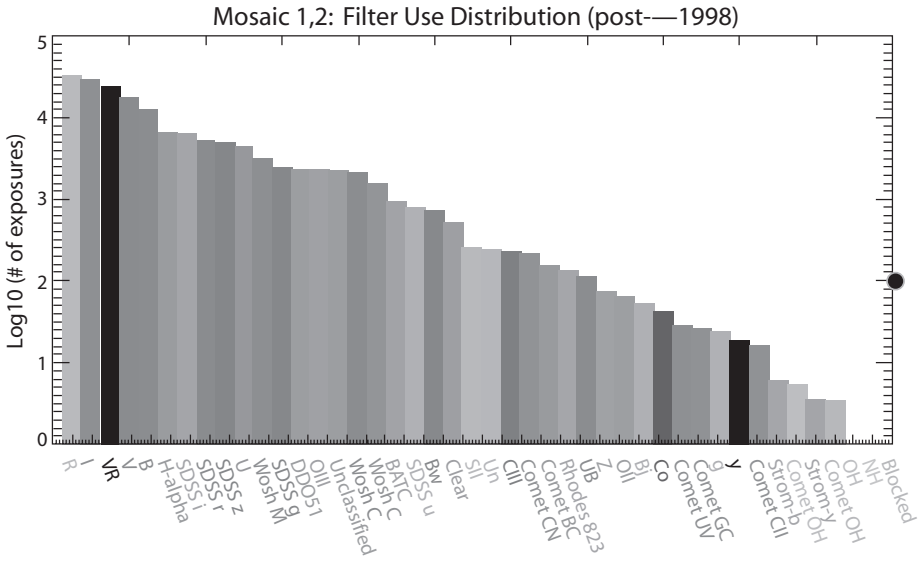

Figure 2. Total number of exposures taken with Mosaic-1 and -2 per filter since 1998.

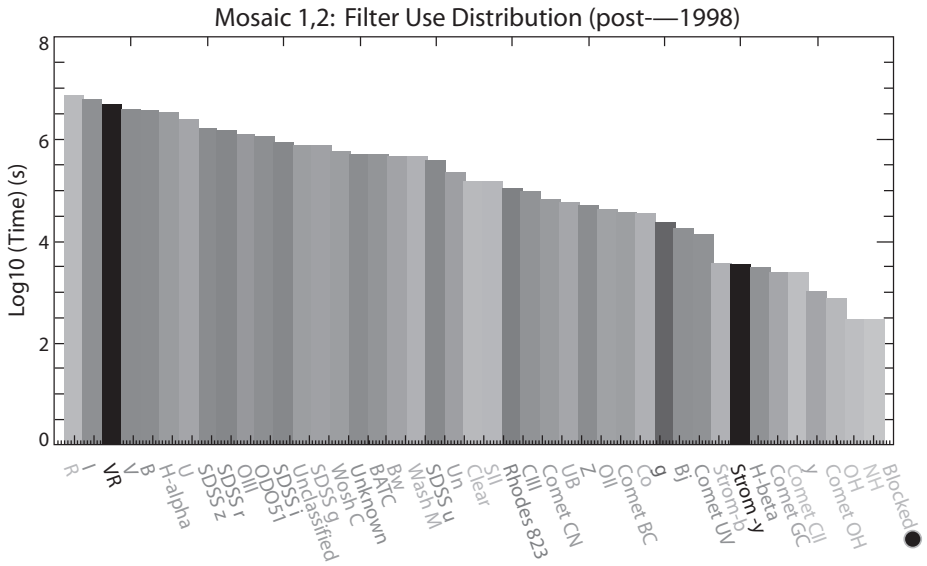

Figure 3. Total exposure time per filter on Mosaic-1 and -2 since 1998.

SDSS u, Washington C, DDO 51, [OIII], H-alpha, and [SII] (in no order of priority).

Over the next year, NOAO will be discussing these issues with the NOAO Users Committee and the astronomical community. In the meantime, potential users are encouraged to send input on the DECam filters to *cmiller@noao.edu*. The DECam will be an extraordinary wide-field instrument available to anyone in the US astronomical community (and beyond), and its success as both a survey instrument and a facility instrument depends on an actively involved user community.