

KPNO/KITTPeAK

N A T I O N A L O B S E R V A T O R Y

Technical Activities for the Summer and Autumn

Richard Green

Though we are not planning to make any submissions to the *Guinness Book of World Records*, the maintenance and upgrade activities on Kitt Peak may very well be setting a new record for duration and number of tasks performed. Major maintenance activities are being carried out for the Mayall 4-meter, WIYN 3.5-meter, and the 2.1-meter telescopes. In addition, KPNO engineering, facilities, and mountain technical groups will be supporting the installation of the Synoptic Optical Long-Term Investigations of the Sun (SOLIS) instrument suite at the Kitt Peak Vacuum Telescope facility during the month of September. The final work at WIYN will not be completed until mid-October this year.

The 4-meter received the first major overhaul, starting in mid-July. The technical challenge was a transmission lube and brake job for the declination drives. The symptom being addressed was a noticeable difficulty in getting the telescope to move after initial power-up in declination, particularly in cold weather. The culprit was one of the two brakes in the system, but it was not a routine maintenance issue. A well-kept secret of the KPNO 4-meter is that the declination drive mechanism was added as a design "afterthought." One of the gearboxes and brake assemblies is essentially inaccessible without disassembling the telescope. The weldment and gears comprise a six-ton unit, which has to be extracted sideways (and reengaged with no line-of-sight access). Indeed, the inaccessible brake was gummed up with 20 years of dried lubricant. It now sports new pads, has been regapped, both gearboxes have been thoroughly cleaned, and the gears have been lubricated and reengaged. New access panels also have been cut in the horseshoe to ease future maintenance efforts.

During that challenging operation, several minor maintenance items were also addressed. The dome shutter gearbox was flushed and refilled with a special oil. The pneumatic clamp system for the Cassegrain rotator was refurbished with new valves. And the Great White Spot was replaced. Its nautical cloth had begun to shred in the dry and windy conditions. Its replacement has metal panels with a highly reflective coating, rated at 99 percent from the ultraviolet through to the near infrared. Mosaic recommissioning includes a careful examination of the new flat-fielding properties.

The gearbox and brake refurbishment went well and met the planned schedule, so the primary mirror was removed and re-aluminized as well. A long telescope commissioning period was planned to allow measuring new force maps for the 4-meter active support system (4MAPS) and integration of the secondary tilt control to remove the coma term at $f/8$. The new wavefront camera will be a major improvement in recording wavefronts at the Cassegrain focus. Full achievement of this plan depends, however, on gaps in the monsoon cloudiness, which are always an unknown.

The 2.1-meter is also receiving a much-needed refurbishment. The long run of multiconductor cabling had gotten snagged and damaged sometime in the last year, leading to multiple peculiar symptoms. As an interim solution, much of the functionality was restored via the large number of spare conductors within the cable. The cabling is being replaced this summer, and a more reliable counterweighting scheme is being implemented to keep the cables from jumping their tracks. In addition, the oil delivery system for the RA bearings received major preventive

maintenance. The schedule is tight for full replacement, checkout of all telescope functions, and restoration to science operations in late August.

Meanwhile, the WIYN 3.5-meter telescope had begun to experience difficulties with its azimuth motion. Increased torques were recorded from the azimuth drive motors, and more frequent drive trips were encountered. Charles Corson led an effort of careful diagnosis and elimination of possible causes, including (again) sticky lubricant. In the end, the culprit seemed to be a degradation of (at least one of) the four azimuth bearings, which are high-precision, custom-fitted parts. The manufacture, assembly, and interfacing of new bearings turned out to be very technically challenging. The WIYN shutdown to accomplish that task is taking place in two parts. An exploratory effort was planned to fill a week in August, overlapping the maintenance and refurbishment of the T2KC bench spectrograph detector. An actual full replacement for all four bearings is planned for the second week of October, by which time the high-precision bearing parts will be delivered from the manufacturer and locally assembled and remachined for installation.

Low downtime during scheduled observations depends on major behind-the-scenes efforts like these. We are grateful for the efforts of all the skilled individuals in Tony Abraham's KPNO engineering group, John Scott's and Mike Hawes' mountain facilities group, Jim Hutchinson's mountain electronic maintenance team, and Skip Andree's instrument support for the sustained hard work required to make these multiple shutdown efforts successful. Please take a look also at the following safety report to gauge the scope of fire prevention activities on the mountain this year.



Fire Prevention Efforts at Kitt Peak

Chuck Gessner & Richard Green

Considerable effort was made last summer to reduce the risk of wildfire damage on Kitt Peak. In 2003, we made additional significant progress.

Kitt Peak managers met with Fire Management Officer Guy Acuna of the Tohono O'odham Nation and Wildland/Urban Interface Specialist Curtis Heaton from the US Fish and Wildlife Service. Mr. Heaton has been a tremendous help in advising us about fire regulations and resource agencies. We agreed that the best short-term approach was to provide defensible space around critical structures by trimming trees and removing undergrowth vegetation and nonnative plant species. The tenants were invited to participate, and MDM, the Southeastern Association for Research in Astronomy, and the University of Arizona have all played an active role.

After this summer's tragic wildfire and the loss of forest land and homes in the Santa Catalina Mountains, we are even more committed to a long-term program of reducing the fuel load of brush on Kitt Peak.

We are also grateful to Tohono O'odham Nation Cultural Affairs Manager Peter Steer for the development of a Tohono O'odham Nation Categorical Exclusion Checklist, complete with signatures from the Nation's chair and environmental manager. This document allowed us to take prompt action just prior to the peak fire season by stating that the planned clearing was unlikely to impact any environmentally or culturally sensitive areas. Landscaping contract work was successfully completed in early July.

This year's additional fire risk mitigation efforts at Kitt Peak included:

- The 5,000-gallon tender with the fire fighting foam machine was readied.
- Mountain facilities staff retrofitted and readied a 500-gallon "buffalo" trailer with pump to be used along with another 500-gallon trailer.
- Staff constructed "portable sprinklers" and hoses for use on endangered buildings.
- Kitt Peak management met with Tohono O'odham Nation Department of Public Safety (DPS) on June 16 to ensure that Kitt Peak is their priority location. Tohono O'odham Nation DPS has toured Kitt Peak's facilities and fire fighting capabilities and has been provided updated emergency information including maps, contact information, and GPS coordinates of structures.
- Kitt Peak management are working with the Tohono O'odham Nation fire department and the Bureau of Indian Affairs (BIA) to put into place a long-term strategy for hazard fuel reduction and a wild land-urban interface that would allow BIA funding for fire mitigation, which will protect both the Tohono O'odham Nation and the research facilities on Kitt Peak.

After this summer's tragic wildfire and the loss of forest land and homes in the Santa Catalina Mountains, we are even more committed to a long-term program of reducing the fuel load of brush on Kitt Peak. A successfully completed environmental study should allow sensible management of steeper slopes and chimney-like canyons to further reduce the fire threat without compromising soil stability or habitat. Although you will find the former "natural" look of the summit area somewhat altered when you return to observe, we're sure you understand and appreciate the need for such changes in the interest of long-term, safe operations.