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Comments concerning this Newsletter are welcome and will be forwarded to the appropriate editors.
Newsletter Posted: 23 February 1997

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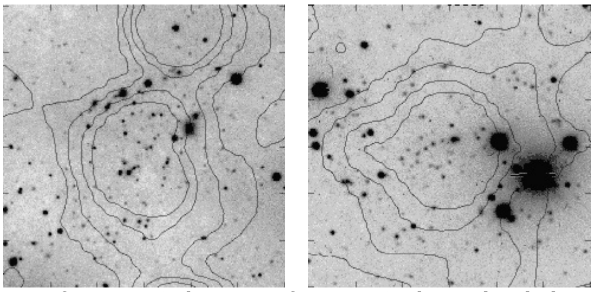
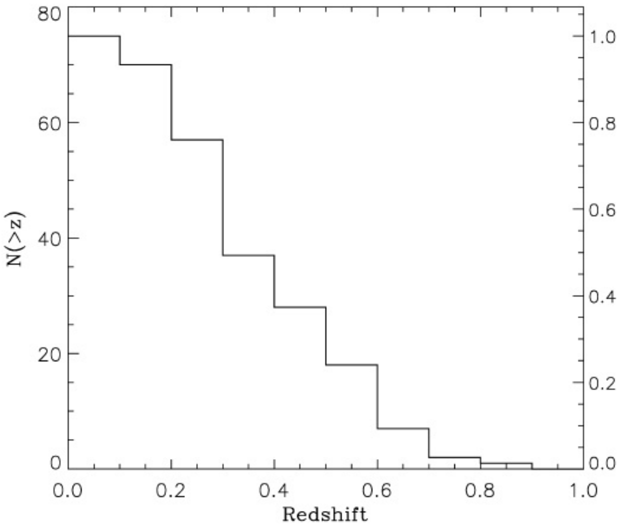
Finding Clusters the X-ray Way

Large homogeneous samples of galaxy clusters, spanning a wide range of redshift, are potentially powerful tools to study the evolution of the large scale structure in the Universe. Unfortunately, finding clusters at cosmologically interesting lookback times, say z > 0.5, let alone defining a complete sample, is a time consuming and difficult task. As a result, the much-needed observational constraints for theories of structure formation have not been forthcoming.



Caption: Figure 1: I-band images and X-ray contours of two RDCS clusters. Left: z = 0.72, obtained with the KPNO 4-m; right: z = 0.64, obtained at the CTIO 1.5-m. The images are 3' across.

In an attempt to remedy this situation, Piero Rosati, in collaboration with Colin Norman and Roberto Della Ceca (all at Johns Hopkins), have embarked on a project, the ROSAT Deep Cluster Survey (RDCS), aimed at comstructing a large homogeneous sample of distant galaxy clusters selected solely on the basis of their X-ray properties. The X-ray selection offers two main advantages over optical selection: clusters are high contrast objects in the X-ray sky and the selection function can be modeled in a relatively straightforward way, being essentially that of a flux-limited sample. Cluster candidates are selected from a serendipitous search for extended X-ray sources in deep pointed observations drawn from the ROSAT-PSPC archive. A wavelet-based technique is used to detect and characterize low surface brightness X-ray sources. The completeness flux limit of the survey, 1 x 10^{-14} erg/cm^2/s, is determined by the flux level at which extended and point-like emission can be reliably distinguished. The ROSAT-PSPC with its high sensitivity, low background, and good angular resolution (~ 30" FWHM), allows fluxes an order of magnitude fainter than those in previous X-ray cluster surveys to be reached. This selection technique yielded 150 candidates over an area of ~ 50 square degrees, drawn from 180 X-ray fields scattered across the two galactic caps.



Caption: Figure 2: Cumulative redshift distribution for the RDCS clusters identified spectroscopically as of December 1996.

To identify these candidates, Rosati and collaborators have undertaken a large optical follow-up program, consisting of deep imaging using the KPNO 4-m and 2.1-m, the CTIO 4-m and 1.5-m, multislit spectroscopy carried out with the CryoCam Spectrograph at the KPNO 4-m for the clusters in the North, and with the ESO 3.6m for those in the South. The imaging survey in I and V bands, now nearing completion, has shown a high success rate of identification, with about 100 new clusters confirmed to date (see Figure 1). These findings imply a surface of density of ~ 10 clusters/deg^2 at the survey flux limit. The spectroscopic follow-up work has secured 75 cluster redshifts so far, spanning the range 0.1-0.8 (40 in the North). A significant fraction of the newly discovered clusters lie at high redshift: 28 at z > 0.4, 18 at z > 0.5 (Figure 2). The rapid build up of such a sample of spectroscopically confirmed distant clusters underscores the efficiency and the validity of the X-ray selection. This large fraction of distant clusters also implies that there is no dramatic dearth of X-ray clusters at high redshifts or negative strong evolution as suggested by previous shallower X-ray surveys; this finding is in keeping with the results of optical surveys (e.g. the Palomar Deep Cluster Survey by Postman and collaborators). A detailed investigation of the issue of cluster evolution will soon be possible when the redshift survey is complete and the Xray luminosity function (XLF) is constructed at different redshifts.

The depth of the RDCS allows the faint end of the XLF to be probed at moderate-to-high redshifts for the first time. In addition to constraining cosmological models, this opens up the possibility to study galaxy evolution in systems with X-ray luminosities equal to and well below the local L* (roughly the Coma cluster), which span a variety of rich environments and constitute the bulk of the cluster population in the Universe.

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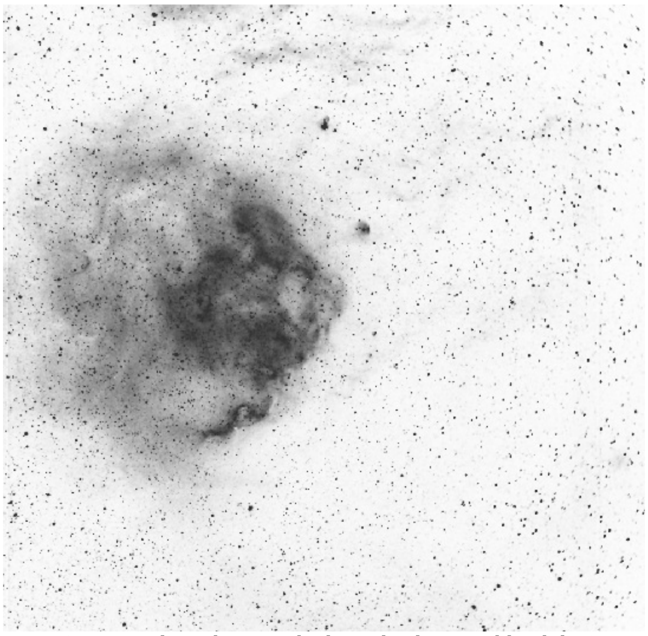
NOAO Newsletter - NOAO Highlights! - March 1997 - Number 49

New White Dwarf Appears on Cerro Tololo

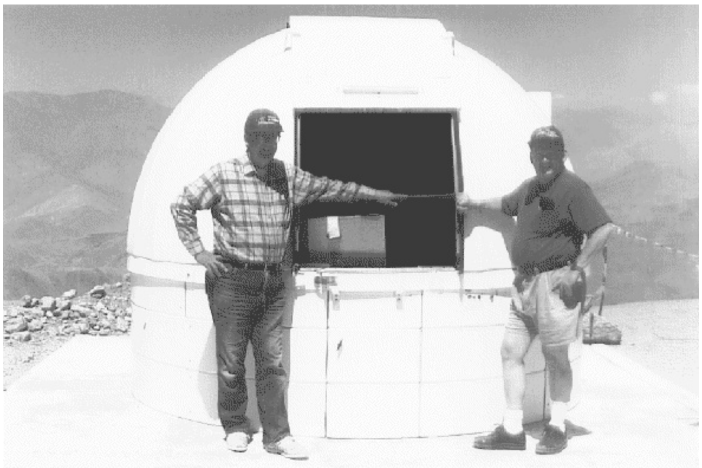
Early in January the skyline of Cerro Tololo was modified by the appearance of a new dome, ten feet in diameter, housing a robotic Hα survey camera. With an optical system of only 0.031-meter aperture (a Canon 50-mm f/1.6 lens), the installation merits its nickname of "El Enano" (the dwarf), but it beats all other telescopes on the mountain in sky coverage - 13° x 13° on a single CCD frame. Over the course of the next two years, the robot will survey the sky at H α to a sensitivity limit of one Rayleigh (corresponding to an emission measure of 2 cm^{-6} pc) at an angular resolution of about 1', comparable to the resolution of the IRAS survey. Like the IRAS survey, the Hα images will eventually be published on a CD-ROM and made available on the World Wide Web for study by anyone in the astronomical community.



Caption: First image taken by the Swarthmore Hα Survey Robot, showing the bow shock around lambda Orionis.

The obvious scientific application of the survey is the study of the structure of the warm ionized component of the interstellar medium, but the survey also has applications to cosmology. Limits on the Hα brightness translate directly into limits on the microwave emission from Galactic hydrogen, a possible contaminant of the measurements of fluctuations in the cosmic microwave background.

The system is not just a remotely controlled telescope, but a true robot. It operates without human intervention, with two exceptions. First, to avoid attempts to observe in cloudy or stormy weather, the robot (via email) asks permission of the local observer support staff before opening the dome. (The dome can also be commanded to close via email.) Second, a technician enters the dome once a week to remove a full data tape and mail it to the project director. Otherwise the system operates completely autonomously. The camera was installed and subjected to initial shakedown tests in January. Routine robotic operations are expected to begin in May. Elapsed time from arrival of the dome and telescope dismantled in packing crates to first light was two weeks, possibly setting a record for facility construction!



Caption: Wayne Rosing (left) and John Gaustad (right) with El Enano (center) on the Tololo summit.

The robotic camera system was designed and constructed by Wayne Rosing (Las Cumbres Observatory) and The Remote Telescope Company (Los Gatos, California). The project is under the scientific direction of John Gaustad (Swarthmore College) with the collaboration of Peter McCullough (University of Illinois) and Dave Van Buren (IPAC).

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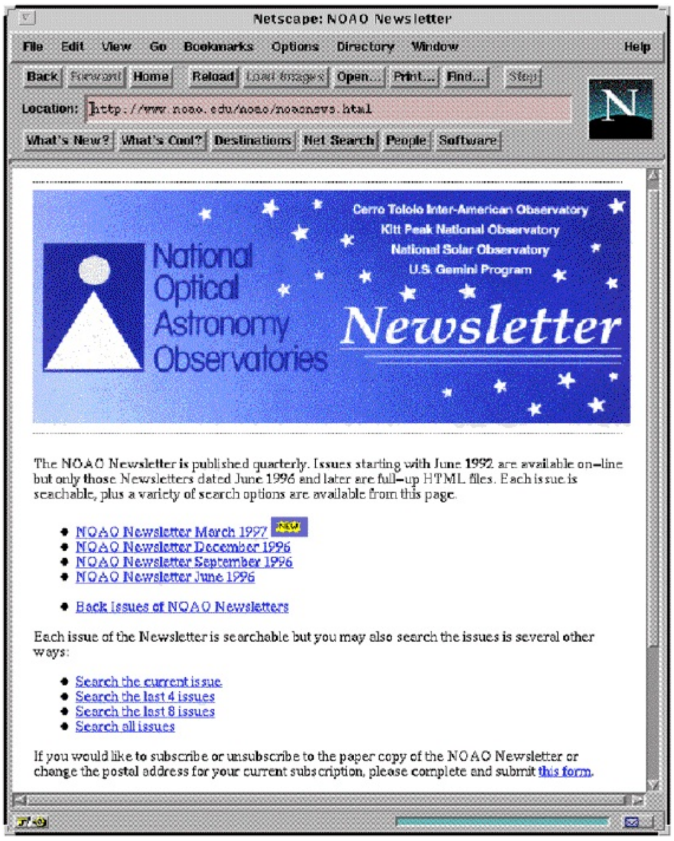
NOAO Newsletter on the Web

We have been posting the latest issues of the *NOAO Newsletter* on the Web - they are easily available from the NOAO home page at http://www.noao.edu. Older issues dating back to June 1992 are also available in text format. Each of these issues of the *Newsletter* is searchable (with a new and improved search engine) and group searches can also be done for the last year, the last two years, and all issues.



The *Newsletter* home page also contains a link to a form for subscribing or unsubscribing to the paper copy of the *Newsletter*; postal address changes for the *Newsletter* may also be sent to us via this form.

So the next time you are looking for a particular *Newsletter* article about NOAO check out our Web page!

Jeannette Barnes

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NOAO Newsletter - Director's Office - March 1997 - Number 49

Long Range Plans: KPNO-CTIO-Gemini

At the end of the next decade, at least a dozen telescopes with apertures in the range 6.5-m and larger will be in operation. It may be an exaggeration to say that this is the greatest advance in capabilities in groundbased O/IR astronomy since Galileo looked at the sky with his first telescope - but it is not much of an overstatement. Given this remarkable change, it is inevitable that what NOAO offers to the community will evolve as well. There are several articles in this *Newsletter* describing this evolution; especially important are the summary prepared by Lee Anne Willson describing the workshops on small telescopes in Toronto and Flagstaff and the report of the joint CTIO/KPNO Users' Committee.

It is appropriate here to review where we have been and where we are going. The following tables summarize the facilities that were offered at NOAO in 1984, the year in which NOAO was officially established, and those that the community will access through applications to NOAO in the year 2000.

Capabilities - North

1984	**2000**
4-m Mayall	8-m Gemini (0.425)
2.1-m	4-m Mayall
1.3-m	3.5-m WIYN (0.4)
CoudÃ© Feed	2.4-m
0.9-m	9-m HET (0.07)
0.9-m	6.5-m MMT (0.07)
Burrell-Schmidt (1/4)	
No. of Nights: 2281	No. of Nights: 1082
No. of nights x $(D)^2$: 9056	No. of nights x $(D)^2$: 22315

D = Diameter

Capabilities - South

1984	**2000**
4-m Blanco	8-m Gemini (0.45)
1.5-m	4-m Blanco
1.0-m (Yale)	4-m SOAR (0.3)
0.9-m	2.4-m
Curtis-Schmidt (Mich.)	
No. of Nights: 1460 (est.)	No. of Nights: 1004
No. of nights x $(D)^2$: 7264	No. of nights x $(D)^2$: 18925

D = Diameter

Note that only one telescope in each hemisphere is common to both lists - the 4-m Mayall at Kitt Peak and the 4-m Blanco at CTIO. The next article discusses the plan for completing the transition from where we are now to where we want to be in the year 2000.

Given the mix of telescopes listed above, the key issue to be addressed by NOAO and the community that uses these facilities is how to use the telescopes most effectively. As the tables show, the number of nights available to users will be reduced by about one-third in the south and by a factor of two in the north, while the number of photons gathered will increase by about a factor of 2.5 because of the increase in aperture. If one takes into account the advances in detector technology and the advent of fiber spectroscopy, then the throughput for certain types of observations is literally orders of magnitude higher now than it was in 1984. As the report of the users' committee emphasizes, a night is still a useful quantum of measurement, and it is likely that fewer nights will mean fewer users. However, the changes in the number of telescopes being operated need not mean 50 percent fewer users if we learn how to use this suite of instruments more effectively than is possible with traditional methods of scheduling and operation.

Two things make the NOAO telescopes unique - the first is public access. The second, however, is that NOAO is the only observatory that offers access to a balanced suite of telescopes in both hemispheres with a range of apertures and a diverse complement of instruments for both optical and infrared astronomy. In order to realize the full scientific advantage of this range of capabilities, we need to treat the facilities accessed through NOAO as an *observing system*, not simply as individual telescopes. Observers should be able to apply to pursue *scientific programs* using optimal observing strategies, which may make use of telescopes of a range of apertures in either or both hemispheres.

The basic idea is that in the future, there should be "one-stop shopping" for observing - one Web address that provides links to all the information on how to use the instruments and prepare observing proposals, one application form, and one deadline for proposals. To first order, observers should not be concerned where the telescopes are located (so long as the object is observable from that latitude) or who operates them.

In order to begin moving toward one-stop shopping, NOAO has consolidated the responsibility for working with the users before and after observing runs under the US Gemini Program, which is headed by Todd Boroson. The USGP was already charged with this responsibility for US users of Gemini. The international Gemini project supports observers only from "sea level to sea level," that is, while they are actually at the observatory making observations. The national project offices are responsible for assisting with proposal preparation, for evaluating proposals, and for assisting with data reduction. The USGP will now provide this same service for CTIO, KPNO, and the open access to the Hobby-Eberly telescope, the upgraded MMT, and any other independent observatories that make time available to the community as part of their instrument proposals to the NSF. The directors of CTIO and KPNO, like the director of the international Gemini project, will be responsible for providing scientific leadership for their sites, including recruiting scientific staff, scheduling the telescopes, supporting observers, upgrading the telescopes, and developing the long range plans for instrumentation.

This assignment of responsibilities to the USGP is the first step toward reorganizing NOAO along functional lines. The goal is to streamline the organization and minimize duplication at the various sites.

The Observatories Council, which oversees the operation of NOAO on behalf of AURA, has endorsed this concept. Specifically, at their most recent meeting they recommended that in the next two years (and sooner if possible), we consolidate all responsibility for external user support, including US support of Gemini, as well as operation of Kitt Peak under a single associate director, with a second associate director being assigned responsibility for the joint CTIO-KPNO instrumentation program. Prior to the onset of Gemini operations, they approved an interim arrangement whereby the position of Director of Kitt Peak would be combined with the position of Deputy Director of NOAO and head of the joint instrumentation program.

I am very pleased that Richard Green has agreed to serve in this triple role and will be responsible for all of the activities of KPNO. He will also be responsible for overseeing all of the engineering and technical staff in Tucson and on Kitt Peak (apart from those assigned to NSO), and can easily make the trades among ongoing programs. Bruce Bohannan will continue to serve as Assistant Director of Kitt Peak, with the major responsibility for mountain operations.

KPNO is clearly central to our plans for the future. While much of the focus recently has been on the downsizing of the observatory, too little emphasis has been placed on how powerful an observatory this is - and will continue to be in the year 2000. The image quality of the 4-m Mayall telescope has been improved to a median that is approaching one arcsecond, and there are significant improvements in the thermal environment still to be made. The WIYN continues to perform well, and the partners have just agreed to make a one time investment over the next two years with the goal of improving the reliability and efficiency of operations. Two major new instruments - Phoenix and the mosaic CCD imager - are being commissioned. I am confident that Richard Green will provide the leadership and vision required to ensure that KPNO remains competitive well into the next century.

As their report elsewhere in this *Newsletter* indicates, the joint CTIO/KPNO Users' Committee endorsed this short term reorganization of NOAO. They recognized that it has been impossible, and is likely to continue to be impossible, to recruit someone from either outside or within NOAO to accept the KPNO directorship while the observatory is in transition unless the position is combined with another activity within NOAO that offers more opportunity for new programs and significant initiatives. Once KPNO reaches a new and stable equilibrium, the users would prefer to have again a separate director for Kitt Peak. This recommendation differs from the views of the OC. Also from my own point of view I believe that there is some merit in reducing the number of directors by one, as we have now done, just as we are reducing staff in every other area of the observatory. After all, in 1980 the KPNO director was in charge of what has now splintered into KPNO, the USGP, NSO/Tucson, the nighttime instrumentation program, and NOAO with its central offices, each with its own director, and the budget for those activities has been reduced by close to 40 percent. I would hope that four directors rather than five would be enough to handle what one did a decade ago. In any case, during the next two years, we will be analyzing options with both the OC and the users' committee for how best to manage the nighttime program when Gemini becomes operational.

Even more important than reducing costs, this reorganization of NOAO along functional lines emphasizes the integration of similar activities across multiple sites. From the standpoint of the nighttime users, we wish to become the National Optical Astronomy *Observatory*, offering a powerful observing system to the community, rather than the National Optical Astronomy Observatories, as we are now, operating separate and distinct sites. This transition toward more unified support of the user community will occur gradually over the next several years, and we need your help and advice in making this transition. One-stop shopping for observing time is a very attractive idea, but making it work will be a challenge. How do we coordinate observing time at multiple sites in two hemispheres? How do we go about evaluating proposals that make use of more than one facility? What level of coordination of activities across sites is appropriate and when does such coordination stifle initiative and slow decisions? We are just beginning to discuss these ideas within NOAO and with the users. Send your comments and suggestions to any of the directors - Todd Boroson, Richard Green, Malcolm Smith or to me.

Sidney C. Wolff

Telescope Availability: The Transition Plan

The astute reader of the will note that several telescopes are listed in the year 2000 that are not yet built, while several telescopes currently in operation are not listed. How do we plan to get from here to there?

The plan for the south, given this concept of an observing system, depends on the construction of a modern 4-m class telescope that will provide superb image quality over a modest field of view to complement the wide-field moderate image quality offered at the Blanco. This new telescope has been given the name SOAR, and there are commitments in principle from Brazil, the University of North Carolina, Michigan State University, and NOAO that we believe would be adequate to fund construction and operation for 15 years. We are currently carrying out preliminary studies, including the exploration of some very innovative designs and the estimation of costs, to ensure that we can indeed satisfy the scientific goals of the partners within the budget we have identified. Progress on this project will be reported regularly through the *NOAO Newsletter*.

A proposal to build two 2.4-m telescopes was submitted to the NSF as part of an overall package for renewing NOAO facilities; also included were requests for support of SOLIS, a project to replace the telescopes used for solar synoptic studies, and of NOAO's participation in SOAR. The NSF has accepted the SOLIS proposal and is trying to identify funding for it. It appears likely that the NSF will approve the spending of $2M toward the construction of SOAR as well as support of the operations phase, subject to the development of a suitable agreement with our partners. The proposal for the 2.4-m telescopes was judged to be less mature than the proposals for the other two parts of the package, and the NSF review team recommended that we work with the user community to develop a better consensus concerning the scientific capabilities to be provided. It remains NOAO's judgment that wide-field imaging capability in both the optical and infrared regions of the spectrum to the deep limiting magnitudes that can be reached spectroscopically by the Gemini telescopes is a capability that must be provided through the national observatories. However, we need to determine the extent to which that view is shared by the community.

As a first step in evaluating what new facilities need to be built by NOAO, the USGP will host a workshop to determine what capabilities are required to ensure optimum use of the Gemini and other large telescopes now being built in the US. These capabilities might include the wide-field survey telescopes, telescopes for obtaining accurate magnitudes and positions of objects, specific surveys beyond those already planned (Sloan and 2MASS), particular technology developments required for the complex instruments being proposed for the large telescopes, etc. We will also look at where these capabilities might be provided; it may be that not all need to be provided by NOAO itself. The USGP-sponsored workshop will focus on US issues; the international Gemini project will host a later workshop in which all of the Gemini partners will look at these same issues in connection with support of the Gemini telescopes themselves. The types of capabilities proposed by the workshops will be an important factor in determining the content of any proposal for new facilities submitted by NOAO.

We will also be working with the existing user community to understand what types of capabilities are most important for supporting their future research, whether or not that research involves the use of the Gemini telescopes. It is clear that we will have to make a compelling scientific case for new facilities. Based on the reviews of the proposal for the 2.4-m telescopes, it is apparent that we will have to identify the unique science that would be done with any new facilities; simply citing the past track record of the user community as a predictor of the excellent science that would be done in the future is not adequate when funding is as tight as it is.

In short, NOAO is still committed to the 2.4-m telescope program and plans to re-submit a proposal for them - but only if the community supports the concept.

There are also a number of telescopes currently in operation that are not listed for the year 2000. CTIO has already announced that the 1-m telescope there will be jointly operated by Yale, Portugal, and Ohio State, with CTIO retaining only a 10 percent share. If budgets permit, and barring catastrophe I have guaranteed level of effort to CTIO until the year 2000, CTIO will continue to operate the remaining telescopes until they are replaced by SOAR and the 2.4-m imaging telescope. If the 2.4-m is not built, the 1.5-m would remain in operation.

At KPNO, we plan to phase out support of two telescopes, but in each case we will retain the scientific capabilities on different telescopes. This will in general be our philosophy as we change the mix of instruments and telescopes that we offer. We will try to give enough warning to people so that they can complete ongoing programs, and we will also try to maintain equivalent or better capabilities. The goal is not to preclude any specific type of research.

The first telescope for which NOAO plans to withdraw support is the Burrell Schmidt, and we have notified Case Western that we will not continue to provide support after 1 October 1997. Observers if they wish may submit proposals for time up to that date. We do plan to offer the 8K x 8K CCD imager on the 0.9-m telescope. This will be a very powerful capability that is actually better suited for more than 90 percent of the research now being done at the Schmidt because of better sampling of the PSF (see the article by Tod Lauer in the Kitt Peak section of this *Newsletter*). Sometime next year, probably in the spring semester, we will also withdraw NOAO support for the CoudÃ© Feed, but not until it is possible to feed the spectrograph with a fiber from the 2.1-m telescope.

These changes were discussed with the users' committee in December. At that time, I indicated that if the budget allowed it, it would be my intention to continue to operate the 0.9-m and 2.1-m telescopes until they were replaced with a new 2.4-m telescope. Now that there is a new director of Kitt Peak, the responsibility for long range planning for the site will fall to him, but he has endorsed this plan. Operating four telescopes at even current budget levels will, however, be a challenge.

This plan for operations is more ambitious than was outlined in last year's Web posting. Were we crying "wolf?" No - many people missed the "if-then" clause in the Web statement. The level of operations is determined by the budget. This year's budget is better than last year's projections, and accordingly more of the facilities are remaining in operation. The plan to the year 2000 that we have laid out here is what NOAO believes the science requires and the demand for observing by the users justifies. The key to the future lies in our ability as a community to make a compelling case for support of astronomy at a time when the federal government is reassessing its funding priorities.

NOAO has already transferred a 0.4-m telescope to Georgia State and a 0.9-m telescope to SARA. Later this year, based on the input from the small telescope workshops, we will be developing an announcement of opportunity that would permit universities and/or consortia to propose for the operation of the 1.3-m telescope. Case Western will assume full responsibility for the operation of the Burrell Schmidt telescope on 1 October. Other NOAO telescopes are likely to become available gradually over the next five years.

Basically, NOAO is increasing the aperture of the telescopes it offers by a factor of two. What about the excellent science that is now being carried out by 1-m class telescopes? One of the most positive activities this past year has been the workshops on small telescopes. I am extremely impressed by the number of small telescopes now operated outside NOAO and the extent to which CCDs have enabled important research to be done at relatively low cost. What has come out of the meetings for me, at least, is a better understanding of what NOAO must do with smaller telescopes and what the community can do for itself. The independently-operated small telescopes can do a better job at certain types of science, especially the photometry of variable stars, than the national observatories ever could because of the ability of the independent observatories to dedicate large continuous blocks of time to single problems. Locally-sited telescopes can also support education and public outreach in a way that national facilities cannot. However, few of these telescopes offer spectroscopy, wide-field imaging, or infrared instrumentation, and so NOAO will focus its own resources on providing these more complex and costly capabilities. What I hope will be the ultimate result of the small telescope workshops will be a recognition of the crucial contribution that the independently-operated telescopes make to the overall fabric of our science - a contribution that will in the future be duplicated nowhere else. I also hope the groups operating these telescopes will find ways to make at least some public access available at low or no cost. As described in Lee Anne Willson's article in this *Newsletter*, NOAO and AURA would like to continue to assist as appropriate the development of an effective working group of operators of small telescopes to share technical developments and scientific plans.

Sidney C. Wolff

Small Telescopes - Looking to the Future

In October, Lowell Observatory hosted a meeting on "*Small Telescopes*"; in January, AURA and NOAO sponsored a workshop on small telescopes in conjunction with the AAS meeting in Toronto. What follows is informed by, if not inspired by, the discussion at both these meetings.

The case for front-line research remaining to be done with small telescopes was made very clear in the meeting at Lowell, which was attended by a variety of users and operators of small telescopes and also by representatives from NSF, NOAO, and AURA. Some of those presenting papers at that meeting have sent abstracts for posting on the NOAO web site (www.noao.edu). At the Toronto workshop, the emphasis was on identifying future roles for the smaller KPNO telescopes taking into account the complementary contributions that are or can be made by the independently owned telescopes of similar aperture. A full report on that workshop will be posted at the NOAO web site no later than early February.

The primary mission of NOAO, according to NSF and its advisory bodies, is to provide world-class facilities for all users. This emphasizes facilities that few or no other US institutions can provide, whether because the cost is prohibitive or for reasons of location or required size of scientific staff needed to operate and justify the operation of a large private facility. I would hope that it is an easy item for consensus that all US astronomers should have the opportunity to apply for time on fully competitive facilities, with observing time distributed purely on the basis of the quality of the science proposed.

Unfortunately, tight budgets together with the above priority make it necessary to reduce NOAO's responsibility for running smaller, less unique, facilities. The budget is forcing choices that are not justified on the basis of the science being carried out on the smaller telescopes - this science is still competitive and unique. The problem confronting NOAO and AURA for the past few years has been how to work effectively within the constraints of tight budgets and without cutting off those services that must be provided to maintain the vitality of US astronomy-including that important source of vitality that comes from the wide geographical and institutional distribution of astronomers.

Both of the workshops mentioned at the start of this report highlighted one aspect of the solution: There are a large number of modest-aperture telescopes in the hands of astronomers in the US, including both smaller telescopes operated by professionals in a wide range of institutions and also some of the larger, well-equipped amateur telescopes. Some successful programs and projects have already been built on such resources: projects such as the Harvard redshift survey, the MACHO searches, and the Whole Earth Telescope have used small telescopes individually or in networks to carry out front-line projects made possible by modern computerized data handling. Through AAVSO and IAPPP professional and amateur observers have contributed monitoring, early-warning, and other support services for big-telescope and space-based observing programs. A few years ago, Jason Cardelli initiated the North American Small Telescopes Cooperative, NASTeC, a loose network of small telescopes making some time available on a cooperative basis; this is now being managed by H. Preston at Valdosta (web page accessible through the NOAO site or at http://www.valdosta.peachnet.edu/~hpreston/sara/nastec.html). Ideas such as obtaining better prices for standard instruments through group purchases are very appealing. The importance of such coordinating efforts is increasing. At one of the next AAS meetings there will be an opportunity for members of such networks and consortia to meet and discuss issues of mutual benefit; that is being organized by T. Oswalt.

Both the changes taking place at NOAO as larger groundbased facilities come on line and the gradual development of cooperative networks of privately owned facilities suggest that the role of the smaller telescopes at Kitt Peak, at least, would be evolving even without the budget pressures. In looking over current use for the KPNO telescopes, and looking ahead to what will be needed when Gemini comes on line, several key functions currently served by these smaller telescopes were identified:

- Support of observations at other wavelengths - radio and from space.
- Support of observations made with larger groundbased facilities.
- Support of astronomy education, including both a direct role in supporting student thesis research and an indirect role in providing opportunities for astronomy faculty in small programs or primarily undergraduate institutions to maintain front-line research programs.
- Support of projects requiring many hours of observing time, sustained observations over a long time, or coordinated observations by a number of telescopes (for example, for longitude networks).

Support of observations made with larger, groundbased facilities is generally considered to be a part of the primary mission of NOAO to provide state-of-the-art observing facilities by open access, and so there will be continued discussion (and a workshop this spring sponsored in part by the Gemini project) to identify the nature and number of telescopes this will require. Also, while there are short-term front-line research projects being carried out now primarily on small telescopes, most of these are expected to move to larger aperture facilities as the mean telescope size continues to increase. The emphasis of the Toronto workshop was therefore on the other functions: support for research at other wavelengths, support for education, and "big projects."

Another point made clearly at both of the workshops on small telescopes was that a number of different ways of building and operating such facilities are being experimented with or used in the community. Quite possibly some of these alternative modes of operation could be used as part of a plan to make effective future use of the smaller NOAO telescopes that will no longer be used and supported as they have been in the past.

A good way to get good ideas is to have many good brains thinking about a problem. In this case, the workshops provided one opportunity to collect good ideas. The next step will be a more formal announcement of opportunity from NOAO for proposals for the future use and operation of the smaller telescopes, with the 1.3-m telescope available now as a test case. Based on the discussions at the workshops plus ideas collected from other sources, this AO is likely to list as variables for consideration all of the following:

- How is the time allocated? This could be allocated by a TAC run by NOAO or another organization, it could be allocated by the organization that takes over operation, or it could be pre-determined by the function(s).
- What function(s) will this telescope serve? This could be several, one or all of dedication to a particular scientific project, open access, open access in support of research at other wavelengths, open access in support of education, or available by purchase or trade.
- Who operates the telescope? This could be NOAO on contract to another institution or consortium that provides the funding; it could be an independent operator on contract; or it could be the institution or consortium proposing a use for the telescope(s).
- How is the telescope operated? Examples of observing modes include classical (observing run) style, by remote access, or fully automated. In each, there are a range of possible levels of user-support that could be offered.
- What is the source of support for operating this telescope? This could involve applying for support for a particular function, for example education, to a private or public entity that supports this function. It could involve membership fees for a consortium used to support the telescope. It could involve "volunteer" services by faculty and technical staff at member institutions in lieu of cash expenditures.
- How are upgrades to the telescope and instruments handled? Without upgrades, facilities rapidly become less competitive, and demand for time decreases on a time scale of five to seven years. For NOAO facilities, planning for upgrades and new instrumentation is a prime responsibility for scientific staff. Under new operating plans, who would be responsible for such planning?
- How long will the telescope be operated in the proposed mode? If operation is for a specific program, what will happen to the telescope when the program is completed? If operation is dependent on external funding, what happens to the telescope if that funding is no longer available?

An issue not discussed at great length at either workshop, but clearly a part of the strategy for maintaining community access to the resources needed for competitive research programs, is the evolving role of key archival data sets. Some archival data sets have provided great opportunities for new activity - for example, IRAS, Einstein, IUE and increasingly HST archives. The searches for massive compact halo objects are yielding a tremendous collection of data on stellar variability. AAVSO archives now provide 100 years of data on variable stars. The Palomar Sky Survey is another example. It would be useful to have a systematic set of answers to questions such as: What characterizes data sets that are useful for archival research? What kinds of support are needed for effective archives? What data archives are likely to be available for research in the next decade? Are there sources of data that should be being archived but are not? Are there major surveys that should be undertaken in order to enable archival research? Also, in the same context, it would be important to examine the role of observations made with telescopes of various apertures in conjunction with archival research - it may be that following up on leads derived from archival research makes archival research contribute more to the demand for telescope time than it releases by providing an alternative opportunity. A workshop on this topic could be both timely and interesting.

Lee Anne Willson, AURA Observatories Council

NSF Provides Travel Support for Observing at Major Foreign Optical Telescopes

For several years the National Science Foundation has provided funding, administered by NOAO, to support travel to large or unique foreign optical telescopes. The telescopes normally covered by this policy include:

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Anglo-Australian Telescope (Australia)
European Southern Observatory (Chile)
Canada-France-Hawaii Telescope (Hawaii)
United Kingdom Infrared Telescope (Hawaii)
Las Campanas 2.5-m Telescope (Chile)
La Palma Observatory (Spain)
Special Astrophysical Observatory (Russia)
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The proposal for foreign telescope time should be initiated by the PI, who must be a US-based astronomer. Generally, the foreign observatory should not require a local collaborator as a condition for telescope time, and the presence of the US-based PI should be essential for the successful pursuit of the research program. Reimbursement under this program is not available to staff employed at national observatories.

Reimbursement covers round-trip airfare only. Subsistence and incidental expenses are not covered. Normally only one trip per fiscal year per investigator can be supported (our fiscal year begins 1 October).

To apply, send a letter requesting support and explaining why your presence is essential, together with a copy of your proposal and a copy of the letter or observing schedule that indicates you have been granted observing time on one of the above telescopes to:

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David De Young
National Optical Astronomy Observatories
PO Box 26732
Tucson, AZ 85726-6732
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Applications should be received at least one month before travel commences. Travel must be on a US carrier if available.

Sidney Wolff

Proposal Information for CTIO and KPNO Observers

Starting with observing proposals submitted for the March 1997 deadline for telescope time at KPNO, we will be using a new database system for handling proposal information. We hope to have the new system ready to receive CTIO proposals starting with the September 1997 deadline. The new proposal database is based on a modern, commercial database product and should allow us to handle proposals more efficiently, and to manage information with greater flexibility.

For the last few semesters, we have been tinkering with the LaTeX template and style file for proposals to ease the transition to the new database system. This coming semester is no exception. As usual, we urge you to obtain the most recent version of these files when you prepare your proposals. We hope the revised instructions will be clearer and that it will be easier to understand what information is needed in each of the fields.

Since proposal data are entered into the database automatically from the Latex-prepared proposals, and then reviewed and corrected by the staff of the Kitt Peak Support Office, we very much appreciate receiving proposals electronically using the LaTeX template. If you are having difficulty preparing your proposal or with the submission of figures, help is only an email message away. Queries sent to kpnoprop-help@noao.edu or ctioprop-help@noao.edu will be answered promptly. Of course, it is helpful to get those proposals in early, as we get swamped on the last day! Proposals for fall 1997 are due 31 March.

You can obtain the revised proposal templates and associated files by sending e-mail to kpnoprop-request@noao.edu or to ctioprop-request@noao.edu. Proposal files are also available by anonymous FTP to ftp.noao.edu (cd kpno/kpnoforms) or to ctio.noao.edu (cd pub/ctioforms). Information is also available through various links off the NOAO Web page at http://www.noao.edu.

Caty Pilachowski for the E-prop Team

Joint NOAO Nighttime Users Committee Report

Introduction

The Joint NOAO Nighttime Users Committee met in Tucson on 13-14 December 1996. Committee members present were Charles Bailyn (Yale), John Bally (Colorado), Suzanne Hawley (Michigan State), Martha Haynes (Cornell), Robert Mathieu (Wisconsin), Patricio Ortiz (Chile), Kristen Sellgren (Ohio State), Stephen Shectman (Carnegie), Verne Smith (Texas), and Michael Strauss (Princeton). Ben Snavely (NSF, NOAO Program manager) also attended the sessions. The committee split into CTIO and KPNO subcommittees for part of one day. KPNO subcommittee members were Mathieu (chair), Bally, Haynes and Smith. CTIO subcommittee members were Hawley (chair), Bailyn, Ortiz, Sellgren, Shectman and Strauss. The chair of the joint committee rotates between the CTIO subcommittee and KPNO subcommittee chairs; this year was the CTIO turn and Hawley was the joint committee chair.

As in previous years, the committee received written summaries of all presentations before the meeting, as well as published documents and summaries of important meetings that had occurred during the year. The committee heard reports from: Sidney Wolff on the status of the observatories (including the recent NSF review of NOAO, the operational vision for the future, the future of the small telescopes), and the NOAO management structure; David Silva on the continuing experiment with the WIYN queue scheduling; Todd Boroson on the Gemini project, particularly the current USGP activities and how the USGP is evolving within NOAO; Sidney Wolff on the NSF program to provide public access to private observatories; Gerald Cecil (North Carolina & SOAR Interim Project Scientist) on the current status of the SOAR telescope project; and Richard Green on the NOAO instrumentation program.

Status of NOAO Nighttime Operations

The committee was pleased to hear the NOAO Director present a positive vision for KPNO and CTIO in which both observatories continue to play a forefront role in national ground-based optical/IR astronomy in the Gemini era. This vision encompasses an array of telescope apertures, including the 0.9-m telescopes with Mosaic imagers in the short term and ultimately 2.4-m telescopes in both hemispheres. It also includes a fundamentally new perception of the observatories as systems, whereby each observatory provides a suite of capabilities for the planning, execution, and data reduction of a scientific program. Successful completion of programs will involve classical observing, queue and service observing at multiple telescopes, and access to databases, all facilitated within the context of the observatory. This approach will provide both superior scientific performance and enhanced efficiency through streamlining operations, avoiding duplication, and unifying processes and functions across sites (including Gemini). We endorse this forward-looking vision; it is essential to the future of the national observatories.

An NSF committee, chaired by Robert Kirshner, was charged with reviewing NOAO and the recent renewal proposal during the summer of 1996. (See last year's users committee report and electronic forum for extensive discussion of the renewal proposal.) Their review was generally positive, and they endorsed the vision presented above. However, parts of the renewal proposal were felt to be hastily prepared, particularly with respect to the 2.4-m telescopes for the northern and southern hemispheres. The NSF committee felt that justification of these telescopes in terms of Gemini support was not adequate; the telescopes must also be justified in terms of forefront scientific programs.

The users committee joins the NSF committee in urging NOAO to prepare a solid scientific case for the 2.4-m telescopes, and to submit a new proposal with all due speed. The continuing threats to the older small telescopes, coupled with the increasing maintenance costs, serve as a sharp reminder that these facilities will not last forever. We agreed to assist in the preparation and internal review of the proposal to provide a community perspective. It is also essential that the optical and infrared community provide broad support for the renewal of the national observatories, and communicate that consensus to the NSF. We must look to the future now, and these 2.4-m telescopes are essential components of both CTIO and KPNO in the Gemini era. This proposal should be a very high priority for NOAO in the coming months.

Turning from the future to the present, the observatories are still in a period of transition. Budgetary reductions and the resulting staff overload have forced the closing of telescopes, causing substantial distress within both the community and recent users committees. Out of this has come a clear and substantive recognition by NOAO that continuity in capabilities is essential as new facilities and instruments come on line and older facilities are retired. The current operations plan calls for the withdrawal of NOAO from the Burrell-Schmidt and the closing of the CoudÃ© Feed telescope in the next year. These closings will not occur until most of the capabilities are replaced; in the case of the Burrell-Schmidt by the Mosaic imager (a wide-field optical CCD camera) on the 0.9-m, and in the case of the CoudÃ© Feed by having a fiber feed from the 2.1-m to the coud spectrograph. The committee recognizes that replacement of old and progressively less useful facilities is inevitable, and indeed vital for the health of the organization. However, the goal must be replacement rather than simply removal. For these two telescopes, NOAO is taking the right steps to retain most of the capabilities for the community. We were emphatic in our recognition that the 0.9-m and 2.1-m telescopes have now become even more essential in the KPNO operation, and that these telescopes must not be closed, at least until the proposed 2.4-m telescopes are built.

Nonetheless, the proposed closings are not without capability loss, such as long slit high resolution spectroscopy and grism spectroscopy over wide fields. In addition, the number of telescope nights will be reduced. The total number of nights available is critical for synoptic observations, monitoring programs, and large surveys limited by setup time. Many forefront scientific programs require an extended series of nights on a small telescope at an excellent site. We recommend future consideration of the restoration of one or both of these facilities in a minimum-cost, high- efficiency mode.

Finally, the committee heard again of the extreme level of staff overload at both sites. The effort to operate the observatories with the kind of support that the community has come to expect, but with fewer people and less money, is continuing to take its toll on the dedicated staff that remain. As always, the committee wishes to take this opportunity to express our sincere appreciation for their efforts, and to urge the NOAO management to find relief in whatever ways are possible. Having fewer meetings was an option which was universally endorsed.

NOAO Management

The NOAO Director and the users committee agree that there is an urgent need for a person to take over the responsibilities of KPNO Director. This person must be an advocate for KPNO within NOAO, and be a liaison with KPNO personnel and the community during the current period of transition. In addition, this person must bring a dynamic vision for the future of KPNO to the development of the 2.4-m telescopes proposal.

In order to immediately address this need, the NOAO Director recommended that Richard Green take on the duties of Kitt Peak Director in addition to his responsibilities as head of Instrumentation. The committee endorsed this recommendation, recognizing the urgency for filling this position and the strong qualifications which Richard brings to both the guidance of Kitt Peak through this difficult time and the development of the proposal. At the same time, the committee expressed concern regarding the ability of one person to handle both positions effectively (particularly in light of a scheduled sabbatical).

The committee sees this only as an interim solution. We feel strongly that an independent KPNO Director (with the same authority as the CTIO Director, head of instrumentation, and USGP Director) should be appointed, after an open search, within two years. At that time we anticipate that KPNO will have attained a stable complement of telescopes and that the status of the 2.4-m telescopes proposal will be resolved.

The NOAO Director also recommended that all user interface development be transferred to the USGP office. The idea is to unify the user interfaces throughout NOAO as the Gemini telescopes become operational. The committee endorses the goal of streamlining operations and agrees that this is an appropriate responsibility of the USGP office (see Gemini section below).

WIYN Queue

The WIYN queue observing program has been much more effective this year than last. The committee commended David Silva for his forthright acknowledgement of last year's problems, and noted that many of the recommendations from last year have now been implemented - namely, restricting the amount of time spent on a given program to the amount awarded by the TAC, providing better feedback to the users about the status of their programs, and making the queue form that must be submitted with the initial proposal simpler by requiring less detailed information. The telescope itself is also performing more reliably now after an initial period of commissioning. The completion rate of programs in the highest rank queue is now quite high, and the user satisfaction is reportedly also much higher. In addition, the lessons being learned about both scheduling and operating the queue have already proved valuable in continuing discussions of the proposed Gemini queue operations and staffing levels. The committee endorsed the continuation of the queue experiment for another year. At the same time, the committee strongly recommended that NOAO undertake a cost-benefit analysis of the WIYN queue observing program. (The cost of the program is about 2.2 FTE.) A decision will probably be made during the next year about whether to continue to operate the WIYN queue in the future. As usual, if members of the community have strong views, they are encouraged to contact a users committee member.

Community Access to Private Observatories

Two private observatories will soon be participating in the NSF program whereby funding for large instruments is tied to providing telescope access to the community. These are the Hobby-Eberly telescope facility, which will provide ~ 27 nights/year for a period of six years, and the MMT-upgrade facility, which will provide ~ 24 nights/year for a period of six years. It should be noted that the community access is to the facility as a whole, and is not restricted just to the instrument that was funded by the NSF. NOAO's responsibilities under this program are to 1) solicit and evaluate proposals; and 2) establish the approach to observing for community users and provide support and interface between them and the private observatories.

The committee endorsed the idea of the program, but was concerned that community observers might not have adequate support or experience to make effective use of the observing time. The committee was particularly concerned that adequate documentation be provided to the community both during the proposal process and during the actual observing. We discussed ways to promote efficiency, and suggested that queue and service observing are attractive options. An alternative observing mode would be dedication of the private observatory time to long term projects, which would reduce the number of users but enable those users to obtain more useful results. All of these modes should be explored while negotiating the program agreements between NOAO, the NSF and the private observatories. We recommended that users committee members participate in the review of the agreements. The users committee representatives were chosen to be Verne Smith for the HET facility and Bob Mathieu for the MMT facility.

Gemini

The Gemini project is proceeding on schedule for first light at the Mauna Kea site in December 1998, and first light at Cerro Pachon in June 2000. The USGP is ramping up its effort, with the first scientific staff hirings this year. Much of the USGP effort will soon be directed to the definition of the interface between Gemini and the US community. This includes, for example, providing the information necessary to submit proposals; setting up the TAC process; working with users to define queue programs and prepare for classical observing; and providing data reduction tools. In general, Gemini has a "sea-level to sea-level" policy, and anything that is done before or after the actual observing run is the responsibility of the project office in the partner country. The goal of the USGP is to coordinate with the rest of NOAO so that the community has only one set of proposal deadlines, forms, and so forth to deal with. This goal is reflected in the assignment of Todd Boroson to undertake both the direction of the USGP office, and the user interface for NOAO as a whole, in the management structure discussed above. Other user interface issues include future IRAF development, compatibility with private observatories, archiving and access to archives, and information access for the community (for example, finding out what observing capabilities are available on the various telescopes operated by NOAO and the private observatories).

A second Gemini issue of current importance to the community is an upcoming workshop on the telescope, instrument and software capabilities required to prepare for a successful Gemini run. The users committee certainly will want to send one or more representatives to such a workshop. It is vital that the general community user, without access to private observatory facilities, be on an equal footing in applying for Gemini time. This issue speaks directly to the maintenance of strong national observatories at Kitt Peak and Cerro Tololo, with telescopes and instruments spanning a full range of capability. An electronic forum discussion may also be forthcoming concerning what capabilities are required to support Gemini observations.

SOAR

The committee congratulates NOAO and the SOAR partners (Brazil, Michigan State University, University of North Carolina) for forging the foundation of a successful consortium. Along with WIYN and Gemini, the SOAR telescope exemplifies the vital future of NOAO. The committee supports the ongoing exploration of innovative designs for the SOAR telescope. Once the scientific trade-offs between designs are clarified, NOAO will solicit community opinion in order to guide their contribution to the selection process. User committee members John Bally and Michael Strauss will act as liaisons between NOAO and the community in this process.

Instrumentation

The NOAO instrumentation group is currently working on several large programs. The committee was very pleased to hear that Phoenix (high resolution infrared spectrograph) and Mosaic (large format CCD camera) were both tested on small telescopes during the fall semester and appear to be nearly ready for integration as user instruments. Mosaic still suffers from poor CCDs, and the committee heard that good thin chips are being acquired with all possible speed. More generally, the need for continuous access to wide-field optical imaging in both hemispheres was widely recognized. Thus, a Mosaic clone (to be used on the Blanco and Mayall 4-m telescopes, and the KPNO 0.9-m telescope) and a mini-Mosaic camera for WIYN were endorsed as highest priority new starts. Another instrument currently being fabricated is the Hydra clone for the CTIO 4-m. The committee noted the top priority it gave last year to this instrument as a new start, and expressed satisfaction that it is already entering the construction phase.

The committee also discussed wide-field near-IR imaging. The plans for the future include GRASP for the north, and upgrades to COB and SQIID for the south. The committee considers the scientific capabilities provided by GRASP, including both a wide-field near-IR imaging mode and a long-slit spectroscopic mode, to be essential for the north. To that end, we endorse a joint effort between Ohio State and NOAO to build GRASP. If the GRASP design produced by Ohio State cannot be built within the NOAO budget or Ohio State's resources, then an alternate design for an instrument with GRASP's scientific capabilities should be pursued with Ohio State, or an alternate partner sought.

The committee was also asked to comment on the need for a new GoldCam for the 2.1m. The committee identified a clear scientific need for moderate resolution spectroscopy on the 2.1-m - examples include survey projects of relatively bright objects and spectroscopy of extended sources. We find it wasteful and inefficient to have a detector on the current GoldCam which can only be used over part of its length due to the inability to focus at the edges. Furthermore, the committee does not anticipate that the demand on the 4-m for moderate resolution spectroscopy will diminish until well into the Gemini era; thus access to this capability on the 2.1-m will remain important for the foreseeable future. We strongly urge that the new GoldCam be completed in a timely manner.

We discussed the WIYN telescope and instrumentation at some length, and came up with two specific recommendations. First, WIYN provides the best images on the mountain, yet there is no substantial effort underway to achieve forefront angular resolution. At least a tip/tilt capability should be developed. The committee recommends that achieving high-angular-resolution imaging at WIYN should be a high priority in the next year. Second, opportunities for bright-time usage of WIYN are inadequate, as reflected in the present low subscription. This is unacceptable for a state-of-the-art telescope. Possibilities for bright time instruments include upgrading Hydra with a near-IR detector, or providing a wide-field IR imager. The near-IR Hydra capability was endorsed as a particularly interesting option (for both the northern and southern versions of Hydra). In general the committee felt that all possible effort should be made to ensure that the WIYN telescope performs to the limit of its capabilities, and that it is provided with forefront instrumentation.

Finally, the committee was asked to comment on the options for a new instrument, possibly with a start in 1998. A high throughput optical spectrograph was generally endorsed, but the committee agreed that more input from the community would be useful, perhaps through the electronic forum.

Other Issues

Two other issues were discussed briefly. NOAO is experimenting with a small scale graduate student training program, where students spend a period of 1-2 months living at the observatory and participating in the day-to-day technical aspects of observatory operations (e.g. instrument changes, service observing, assisting telescope operators, etc.). It is also possible that students could participate in small research programs in cooperation with NOAO scientific staff. The goal is to provide some aspects of graduate student training in observational astronomy that are not generally available to those students at institutions without privileged access. The committee felt that the philosophy of the program was a good one, but was concerned that the implementation could cost the observatories money (in short supply at the moment), and might impact negatively on the staff if the students were not well chosen. However, we endorsed continuing on a case-by-case basis, with the hope that the universities will absorb the students' costs in exchange for the opportunities being offered. Interested parties should contact Richard Green for more details on this program.

The second issue was the potential competition of the AURA cooperative agreement for the operation of NOAO at the end of the current term. While the committee felt that competition might, in principle, be a good idea, the current lack of definition of the ground rules for the competition process is resulting in serious morale problems among the observatory staff. If the NSF indeed intends to hold such a competition, it needs to clarify the process as soon as possible. We also urge the NSF to define the competition in such a way as to protect the integrity of the observatory infrastructure, particularly its staff.

KPNO Subcommittee Report

While all of NOAO suffers from excessively limited resources, each subcommittee met to discuss the implications unique to their observatory.

One of the most critical issues facing Kitt Peak operations is the retention of observing support personnel. Highly talented, well trained, and dedicated staff are as critical to successful astronomical observations as the telescopes themselves. KPNO continues to attract the highest caliber people to observing support. However, in recent years KPNO has not been as successful at retention. The cost is high in terms of lost investments in training, a paucity of highly experienced personnel, loss of institutional knowledge, a lack of continuity for astronomers, and morale. This situation is recognized by NOAO and a plan has been developed to address it.

While the reasons for turnover are diverse, several that can be pointed to are lack of career advancement opportunities, burnout from continuous night shifts, and too limited communication with supervisory staff who work days. The proposed solution is to integrate the telescope operators more broadly with mountain support through regular daytime shifts. Examples include involvement in observer start-ups, support of telescope services and programming, daytime technical assistance, etc. Increased service observing activities would also integrate telescope operators more closely with the science itself. In addition, the creation of a supervisor of observing support provides the day-to-day leadership and advancement opportunity.

Recognizing that this plan may require reductions elsewhere in mountain operations, the users committee strongly endorses this reorganization of duties. We are confident that this will lead to both enhanced fulfillment and reduced stress for the observing support staff. Furthermore, this plan will naturally lead to a greater level of technical expertise on the mountain at night, somewhat offsetting the steady reduction in nighttime technical support. Finally, increased knowledge of the instrumentation will lead to better support of data collection. We recommend that KPNO develop and execute this plan as soon as possible, and urge the inclusion of observing support personnel in the process.

Bruce Bohannan provided a report on improvement projects completed during the past year and plans for FY 1997. The committee admires and appreciates the progress being achieved in spite of resource limitations, and supports the careful and focused prioritization of improvement activities. The top priority has been improvement of image quality at the Mayall 4-m. Median seeing has improved to about 1" due to support refurbishment and quantitative collimation during the 1996 summer shutdown. The committee endorses continued efforts to improve the 4-m performance, including ventilation of the dome, secondary encoding for repeatable collimation, and controlled air flow over the primary.

In accord with the NOAO shift toward a systems approach to observing capabilities, Bohannan is developing a presentation of KPNO capabilities which is organized by function rather than telescope and instrument. Envisioning the observatory as a unified system with a variety of capabilities, and providing interfaces which guide prospective users through the system (e.g., a smart Web page), is a powerful approach which the committee heartily encourages.

The committee was encouraged by the development of a positive vision KPNO's future. While the imminent closing of the CoudÃ© Feed and the withdrawal from the Burrell-Schmidt will be painful, the development of a fiber feed to the coud spectrograph and the Mosaic camera on the 0.9-m retain many of the capabilities. Furthermore, the presence of Mosaic at the 0.9-m places this telescope at a forefront of imaging work, and provides compelling justification for continued support and upgrades of the 0.9-m until a future generation telescope is built on Kitt Peak. The recent NSF review endorses the future of KPNO as a vital and necessary observatory with WIYN, the Mayall 4-m, and a new generation 2.4-m telescope. We add our endorsement of that vision as well.

Working within this plan, the committee raised two specific concerns. First, the future of WIYN is not being adequately promoted by NOAO. WIYN is the state-of-the-art telescope on Kitt Peak, and yet does not play a prominent role in future instrumentation plans. Even at present WIYN is not oversubscribed in bright time. The committee recommends that NOAO greatly increase the profile of WIYN in both present and future development of KPNO.

Second, the Mosaic camera will serve both the 4-m and the 0.9-m telescopes, with the 4-m having priority. KPNO needs to consider innovative uses of the 0.9-m when the Mosaic is not available. Directed support of synoptic or monitoring programs should be considered, perhaps with a service component. The latter might be linked to graduate student training. At the same time, the use of the Mosaic camera on the 0.9-m will likely raise the operating costs of this telescope. It is essential that this be recognized and incorporated in KPNO planning. The vision of the 0.9-m as replacing the capability of the Burrell-Schmidt demands adequate planning in the face of future budget constraints.

CTIO Subcommittee

Much of the CTIO subcommittee discussion centered on the future of the telescopes currently at the site and those proposed to be built. The committee agreed that the 2.4-m telescope for the south should be identical to the one in the north. That is, it should be designed for both optical and IR imaging, and the idea of making the telescope compatible with Sloan Digital Sky Survey instrumentation should be tabled for the near term. A radical suggestion was made that a "telescope farm" of perhaps four 2.4-m telescopes could be built quite cheaply, and would go a long way toward providing the kind of commodity time that the community clearly wants. This suggestion met with general approval, but may be too ambitious at the moment. In any case, the 2.4-m telescope(s) proposal was seen to be a very high priority for CTIO as well as for NOAO as a whole.

Of the currently operating telescopes, the Yale 1m is in the process of being privatized with a consortium from Yale, Portugal and Ohio State. The ASCAP is to be replaced with an optical/IR imager provided by Ohio State, and the telescope will be operated in a queue observing mode optimized for synoptic and target-of-opportunity observations. Under the plan now being finalized, the NOAO users community will retain a 10% share of the telescope; thus users will have an opportunity to propose for these kinds of observations. The Curtis-Schmidt will remain in operation for a period of perhaps two more years, and discussions are underway with the University of Michigan regarding ways to continue its operation beyond that. The 0.9-m and the 1.5-m are planned to continue operating for the foreseeable future, at least until the status of the proposed 2.4-m telescope(s) is decided.

There are several new private telescope projects on the mountain, including the 2Mass survey telescope, an Hα survey instrument, and a USNO telescope. On the whole, the CTIO operation appears to be in excellent shape after a painful period of downsizing in the past few months. We commend the CTIO Director for his leadership during this period and hope that the situation will now be stable through the period of Gemini commissioning. We also heartily endorse the recommendation that the NSF take over responsibility for meeting exchange rate fluctuations.

The committee also discussed the SOAR telescope and was enthusiastic in its endorsement of the project and excited by the prospect of a new 4-m telescope in the South. The possible new science capabilities of a low scattered-light design were thought to be of interest to the community, and we look forward to seeing a more detailed discussion when the current studies are completed. The ability to accommodate Gemini instrumentation was seen as an important aspect of SOAR, providing that this can be accomplished in a cost-effective way. The committee agreed that a near-infrared spectroscopic capability at SOAR was a very high priority, whether or not SOAR is able to share Gemini instrumentation. Malcolm Smith presented airflow models suggesting that turbulence induced by a large dome at the site of the current 16" dome on the CTIO summit, which is being considered as a site for SOAR, might impact on the seeing at the Blanco 4-m. Although the committee thought that the models were inconclusive, we were emphatic that the SOAR telescope should not be sited where it would have an adverse effect on the Blanco seeing. The committee also concurred with the NSF review panel in urging the NSF to provide adequate funds for the operations phase of SOAR.

The ongoing improvements to the 4-m optics have made a quantitative difference in the median image quality. The tip/tilt f/14 secondary should be in normal operation in the next year, with the goal of delivering 0.25" images in the K-band. The current instrumentation project for CTIO is the Hydra clone (in fabrication). The Mosaic clone (highest priority next start) will allow continuous access to wide-field imaging in both the north and the south. In addition, an Aladdin array will eventually be installed in the IRS to upgrade the IR spectroscopic capability. There are a few planned upgrades to the 1.5-m telescope/building including dome ventilation, control system upgrade and improvements to the f/13.5 and f/7.5 secondary mirrors and supports. These are considered to be fairly low cost, intermediate steps to be undertaken rather quickly, while the 1.5-m telescope is required to bridge the gap between the current telescope complement, and that expected in the early 2000's. The committee endorsed these instruments and improvement plans.

As with NOAO in general, the staff at CTIO is heavily overworked, and the loss of postdocs has in particular had an adverse scientific effect. The committee recommends strongly that NOAO take steps to regain the normal staffing level at CTIO, especially with regard to postdocs. We also want to take the opportunity to recognize the excellent working relationship between the Chilean staff and CTIO, and our hope that this continue in the future.

Concluding Remarks

In summary, the committee was pleased with the positive tone and forward-looking plans for the future of the observatories. Times are changing; the community will soon have more aperture-nights and fewer telescopes than in the previous 30 years. The transition period we are currently experiencing has not been pleasant, but we are optimistic that both KPNO and CTIO will continue to provide the forefront capabilities that the community needs to be competitive. Both NOAO and the user community must be willing to accommodate change during this difficult period.

Communication between the observatories, the funding agency, and the community was a topic of discussion throughout the meeting. There was widespread acknowledgement of important communication gaps between NOAO, NSF, and the user community. Their origins are several. The memberships of NSF review panels do not adequately reflect the user community. In particular, scientists of the very highest caliber are becoming more and more widely distributed within the academic community. NOAO plays an essential role in support of research at smaller institutions, not just for education but for the production of superb science. Review panels must reflect this demographic change, and more generally the NOAO user community, to enable the NSF to better understand community needs and opinion. Communication between NOAO and the community has also been limited, and the result has been numerous misperceptions on both sides. NOAO must make available the background information necessary to promote a useful dialogue, and incorporate the community in the development and review of planning and proposals. At the same time, the community must make the effort required to develop informed opinions. Perhaps most importantly, it is essential that all of these endeavors foster a trust that has been missing of late.

The committee recognizes that the education of the community and the promotion of better communication between the various segments of the community is a high priority, and charged itself to take on a more active role. For example, this report will be posted on the Web with links to additional information made available to the committee during our meeting. The electronic forum will be continued; likely topics in the next year include the upcoming Gemini workshop, the SOAR telescope design, science with the 2.4-m telescopes, and new instrumentation at NOAO. The users committee is also considering holding discussions at AAS meetings, in order to promote better communication between NOAO and the community. Other ideas are welcomed.

Finally, as always, we urge the community to work together to promote astronomy as a whole. A strong and vital NOAO is essential for many of us, and we welcome your comments and suggestions. Please contact any users committee member, or next year's chairperson Bob Mathieu, with your ideas and concerns (mathieu@madraf.astro.wisc.edu) .

Suzanne Hawley, Bob Mathieu and the Members of the Users' Committee

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NOAO Educational Outreach

Project ASTRO-Tucson Update

The Project ASTRO-Tucson two-day training workshop took place in November and brought 23 teams of teachers and astronomers together to learn hands on activities for teaching astronomy in the classroom. Many astronomers have already made their initial classroom visits. Some have returned with humorous and insightful drawings showing what the students expected an astronomer to look like. All have returned with a heightened sense of purpose and optimism for the coming semester. Our activities continue with a follow-up workshop at NOAO in January, and star parties at the Arizona-Sonora Desert Museum and Kitt Peak National Observatory later this spring. Highlights of the workshop agenda, including photos, can be viewed on-line at URL http://www.noao.edu/education/agenda1122.html.

Instructional Materials

Two new brochures for classroom use are nearing completion at this writing. Funded by a NASA IDEA Grant and capitalizing on the high level of interest in Comet Hale Bopp, "*Visitors From Space*" conveys accurate science information about comets in a popular format to supplement the media headlines. In the second brochure, a color CCD image and flyspanker are used to determine "*The Age of the Jewelbox Star Cluster*." This project helps to develop measuring and estimation skills. Both exercises are intended primarily for middle school students and have been developed by Outreach Advisory Board teachers working with NOAO staff. More information about these materials and all NOAO Educational Outreach Activities can be viewed at URL http://www.noao.edu/education/noaoeo.html.

Suzanne Jacoby
Project ASTRO-Tucson Program Director
NOAO Education Officer

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Cost Savings

We frequently hear the comment that all of the budget reductions are falling on observing support-why aren't reductions being made in other aspects of the program? In fact they are. All of the NOAO staff is committed to focusing as much of our resources as possible on our final product - the acquisition of data. The following two articles summarize some of the recent successes in reducing the costs of operating facilities in Tucson and on Kitt Peak.

Facility Operations: Tucson

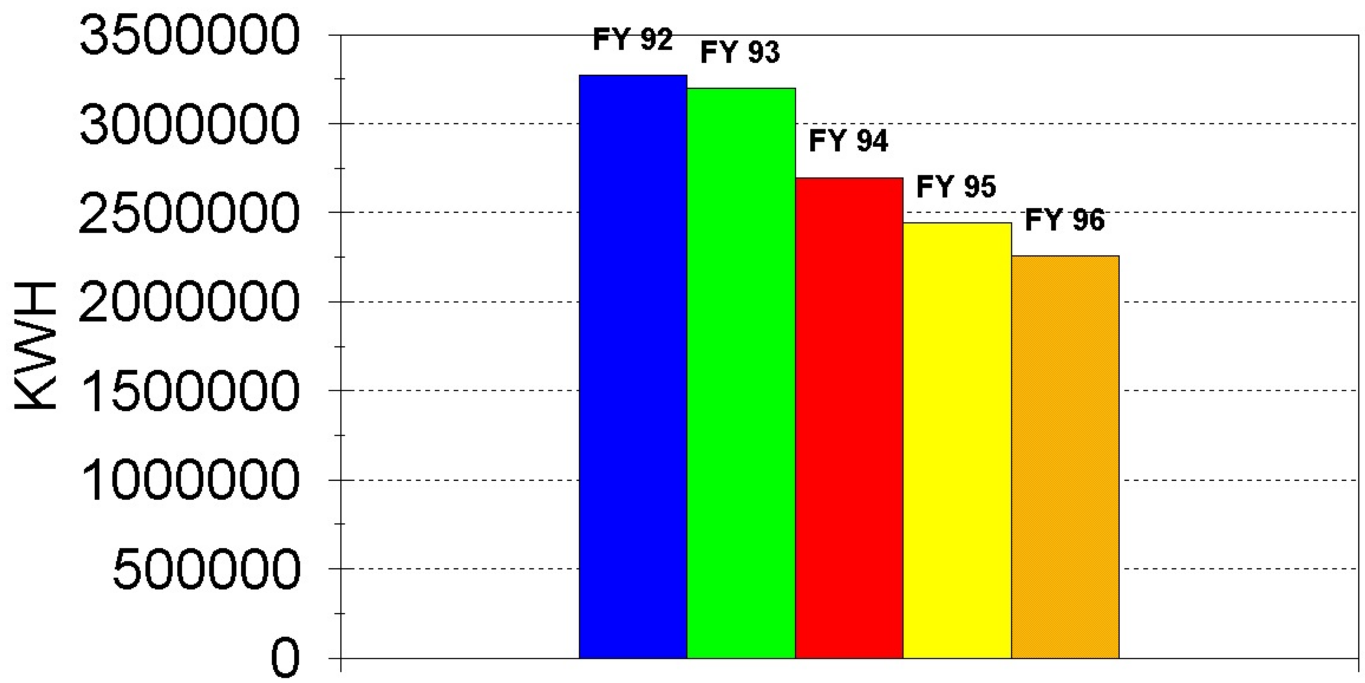
Operation of the NOAO/Tucson facilities has undergone a significant transformation over the past five years. Due to budget reductions, the FY 1996 budget was 12% below FY 1992 levels. Through attrition, separations and retirements, the Tucson facilities staff has been reduced by nearly 40 percent (7 FTEs) since FY 1992 with their duties either out-sourced or assigned to remaining staff. Also during this period full-scale operations of both the GONG and Gemini programs placed increased demands upon a reduced facilities staff.

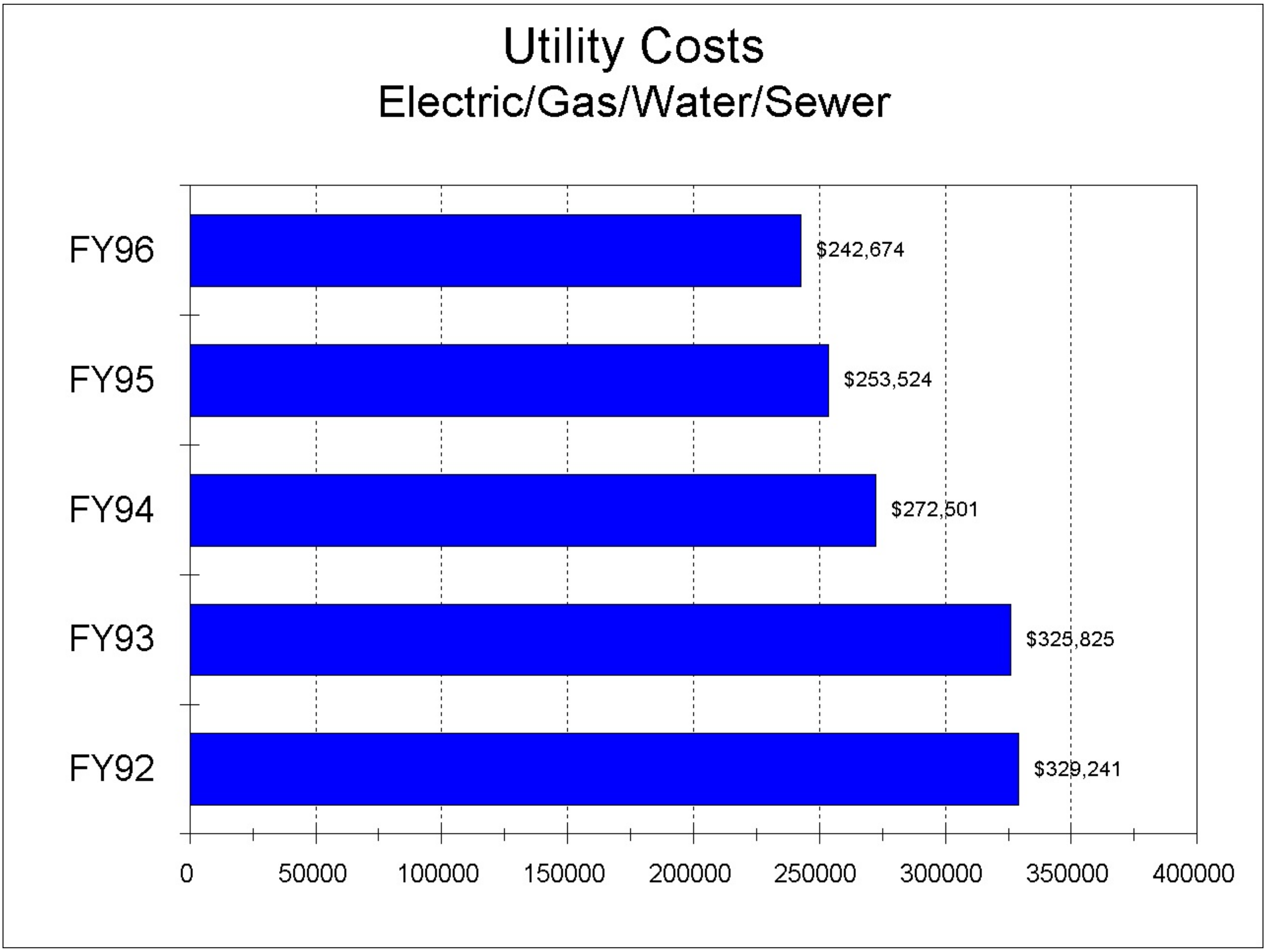
To accommodate these changes in staffing and program scope, the Tucson Facilities staff has focused their efforts upon controlling, stabilizing and, where possible, reducing facility operations costs. Custodial and boiler/chiller maintenance were successfully out-sourced for a 20% savings below FY 1992 levels. Staff efforts have also helped to reduced office supplies and postage costs by 25% since FY 1992.

In an effort to reduce increasing utility costs, a multi-year energy conservation plan was developed and initiated in late FY 1992. This program, which focused upon the installation of a building energy management system, energy efficient motors, and lighting systems, has significantly reduced electrical energy consumption (see Graph 1). This effort has resulted in minimizing the effects of utility rate increases (approximately 7% during this period) while reducing costs to an average of 25% below FY 1992 levels (see Graph 2).

Electric/KWH Usage

950 N. Cherry





Facility Operations: Kitt Peak

We now wish to extend these same approaches for reducing facilities maintenance costs to Kitt Peak mountain. The operation of Kitt Peak is not limited to telescopes but also incorporates the operation and maintenance of an extensive infrastructure system. During FY 1996, in an effort to consolidate operations and control costs, administration of Kitt Peak (KP) and Tucson facilities was placed under a single manager. Within the KP facilities group, budget reductions resulted in a staff reduction of 20 percent (3 FTEs) during FY 1996. The combined facilities staff is now focusing their efforts on implementing operational changes that should control and reduce costs. An in-depth review of the facilities and of space utilization is in progress. The Tucson staff is helping to develop an energy conservation plan, which incorporates the installation of energy efficient lighting and monitoring electrical consumption to identify high-use areas. A program has been initiated to expand the installation of water conservation fixtures both to reduce water processing costs and increase conservation. All of the facilities staff personnel are actively identifying areas for cost reduction while also working to improve the maintenance program. Refuse services were out-sourced in FY 1996 to produce a net savings of FTE. Large maintenance contracts are being reviewed and revised to ensure competitive quotations. As an example, annual savings of $7K were realized with the rebid of the elevator maintenance contract.

Within the food services group, efforts have also focused on controlling costs. Operational changes, primarily involving a change to a light sandwich-based lunch, have been implemented to reduce food costs, and kitchen staffing has been reduced by 25 percent (2 FTEs). Additional changes are being evaluated with the goal of continuing these cost reduction efforts, and food service costs are reviewed on a regular basis to maintain accountability for charges for meals served.

We welcome additional suggestions from both observers and staff for ways to reduce costs.

John Dunlop, Sidney Wolff

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NOAO Preprint Series

The following preprints were submitted during the period 1 November 1996 to 31 January 1997. Please direct all requests for copies of preprints to the NOAO author marked with an asterisk.

727 Stenflo, J.O., *Keller, C.U. "The Second Solar Spectrum: A New Window for Diagnostics of the Sun"

728 *Keller, C.U., Harvey, J.W., Barden, S.C., Pilachowski, C.A., Hill, F., Giampapa, M.S. Asteroseismology from Equivalent Widths: A Test of the Sun and Methodologies for Stellar Observations"

729 *Sarajedini, A., Layden, A. "Reddenings, Metallicities, and Possible Abundance Anomalies in Young Globular Clusters"

730 *Broels, A.H., *Courteau, S. "Modeling the Mass Distribution in Spiral Galaxies"

731 *Sarajedini, A. "Palomar 14: A Young Globular Cluster in the Outer Galactic Halo"

732 *Kuhn, J.R., Bogart, R., Bust, R., Sa, L., Scherrer, P., Scheick, X. "Precision Solar Astrometry from SOHO/MDI"

733 *De Young, D.S "How Do CSOs Grow Old?"

734 *Penn, M.J., Allen, C.L. "He I 1083 nm Oscillations and Downflows Near the North Solar Pole"

735 Cavallo, R.M., *Pilachowski, C.A., Rebolo, R. "Oxygen Abundances in Metal Poor Subgiant Stars from the O I Triplet"

736 *Massey, P. "Observations of the Most Luminous Stars in Local Group Galaxies"

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Other NOAO Papers

Preprints that were not included in the NOAO preprint series but are available from staff members are listed below. Please direct all requests for copies of these preprints to the NOAO author marked with an asterisk.

Baldwin, J.A. "Broad Emisson Lines in Active Galactic Nuclei"

Beckers, J.M. "Progress Report on a Feasibility Study of a Large Optical/Infrared Solar Telescope (CLEAR)"

Cacciani, A., Moretti, P.F., DiMartino, V., Jefferies, S.M. "Search for Alfven Waves in Active Region Magnetic Fields"

Cacciani, A., Moretti, P.F., DiMartino, V., Jefferies, S.M "Search for Alfven Waves in the Solar Atmo sphere"

Christou, J.C., Hege, E.K., Jefferies, S.M. "Post-Processing of Adaptive Optics Images"

Cimatti, A., *Dey, A., van Breugel, W., Hurt, T., Antonucci, R. "Keck Spectropolarimetry of Two High z Radio Galaxies: Discerning the Components of the Alignment Effect"

Feldmeier, J.J., Ciardullo, R., *Jacoby, G.H. "Planetary Nebulae as Standard Candles. XI. Application to Spiral Galaxies"

Hall, P.B., Ellingson, E., *Green, R.F. "X-Ray Emission from the Host Clusters of Powerful AGN"

Harvey, J.W., Jefferies, S.M., Duvall, T.L., Osaki, Y., Shibahashi, H. "Studies of Solar Oscillation Background Spectra"

Harvey, J.W., and the GONG Team "GONG Instrument and Science"

Hunter, D.A., Vacca, W.D., *Massey, P., Lynds, R., O'Neil, E.J. "Ultraviolet Photometry of Stars in the Compact Cluster R136 in the Large Magellanic Cloud"

Jefferies, S.M. "Deciphering the Enigma of Sunspot Formation"

Kennedy, J.R. "Effects of Polar-Angle Errors in Imaged Helioseismology"

Leitherer, C., Schommer, R.A.. et al. "A Database for Galaxy Evolution Modeling"

Lin, H., Penn, M., Kuhn, J.R. "He I 10830 A Polarimetry" A New Tool for the Study of the Filament Magnetic Fields"

Korista, K., Baldwin, J., Ferland, G., Verner, D. "An Atlas of Computed Equivalent Widths of Quasar Broad Emission Lines"

Kraft, R.P., Sneden, C., Smith, G.H., Shetrone, M.D., Langer, G.E., *Pilachowski, C.A. "Proton Capture Chains in Globular Cluster Stars. II. Oxygen, Sodium, Magnesium, and Aluminum Abundances in M13 Giants Brighter than the Horizontal Branch"

Meech, K.J., Buie, M.W., *Samarasinha, N.H., Mueller, B.E.A., Belton, M.J.S. "Observations of Structures in the Inner Coma of Chiron with the HST Planetary Camera"

Schmidt, R. "On the Optimization of CCD Readout Noise"

Simon, G.W., Weiss, N.O. "Kinematic Modeling of Vortices in the Solar Photosphere"

Smith, R. "How Linear are Typical CCDs?" Available by anonymous ftp to ctio.noao.edu as file /pub/roger/linearity_paper.ps.Z

Smith, R. "Application of the Arcon CCD Controller to the NOAO 8K Mosaic Imager." Available by anonymous ftp from ctio.noao.edu as file /pub/roger/mosaic_paper.ps.Z

Smith, R. "Readout Speed Optimization for Conventional CCDs Employing Dual Slope Integration for Double Correlated Sampling." Available by anonymous ftp from ctio.noao.edu as file /pub/roger/speed_paper.ps.Z

Stenflo, J.O., Bianda, M., Keller, C.U., Solanki, S.K. "Center-to-Limb Variation of the Second Solar Spectrum"

John Cornett, Suzan Ecker,
Elaine Mac-Auliffe, Jane Marsalla,
Shirley Phipps, Cathy Van Atta

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Small Telescopes and Educational Outreach at CTIO 1997-2002 and Beyond

The following new projects, ranging from 3-cm to 8-m aperture, are currently underway at CTIO. (For some of the smaller projects I am assuming that current draft Memoranda of Understanding (MOUs) do progress to fruition, as seems likely):

```
Gemini South - 8-m
SOAR - 4-m
2MASS South - 1.3-m
Yale/OSU/U.Lisbon/NOAO - 1-m `privatization' consortium
USNO southern astrometric survey - 20-cm
Swarthmore robotic southern Ha survey - 3-cm
```

Discussions are in progress on several other projects of various sizes, which we will report if they reach the point of an exchange of MOUs.

In the last *NOAO Newsletter* (October 1996) we announced that sources have now been identified for the US$42M estimated to be needed for the construction ($21M), commissioning ($1M), instrumentation ($6M), and operation ($14M) of the SOAR 4-m telescope. During the first half of this year we expect to conclude the project definition and scientific requirements phase, sign an interim agreement and hire a project manager to begin the SOAR project.

This will complete the preliminary phase of the current long-range plan at AURA to set up the larger-telescope end (Gemini South 8-m, SOAR 4-m and refurbished Blanco 4-m telescope) of a suite of general-user, southern-hemisphere, ground-based facilities for open competitive access to the general research community. The plan is fully consistent with the NAS decadal review for the 1990s and the report of the McCray panel on the future of NOAO.

Some of our planning energies can now be used to address the medium and small end of the aperture spectrum and provide a broader foundation for our pure research activities - to include all-sky surveys, along with educational and public outreach. Later in the year, under the auspices of a USGPO workshop and then a Gemini-sponsored international workshop, we will consider aperture requirements in the intermediate range of 2-m to 4-m. For example, even when the 2MASS near-IR survey is complete, we will still have a gap of at least 5 magnitudes between the faint limit of that survey at K (2m band, in both Northern and Southern hemispheres) and the magnitude level at which we expect to be doing spectroscopy with the Gemini telescopes. This is a situation that we cannot allow to continue further into the future; nevertheless, until the Gemini workshop takes place, work on the middle part of our "aperture pyramid" will have to wait while we gather more information.

```
            8-m Gemini South

        4-m SOAR           4-m Blanco
```

The *aperture pyramid*, 1997-2002.

This article will be concerned with the bottom (foundation) end of the aperture pyramid, telescopes of aperture <2-m. In conjunction with the NOAO user community, the NOAO Public Information Office (PIO), and following conversations with Kathy Wood in the US Gemini Project Office, Susana Deustua of the LBL "Hands-on Universe" Project, Jose Maza of the Department of Astronomy in the University of Chile, and local officials in La Serena and Vicua, we are considering how to address the application of small-aperture telescopes to research, teaching and outreach (to the public and to high-school and college classrooms). This activity will probably include members of the SOAR consortium as that project prepares to come on-line. We have been greatly encouraged by recent conversations with Saul Perlmutter and Aaron Canales, about the possibilities of providing increased communications bandwidth between the US and Cerro Tololo, at least prior to the arrival of the longer-term upgrades necessary for Gemini and SOAR operations here. More in the next *Newsletter* if these lead to positive results.

Our users have correctly reminded us that these small telescopes (diameter < 2-m) are the foundation of the whole research structure at NOAO. Here, for example, we have the best opportunities for direct day-to-day interaction with the teaching activities of AURA's member institutions - which, like the construction of large, state-of-the-art facilities, has much to do with securing a healthy future of our science and for our community, at a time when the impulse of funding into science and technology as a result of the Cold War is now over. Over the next 1-5 years the current 64Kbit/s bottleneck in international communications between US facilities in Chile and institutions at home in the US (and with our other international partners) will, one way or another, be removed. We are starting to prepare for the first time to play an active, on-line role in classroom and lecture-room activities in the US and in Chile. In conjunction with the newly-energized NOAO public information office (PIO) in Tucson, we are seeking to broaden our contacts with interested institutions in the US and Chile. More details will follow in a future *Newsletter* article - meanwhile, please contact me if you are interested in being able to help.

The results of the NOAO sponsored sessions on small telescopes at the Toronto AAS meeting are summarized in the Director's section of this *Newsletter*. What follows is an initial report on implementation of those recommendations in Chile:

Global Networks of small telescopes

A collection of some fairly recent papers on this topic appears in session 69 of the Tucson (185th) meeting of the AAS - e.g. look at: http://www.aas.org/meetings/aas185/abs/S6905.html, a paper by Pennypacker, Deustua, Perlmutter, Goldhaber and Arsem at Lawrence Berkeley Lab. describing the use of automated telescopes to search for supernovae and in support of LBL's "Hands-on Universe" high-school educational project: (http://hou.lbl.gov). This effort resulted in the acquisition of the earliest images of SN1994I by two students from Oil City High School, Pennsylvania.

The first robotic network station to be brought into operation at CTIO is in fact used to study the sun. This station - one of six operated by the Global Oscillations Network Group (GONG) - was set up and put into operation on CTIO during 1995. Progress reports and photographs can be found via: http://www.gong.noao.edu/sites.html.

The installation of this station allowed us to successfully re-open the first (Site CT-P-"A") of a series of telescope sites along the NNE precipice just below the summit of Cerro Tololo. A site map for GONG (and 2MASS) can be found at: http://pegasus.phast.umass.edu/2mass/site/ctio_site_map.jpg. GONG is at site "A," near the "T"-shaped end of the precipice access road (colored blue). We have begun conversations with a second solar oscillation network group - the TON, or Taiwan Oscillation Network - with a view to setting up one of their global network stations here. We have also begun informal conversations with people from two groups setting up global networks of small stellar robotic telescopes in the 0.5-1.0-m range. These non-profit groups are GNAT (see: http://www.darksky.org and Remote Telescopes Inc., headed by Wayne Rosing (rosing@trtci.com).

Other robotic telescopes

Swarthmore College has recently installed a 3-cm, all-sky, Ha robotic survey telescope on the former GONG site survey platform, on the Tololo summit. A separate article and pictures in the NOAO Highlights section provide further information on this newest addition to the telescope complement.

Other all-sky survey telescopes on Tololo

Moving up in aperture, the next survey telescope will, around May, be replacing the existing 16-inch Boller & Chivens telescope. The United States Naval Observatory (USNO) will begin a two-year campaign to secure astrometric CCD-based measurements and produce a high-density catalog of reference stars in the Southern Hemisphere between magnitudes 7 and 16 with accuracies of ~ 20 mas at epoch. This will be done using a specially developed, US$500,000, 8-inch, astrographic lens and a commercial, thermo-electrically cooled CCD camera. This equipment will be attached to a remotely-controlled modified Boller and Chivens mount originally used for a 24-inch telescope. Details of this project were presented by Steve Gauss et al. at the Toronto AAS meeting (conveniently next to a poster by one of my recent REU-program students). Further information can be found at: http://aries.usno.navy.mil/ad/ucac-s/.

This astrometric work will provide a dense set of positions ideally suited for initial calibration of our Hydra-CTIO multifiber spectrograph (currently under construction in our NOAO shops in Tucson) and to the near-simultaneous activity at our largest new all-sky survey telescope:

2MASS (South)

Installation of the building and dome for this telescope is nearing completion at site CT-P-B (Site "B"), i.e. just below the GONG site on Cerro Tololo. Installation and commissioning of the telescope will begin later this year. More information about the 2MASS project can be found via: http://pegasus.phast.umass.edu/.

Upgrading/privatizing older telescopes as an alternative to closure

Following announcements by Charles Bailyn and myself in previous *NOAO Newsletters*, the Yale 1m was closed at the end of January. The Yale 1m consortium (Yale, Ohio State, Lisbon, NOAO and perhaps the University of Chile) will carry out engineering work on the telescope during 1997, with a view to re-opening it for synoptic work early next year and operating it over a 3-4 year period. Ohio State, under the leadership of Darren DePoy, will be providing a two-channel IR/optical imager, ANDYCAM, for this telescope. The University of Lisbon will be providing the funds for bare-bones operation of the facility. Roughly 9% of the time is likely to be available for NOAO Users; further details will be provided in the next two *Newsletters*.

Malcolm Smith

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CTIO/ESO Telescope Time Exchange: A Reminder

We wish to remind users of the availability of approximately 12 nights during the period 1 October 1997 to 31 March 1998 for the US community on the ESO 3.6-m telescope. This time is made available through an experimental CTIO/ESO telescope time exchange program initiated last year. The specific instruments available for use on the 3.6-m are:

1. ADONIS: An adaptive optics system for 1-5m.
2. TIMMI: A thermal infrared imager and spectrometer.
3. EFOSC1: An optical multi-slit spectrograph, imaging polarimeter, spectropolarimeter, and imaging coronagraph.

This array of instrumental options provides our user community with capabilities not yet offered on CTIO telescopes. A more complete description of this program with a brief outline of the performance of each of these ESO instruments can be found on pages 26-27 of *NOAO Newsletter* No. 45 (March 1996) or in the CTIO WWW pages (http://www.ctio.noao.edu/eso_time_swap.html). Prospective users of EFOSC1 should note that the available nights will be limited to bright or gray (7-10 nights from new moon) lunar phases.

Proposers from the NOAO/CTIO community who wish to use these ESO instruments should submit a proposal to CTIO on our normal telescope request form, but indicate clearly on the front page which ESO instrument is requested. Proposals will be rated by the CTIO TAC based on scientific merit, and then passed to the ESO scheduler.

We look forward to receiving your proposals!

Mark Phillips, Ron Probst

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NOAO Newsletter - Cerro Tololo Inter-American Observatory - March 1997 - Number 49

Long-Term Proposal Status at CTIO

Recent inquiries from users as well as members of the CTIO TAC have indicated to us the necessity of clarifying the concept of "long-term status" for observing proposals approved by the TAC. The current version of the CTIO observing proposal form includes a question on the front page that asks if long-term status is being requested. However, it has been several years since the policy governing such requests has been clearly stated. Hence, beginning in the next scheduling period (1 August 1997-31 January 1998) and until further notice, we shall handle long-term status under the following rules:

CTIO will accept proposals for scientific programs on any of its telescopes that extend beyond a single semester. If you wish to apply for such long-term status, check "yes" on the front page of the observing proposal form and provide a one-line summary of your request (e.g., "six nights per semester for four semesters"). The initial proposal should provide the full justification for the total number of nights required to achieve the proposed scientific goals. If long term status is granted, proposals must still be submitted in each subsequent semester. These need include only a brief description of the scientific justification and should concentrate more on summarizing the progress made to date and a restatement of the number of observing runs required for successful termination of the project. Although the granting of long-term status by the TAC does carry with it a commitment for observing time in future semesters, the TAC and the CTIO Director retain the right to terminate long-term status for a proposal if it is felt that insufficient information concerning the progress of the project has been supplied by the PI.

Malcolm Smith, Mark Phillips, Nick Suntzeff, Ron Probst

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NOAO Newsletter - Cerro Tololo Inter-American Observatory - March 1997 - Number 49

Status of ACTR Instrumentation Projects

The La Serena engineering group, together with scientific staff, plays a major role in NOAO-wide projects and also supports improvements in CTIO facilities. Over the past several months our main efforts have been (1) the delivery and integration of Arcon controllers for a CCD mosaic imager, which will initially be used on Kitt Peak; and (2) the commissioning of COB and the f/14 tip-tilt system for the Blanco 4-m, as detailed in a separate article. Other projects nearing completion include a ventilation system for the 1.5-m dome. During October-December 32 doors were installed at the base of the 1.5-m dome to provide better air flow through this telescope enclosure. Electrical installation is proceeding in January-March.

The new SITe 2K CCD, mentioned in *Newsletter* No. 45, was successfully commissioned and has been in routine use since October. This has allowed us to have four telescopes on Tololo taking data with 2K chips on occasion, and has provided an invaluable backup to our heavily used 4-m and 0.9-m systems.

The BTC mosaic camera is heavily scheduled this semester at the Blanco prime focus, following a successful engineering run in December. This quad-2048 CCD system, produced by Tony Tyson and Gary Bernstein, was described in *Newsletter* No. 47. Technical information is available in that article and on the web (http://www.astro.lsa.umich.edu/btc/btc.html and http://www.ctio.noao.edu/pfccd/btc_arw.html).

Save-the-Bits has been implemented on the 1.5-m and 4-m Arcon CCD systems, in addition to the 0.9-m and Schmidt. The implementation for the IR Wildfire and BTC systems is pending.

Other projects underway for the Blanco include the conversion of the IRS to the f/14 focus, additional thermal control projects, and design of the R-C focus ADC corrector system for the Hydra spectrograph.

Bob Schommer, Chair, ACTR

Tip-Tilt Image Stabilization Achieved on the Blanco 4-m

Significant improvements in image quality, and resulting sensitivity, at both optical and infrared wavelengths can be achieved by first order wavefront stabilization. When implemented in hardware with high speed, small amplitude motion of an optical element, this is known as tip-tilt correction. Tip-tilt retrofits are improving the performance of many existing large telescopes. Under the leadership of Richard Elston, the Blanco 4-m has now joined the club.

A complete tip-tilt system requires a moving optic, a guiding sensor, servo system, and an appropriate science instrument. Fortuitously, we had available a rough-ground secondary and complete cell and mechanical structure, originally built 25 years ago for a 4-m f/13 widefield Cass focus but never implemented. Gary Poczulp of the Tucson optical shop trimmed, lightweighted, and figured the glass for IR use at f/14. The La Serena engineering group reworked the cell and mount, using commercial piezoelectric transducers to provide fully controlled motions of order an arcsecond at tens of Hertz. At the focal plane, we have built a fast guider interface, which uses a dichroic to feed both a science instrument and a CCD TV. The sampling area of the CCD is limited to a few arcseconds and provides centroid information from a guide star at up to 240 Hz. Mounted on an extremely rigid XY stage, it may access a suitable guide star anywhere within a 100 x 100 mm field.

For the initial science instrument, the IR imager COB has been permanently relocated from KPNO to CTIO. The KPNO IR group had previously modified it to provide 0.1" per pixel over the field of a 1024^2 Aladdin InSb array. During July and August 1996, Tucson engineers installed a 512^2 Aladdin quadrant and a new preamplifier. Ron Probst and Esteban Parkes (from the Tololo electronics group) spent September in Tucson participating in the final stages of installation and testing. Following successful laboratory and telescope tests, the instrument was crated and shipped to CTIO. This is the largest instrument we have ever transported between sites; the crate had to be carefully specified not to exceed the size capacity of airplane cargo hatches!

A significant milestone was achieved last 18 January on the Blanco telescope. We closed the tip-tilt guiding loop between secondary and sensor, providing stabilized images at 2m to COB. Further engineering tests and usage over several nights were encouraging. Power spectra of the centroid error signals are flat beyond 10 Hz, indicating that all low frequency sources of image motion are compensated - seeing, wind shake, servo errors, etc. Flexure tests show that the system, including optical coupling to a science sensor deep inside its large dewar, is adequately rigid. Centroid stabilization shows a broad maximum in performance with respect to system gain, and useful correction is achieved at frequencies an order of magnitude less than the system capability. Unfortunately a low quality folding flat, pressed into service due to delayed delivery of the final mirror, degraded the delivered image quality on the IR array. However, image cores were still significantly tightened compared to non-tip-tilt corrected images. Finally - and very important for a facility instrument - the mechanical hardware, electronics, and software were robust when used by astronomers, not engineers.

Over the next several months we will be further testing and refining the system to improve sensitivity, defining its performance, and developing a user interface for the telescope operators. In addition to IR imaging with COB, we will be using the system for IR spectroscopy with the IRS beginning in June 1997 (see separate article). In the longer term, we will upgrade the IR array in COB to a full 1024^2 Aladdin array, providing 100" x 100" of corrected field of view, as soon as a suitable device is provided by the Tucson array development effort. Users of CTIO optical instruments may eventually benefit as well. The tip-tilt guider box is designed for easy, rapid switching of dichroics, which could enable use of the system for CCD imaging with appropriate blue/red dichroic splits.

Nick Buchholz, Richard Elston, John Filhaber, Brooke Gregory,
Paul McIntyre, Gabriel Perez, Ron Probst, Nic Roddier,
Ricardo Schmidt, German Schumacher, and a host of colleagues in La Serena and Tucson

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IRS News

The CTIO IR Spectrometer has benefited from detector and grating upgrades within the last few months, and a major optical modification will take place in the March-May period.

New Detector

The IRS has been the beneficiary of the detector upgrade in the COB instrument to an Aladdin detector: COB's previous detector, a 256 x 256 Santa Barbara detector of excellent cosmetic quality and low dark current, has been handed down to the IRS. The detector has lower well capacity than the previous one, but it is adequate for operating in all bands. The most important implication of this change is to require more care in setting the integration time under high flux conditions (beyond 3m). Here is a brief summary of its characteristics:

IRS Detector

Type	InSb
Gain	8.1 e-/ADU
Bias	0.55 volts
Read noise	45 e- (single read-pair)
2% non-linear	3500 ADU
4% non-linear	5000 ADU
Dark	0.5 e-/sec

The stray light level in the instrument, (currently ~ 16 e-/sec), is now strongly limiting the performance of the instrument under some conditions. We are about to embark on several efforts to reduce stray light so as to get the full benefits of the detector.

New Cross-dispersed grating

The original cross-dispersed grating module used an off-the-shelf grating replica from Spectronic Instruments (formerly Milton Roy). The new one has a custom ruling designed to match the free spectral ranges more nearly to the chip dimensions. Also, the original ruling was not a particularly efficient one and it was hoped that a new ruling would improve the efficiency. Unfortunately, in the latter area of performance the cross-dispersed grating module is still significantly less efficient than the 75 line/mm, 1.9m blaze grating in the K band. In the H band the throughput is similar and at short wavelengths the cross-dispersed prism somewhat surpasses the simple grating/filter combination. The cross dispersed mode is the clear favorite if multiband coverage is a required by the science program, for reasons both of efficiency and of the consistency of relative throughput over the bands. The following table describes the new resolution data for the device:

Band	(m) (central)	2-pix Res.	Dispersion 10^{-3}m/pixel
K	2.17	558	1.94
H	1.63	561	1.45
J	1.30	559	1.16
I	1.08	558	0.97

Conversion to f/14

The foreoptics conversion to accept an f/14 input beam, postponed due to a shortage of engineering resources, will take place during March and April 1997 with telescope tests in May. This will match the instrument input to our new f/14 tip-tilt secondary in order to benefit from the tighter image cores it provides. We will also implement improvements in the cold stop and internal baffling for scattered light control. The image scale at the slit will remain unchanged, with the a two pixel slit size at the 4-m being 0.6". The internal f/ratio (after the slit) remains the same. So for proposal planning purposes the basic performance specifications (slit widths, resolutions, and throughput) will show little change.

Instrument manual

The IRS Users Manual, available on the CTIO Web pages at http://www.ctio.noao.edu/manuals/irs, has been updated to reflect these changes.

Brooke Gregory

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Travel Assistance: Who to See

As part of a reassignment of duties following downsizing of the La Serena administrative staff, travel arrangements for visiting astronomers are now handled by Marcela Urquieta. Her office is in the administrative wing of the Engineering Building, and she can be contacted at murquieta@noao.edu. Please inform Marcela of your travel plans, especially any last minute changes, so that she may coordinate airport taxi, guesthouse reservations, etc. for your convenience.

Enrique Figueroa

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Requests for CTIO Telescope Time: February - July 1997

Telescope	Nights Requested	Nights Scheduled	Requested/ Scheduled	Visitor Nights	%Visitor Nights	Staff Nights	%Staff Nights	Eng. & Maint.
4-m Dark	224	88	2.5	75	85	13	15	5
Bright	209	72	2.9	68	94	4	6	16

1.5-m Dark	130	91	1.4	87	96	4	4	2
Bright	90	65	1.4	63	97	2	3	22
0.9-m Dark	123	92	1.3	86	93	6	7	0
Bright	136	55	2.5	52	95	3	5	8
Schmidt	142	122	1.2	108	89	14	11	6
ESO 3.6-m	11	8	1.4	8	100	0	0	

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CTIO Telescope/Instrument Combinations*

4-m Telescope:

BTC Mosaic Imager	4K x 4K CCD Mosaic [47]
ARGUS Fiber-Fed Spectrograph	+ Blue Air Schmidt Camera+ Loral 3K [40,41,42,45]
ARGUS Echelle FF. Spect.	+ Blue Air Schmidt Camera+ Loral 3K [40,41,42,45]
R-C Spectrograph	+ Blue Air Schmidt Camera+ Loral 3K[40,41,42]
Echelle Spectrograph	+ Blue Air Schmidt Camera+ Loral 3K[40,41,42]
"	+ Folded Schmidt+ Tek 1K CCD [22,23,25,26]
"	+ Long Cameras+ Tek 2K CCD [23,25,26,39,45]
Prime Focus Camera	+ Tek 2K CCD [36,39]
"	+ Photographic Plates [23,38,41] (User must supply plates)
Cass Direct	+ Tek 2K CCD [39]
Rutgers Imaging Fabry-Perot	+ Tek 1K CCD [25,26,42]
Cryogenic Optical Bench	+ 512^2 InSb [45]
CTIO IR Imager	+ 256^2 HgCdTe [40,41]
CTIO IR Spectrometer	+ 256^2 InSb [37,39,41,45]

ESO 3.6-m (#12 nights/semester available): [45]

ADONIS [45]
TIMMI [45]
EFOSC1 [45]

1.5-m Telescope:

Cass Spectrograph	+ Loral 1200x800 CCD [43][45]
Bench-Mounted Echelle Spectrograph	+ BME Camera + Tek 2K CCD [22,23,39,42]
Cass Direct	+ Tek 1K CCD, Tek 2K CCD [39]
Rutgers Imaging Fabry-Perot	+ Tek 1K CCD [25,26,42]
ASCAP Photometer [24,25,28,43]	
CTIO IR Imager	+ 256^2 HgCdTe [40,41]

1-m Telescope: Closed [46]

0.9-m Telescope: Cass Direct + Tek 2K CCD [39]

Curtis Schmidt: STIS 2K CCD (Direct or Prism)[42]

* Numbers in boldface following an instrument indicate the most recent *Newsletter*(s) containing relevant articles. If there is no number, the 1990 edition of the Facilities Manual is fully up to date. The most recent general summary of CCD characteristics is in 45; see also 33, 26 and 28. Information on telescope control guiders is in 21, 22, 24, 32.

Mark Phillips (mphillips@noao.edu)

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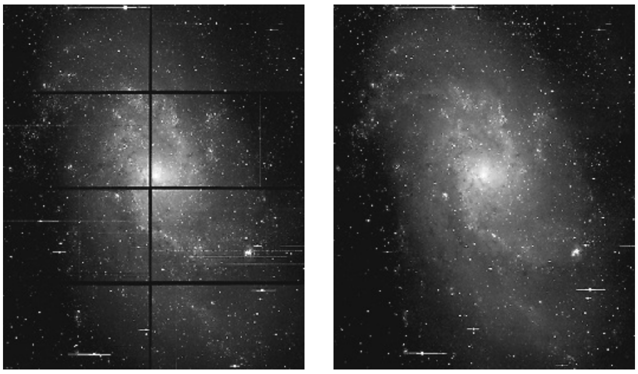
CCD Mosaic Imager Update

Since the most recent *Newsletter* article on the CCD Mosaic Imager, we have had Mosaic testing runs at the 0.9-m in January, and the 4-m in November and January. The software has advanced, the system is more reliable, and we have conducted numerous tests.

The 4-m Corrector

During the January engineering run, we performed an initial evaluation of the new corrector and its atmospheric dispersion compensator (ADC). Although the seeing was variable during the run, excellent subarcsecond images were obtained near the zenith with (or without) the ADC in use. Images also were taken up to 70° from zenith in B. At the larger zenith distances, the ADC improved the images as expected, although the seeing at the time was about 1.3", so the improvement was small. The software to operate the ADC allows the observer to use it in a transparent tracking mode for long exposures, or to set them to a null position where no correction is applied.



Caption: The left-hand image is a single 5 minute exposure of M33 taken at the 4-m. Images from the eight calibrated CCDs have been transformed into a single, geometrically corrected (for CCD alignment and optical distortions) image. The right-hand image is a combination of 5 shifted exposures which have been registered and median stacked. Trails from extremely bright stars remain but all other defects and gaps vanish. The two images are shown at the same size of 8K x 8K though the full combined image is 9K x 10K. Image reduction courtesy of Frank Valdes.

There remains one problem with the ADC that we expect to have largely eliminated before the 14-17 April engineering run. When using narrow-band interference filters, a faint image of the telescope pupil falls on the CCD with a diameter of about 10'. Depending on the bandpass and construction of the filter, this reflection typically manifests itself at a 3-5% level above the background. It arises from an internal reflection off the front surface of the rear element of the corrector despite the use of an extremely good anti-reflection (AR) coating. Our investigation suggests that similar four-element correctors currently in use should experience a similar effect; tests performed recently by Alistair Walker with the CTIO 4-m confirm this analysis.

For the purposes of the Mosaic, our approach to solving the internal reflection is to re-coat the critical surface with an AR coating specifically optimized for superb performance over the wavelength range where most interference filter work is done: from 5000 to 7000. To extend much beyond this range, interference filter users will have to rely on flat-fielding to minimize the effects of the reflection. During subsequent engineering runs, we will be exploring observing strategies to minimize the effect.

Filters

We currently have B, V, and R large-format filters for Mosaic. We are in the process of ordering several additional large-format filters. Depending on the pricing and vendor delivery schedules, we hope to obtain all or most of the following by June: Kron-Cousins I-band, Ha (80 FWHM) and four redshifted filters at velocity intervals of 1800 km/s, [OIII] 5007 (50 FWHM), and a continuum filter at 5300 (250 FWHM).

Data Pipeline

For each read of the Mosaic array, 128 Mbytes of data are generated. The readout time currently is 110 s (with one amplifier per CCD), but the time to handle the data and save it to disk requires an additional 4 minutes. Only then can one display the image and perform typical quick-look interactive analysis to assess the data quality. We consider this overhead of 6 minutes unacceptable.

The IRAF group has developed a strategy to improve the throughput of the Mosaic data pipeline significantly. A data messaging system, operating across computers, will take packets from the Arcon CCD controllers and ship them to our recently acquired Sun Ultra-Sparc 2. Clients on the Ultra will unscramble the packets from all the different CCDs/amplifiers, save the data to disk in an efficient new FITS format, and simultaneously display the data during readout to a new real-time image display. During the readout/display process, data can be accessed by all IRAF quick-look utilities (e.g., IMEXAMINE) to assess the data quality (e.g., focus, background level) even before the full image is finished reading out.

Preliminary tests of the messaging system, the fast ethernet link to the Ultra, and the new data format all appear promising. The new display system has not been developed yet, but should be available in the fall. In addition, the data pathway from raw images to astrometrically corrected and combined images has been verified. These tests utilize the new IRAF astrometry package, a new multi-amp version of CCDPROC, and the new multi-image FITS format that will be available under the next version of IRAF (V2.11). As an example, images of M33 were combined to produce the picture shown on the previous page.

Mosaic During Spring Semester

We have additional 4-m Mosaic testing scheduled for February, April and July. In addition, three nights of shared-risk science have been scheduled at the 4-m in June/July and seven nights at the 0.9-m in June. We received eleven Mosaic expressions of interest for this time. Six of these programs had technical requirements consistent with current Mosaic performance; we have solicited and received detailed project descriptions from these proposers. We will finalize the disposition of these shared-risk blocks shortly.

Science-Grade CCD Upgrade

The largest remaining task in the Mosaic project is the upgrade to science-grade CCDs from the current engineering-grade devices. As described in the December 1996 *Newsletter*, we have placed an order with SITe for thinned high-QE low-noise 2K 4K CCDs. We do not know when we will receive eight suitable CCDs from SITe and have them optimized. Therefore, the operating assumption is that the current engineering-grade CCDs will remain the Mosaic detectors for the fall 1997 semester. However, we will do everything possible to expedite the CCD upgrade. For example, construction has begun on a copy of the Mosaic dewar. The science-grade CCDs will be installed in this new dewar in order to minimize the Mosaic downtime needed for the CCD upgrade. The dewar that is currently in use will become part of Mosaic Clone, which will eventually be deployed at CTIO.

Applying for Mosaic Time

We invite applications for shared-risk Mosaic time in the fall 1997 semester. Proposals should follow the normal application procedure. The proposals will be given a science grade by the TAC and also reviewed for technical compatibility with the current state of the Mosaic Imager by the Mosaic team. Proposers should list what filters they plan to use and the required photometric uncertainty at a given magnitude. As described above, there can be no assurance of the CCD upgrade occurring during the fall, but there is some possibility that it could occur late in the semester. Therefore, proposers should write their proposals for the engineering-grade CCDs; however, please feel free to let us know how the program would benefit if the science-grade CCDs become available. Programs with the greatest likelihood of being scheduled will have high science grades from the TAC, technical requirements that are consistent with the performance of the current CCD Mosaic Imager, and, to a lesser extent, observing goals that will aid in final Mosaic evaluation and commissioning.

Many users will need to choose between Mosaic and the standard CCD imagers at the 4-m and 0.9-m (T2KB and T2KA, respectively). In the September 1996 *NOAO Newsletter*, No. 47, page 27, we cautioned users on a number of deficiencies of the current Mosaic engineering-grade CCDs: they are unthinned and uncoated chips and therefore have poor sensitivity in the blue; the Mosaic CCDs are much poorer cosmetically than T2KB or T2KA; the effective readnoise can be as high as 30 e- over parts of the array. In addition, we only have a limited supply of Mosaic filters at present (see above). Finally, although the system is maturing, users should be aware that Mosaic is not yet as user friendly or reliable as PFCCD. Rough guidelines for using PFCCD versus Mosaic are as follows:

- The standard CCD imagers have fields of 14' x 14' at the 4-m with the new corrector (T2KB) and 23' x 23' at the 0.9-m (T2KA).
- Mosaic has a field of 36' x 36' at the 4-m and 59' x 59' at the 0.9-m.
- Any program requiring deep exposures in the blue, such as U or B, should use T2KA/B.
- Any program needing specialized filters not listed above should use T2KA/B.

- If the primary determinant of success is going very deep or having small photometric errors, T2KA/B are likely preferable. As an illustration of this, the count rates listed for Mosaic at the 4-m in the December 1996 *NOAO Newsletter* are down by 78% in B, 54% in V, 38% in R, and up by 17% in I compared to the rates measured for T2KB and the new corrector/ADC.
- If the primary determinant of success is covering as much sky area as possible, Mosaic is likely preferable.

Feel free to consult with any of the undersigned if you are unsure of whether to apply for PFCCD or Mosaic for fall 1997.

For updates on the progress of the Mosaic project, check out the Mosaic web page at: http://www.noao.edu/kpno/mosaic/mosaic.html.

Taft Armandroff, George Jacoby, Todd Boroson (for the Mosaic Team)

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Message from New Kitt Peak Director

I am truly grateful for the opportunity to lead the program of Kitt Peak as Director. Kitt Peak is a vital Observatory on a competitive site, with a flagship modern telescope in WIYN, the powerful and versatile Mayall 4-m, a dedicated and talented staff, and world-class instrumentation. We are currently positioning the Observatory for its long-term role as an indispensable part of NOAO in its 21st century operations.

I recently accompanied AURA's Observatories Council on a visit to the mountain. Lee Anne Willson's reaction to that visit reflects feelings throughout our community: We are so engrossed in long-term budget problems we can easily forget what an exciting place Kitt Peak is. The WIYN Telescope provides image quality near that of the site-delivered seeing night after night. Phoenix is opening a new volume of space to study at high dispersion in the near-infrared. The 8K square CCD Mosaic imager should have thinned chips installed within a year. It gives a field of view not available since the days of photographic plates.

Where are we headed? Within five years, the limiting faint object work that has been done on the 4-m will migrate to Gemini. The impact on the current pattern of usage of Kitt Peak facilities will be profound. We need only look at the near absence of requests for high-dispersion quasar absorption line observations on the 4-m echelle since the advent of Keck HIRES to appreciate the case in point. Kitt Peak must offer the capabilities to prepare for Gemini observing, to complement Gemini programs by covering the bright end of samples with a range of fluxes, and by supporting those programs that do not require large aperture to achieve forefront results.

Scientific opportunity must drive the range of capabilities that Kitt Peak offers to its users. The diversity of the community's interests has always been reflected in the variety of programs supported on the mountain. At the same time, we can discern some major themes in the direction of our discipline. These include the evolution of galaxies, the early phases of star formation, and stellar populations, among others.

What capabilities do we envision? Kitt Peak will work actively with its WIYN partners to keep that telescope meeting its potential. A rapid image compensation system is a high priority. Expanding Hydra's grasp to the non-thermal infrared is an exciting prospect.

The Mayall telescope will deliver deep, moderate field imaging at prime focus. It will be the vehicle for near-infrared spectroscopy and high-throughput optical spectroscopy. It also could be used to push high-dispersion spectroscopy to fainter limits.

Today we use surveys on 1-m class telescopes to isolate samples of objects requiring spectroscopic follow-up on the 4-m. For our future access to 8m and 10m telescopes, that survey capability must be scaled up to a 2-m class instrument. That size aperture is necessary and sufficient to fill the gap between the 2MASS and Sloan Sky Surveys and the flux limits to which the large-aperture telescopes can make spectroscopic measurements. I am committed to carrying out the Users Committee recommendation that we vigorously pursue the option of a new 2.4-m imaging telescope for Kitt Peak. The beginning of the process is to hear from you about the need for observations made at this aperture as the Gemini telescopes become available.

Our budget history is no secret, and we are all painfully aware of the changes taking place in the suite of apertures available to us. Please see Sidney Wolff's discussion of the near-term plans for the NOAO share of the Burrell Schmidt and the CoudÃ© Feed. The good news is that the 0.9m with the CCD Mosaic Imager provides such a unique capability for wide-field imaging with adequate PSF sampling that we will make every effort to keep that facility operating as long as our budget permits. I intend to pursue two approaches to compensating for the loss of telescope nights that closures of small aperture telescopes represent. One is to explore a wider variety of scheduling options, to take advantage of the greater data gathering efficiency provided by highly multiplexed, efficient instrumentation. The other is to be available to encourage community coordination of the substantial number of 1-m class telescopes now in use.

Our advisors and concerned users ask the same reasonable question: What will you do with the relatively modest amount of money that you save from not operating these useful small telescopes? My answer is that the savings have already been taken in previous staff reductions, and that the current staff is stretched well beyond reasonable expectations for their service. This condition jeopardizes morale. Our management approach will be to match the level of support effort more closely to the ability of our dedicated teams to meet their demands. We will still actively seek new ways of approaching those tasks more efficiently, to minimize losses in productivity of our working telescopes. I rely on the skill and dedication of our management team, Bruce Bohannan, Tony Abraham, John Dunlop, and Bob Barnes, in realizing these goals.

Kitt Peak is currently a vital observatory. No one can predict with certainty the outcome of the longer-term countervailing trends at the national level: the commitment to support of basic research versus the drive to balance the federal budget. I am committed to working with you and the Kitt Peak staff to maximize our opportunity to produce forefront science with the resources available to us.

Richard Green

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0.9-m Mosaic Versus Schmidt Imaging

At the end of the present observing season the Burrell Schmidt will no longer be available through KPNO, as is discussed in the Director's section of this *Newsletter*. At the same time installation of the CCD-mosaic imager at the 0.9-m telescope will actually improve the wide-field imaging options offered to

KPNO observers. Despite the loss of the Schmidt, there will be a net gain for programs that had relied on its capabilities.

Previous to the installation of Mosaic on the 0.9-m, the Burrell Schmidt was unique in offering an extremely large, 69' x 69', field-of-view, compared to other CCD cameras on the mountain. Although the Mosaic on the 0.9-m actually has a smaller field, 59' x 59' (at f/7.5), or 0.73 of the Schmidt's imaging area, when the telescope plus CCD throughput is folded in, the Mosaic-0.9-m combination gets to a given depth over a given area faster. For example, in the case of source-dominated applications, that is those where the object is much brighter than the sky, the Mosaic-0.9-m is 1.6x faster to a given flux limit in the R-band, or still 1.2x faster when the its smaller field is considered. The Mosaic is slightly slower in V and I, but even at B with the present thick-CCDs, it is just as fast as the Schmidt. As thinned-CCDs are installed, these ratios will improve further (see the lead article in this section).

The real gain of the Mosaic-0.9-m combination over the Schmidt occurs for faint sources, where the sky dominates. The Mosaic-0.9-m combination offers 0.43" pixels, compared to the 2.03" pixels of the Schmidt, which with the improved corrector and seeing at the 0.9-m, allows for much better rejection of the sky background. For sky-dominated images in the R-band, for example, in 1" FWHM seeing the mosaic is already ~ 4x faster to a given area-flux limit than the Schmidt, and still ~ 3x faster in B even with the thick CCDs. The sharper images and finer pixel scale also allow analysis applications, such as star-galaxy classification, PSF-fitting, and so on, to be conducted to much fainter limits than is possible with the Schmidt.

The only major deficit of Mosaic-0.9-m imaging compared to the Schmidt is the loss of objective-prism spectroscopic applications. Such work represented a small, but important minority of the Schmidt programs that we have supported in the past. It is possible, however, that we will be able to offer similar capabilities at the 0.9-m. George Jacoby has experimented with gratings within the camera to offer low-resolution spectroscopic imaging. The results of the experiment are encouraging and may lead to an understanding of how best to add this capability to the Mosaic.

Lastly, there are many "secondary" attributes of the 0.9-m that make it a superior imaging platform over the Schmidt. Unlike the Schmidt, the 0.9-m features a complete telescope-control system, is completely operable from a control room, and so on. Such features offer greater efficiency at the telescope, and greater ease in data reduction away from the telescope.

Tod Lauer

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Completion of the WIYN Fall 1996 Queue Observing Program and a Preview of Spring 1997

19 January 1997 marked the final night of the WIYN Queue Observing Experiment for the fall 1996 semester. Data were obtained on 43 of 50 nights awarded to the Queue by the WIYN Consortium (data were also obtained on 2 additional partial nights during NOAO T&E), though many of these nights were only partial. Of the complete nights lost to the Queue, 2 were to major equipment failures preventing use of the telescope and 5 were to weather. In addition, WIYN was successfully used for 1.5 nights of Director's Discretionary Time. All told, weather and technical problems resulted in the execution of Queue science programs during 55% of the time (53% of dark time and 61% of bright time). We estimate that about 10% of the available time was lost to a variety of technical problems. A more thorough breakdown of the WIYN Queue's progress during fall 1996 can be found at http://www.noao.edu/wiyn/obsprog.

All of the fall 1996 Queue programs have now been officially terminated and all remaining data should be distributed to the program PIs within a few weeks. If you are expecting to receive data from the WIYN Queue and have not by mid-February, please contact us at wiynq@noao.edu. We remind investigators whose programs were not completed or initiated during the semester that new proposals must be submitted for review by the TAC to reinstate these programs to the WIYN Queue.

Time lost to weather and technical problems resulted in 3 Long and 2 2HrQ "Best Effort" programs not being activated. The table summarizes the level of completion attained during the fall 1996 semester for the 34 observing programs allocated time.

The level of completion for a non-synoptic Long program was determined by dividing the number of Queue hours spent on the program by the number of hours allocated by the TAC. It is more difficult to determine the completion level of the two synoptic programs. One program required an observation during every Queue night, but the target was not accessible until about midway through the semester. We estimated the "completion level" of this program as simply the number of nights the target was observed divided by the total number of Queue nights that it could have been (a little over 80%). The other synoptic program included a non-synoptic portion and since this program used up nearly its entire allocation, it is classified as being completed.

Several 2HrQ programs were initiated but not completed. These were typically programs requiring excellent seeing conditions that were rarely attained during the fall semester. In fact, programs demanding seeing of 0.8" or better were also at a disadvantage because of an intermittent focus drift problem that at times made it difficult, if not impossible, to obtain the required image quality. During periods when the focus drift was apparent, the additional time required to re-focus substantially degraded observing efficiency. This problem remains undiagnosed, though it was not a problem during the final month of the semester.

Completed Fall 1996 WIYN Queue Observing Experiment

		Level of Completion				
	Total	**0%**	**25%**	**50%**	**75%**	**100%**
Long Programs						
High Priority:						
Standard	9			1	2	6
Synoptic	2				1	1
Best Effort:	7	3	2	1	1	
2HrQ Programs						
High Priority	7			4		3
Best Effort	9	2		2		5
Totals	34	5	2	8	4	15

The observing queues for the spring 1997 (February-July) semester have been constructed and the Queue observing program has been allocated 51 nights. The High Priority, Best Effort, and 2HrQ programs are listed in the "spring 1997" link from our home page. Below is a summary of the approved WIYN Queue programs for the spring 1997 semester.

Due to a large number of accepted proposals with essentially identical TAC grades, there is a slight oversubscription of both dark and bright time. This is mostly caused by the large number of programs in the Best Effort Queue. Proposers with programs in this queue should remember that their projects will only be initiated if time and conditions permit (see the spring 1997 "Queue Rules" at http://www.noao.edu/wiyn/obsprog/queue/S97/QRules.S97.html). Note that in fall 1996, only 30% of the requested hours in the Long Program Best Effort Queue were executed and none of these programs was actually completed. We hope to do better in the coming semester as telescope reliability is improved and if the weather is more cooperative. A concerted effort is underway to increase the technical reliability of the WIYN facility. Substantial progress in this area will greatly benefit the efficiency of the Queue program. The observing programs in the Best Effort Queue will be helped most by this eventuality as high-priority programs are completed in a more timely manner.

Another aspect of the spring 1997 semester of which investigators in the Best Effort Queue should be aware is that there are many high-priority programs with targets clustered around 13 hours in RA. As a consequence, it will be difficult to initiate Best Effort programs with targets near 13 hours unless we are very successful in completing high-priority programs early in the semester.

We would like to gauge the impact of the NOAO WIYN Queue Experiment on astronomical research. Feel free to send us any preprints or reprints of work that includes data obtained at WIYN. These can be sent to:

WIYN Queue Experiment
c/o Paul Smith
National Optical Astronomy Observatories
P.O. Box 26732
Tucson, AZ 85726-6732

If you have questions, suggestions, or comments concerning any aspect of the WIYN Queue Observing Experiment, please send e-mail to wiynq@noao.edu.

WIYN Queue Observing Experiment: Spring 1997

	# of programs		Hours requested	
	Dark	**Bright**	**Dark**	**Bright**
Long Programs				
High Priority	7	4	147	95
Best Effort	10	3	179	44
2HrQ Programs				
High Priority	7		14	
Total	24	7	340	139
Available Hours			330	123

Paul Smith, for the WIYN Queue Team (Di Harmer,
Alex Macdonald, Dave Silva, Daryl Willmarth

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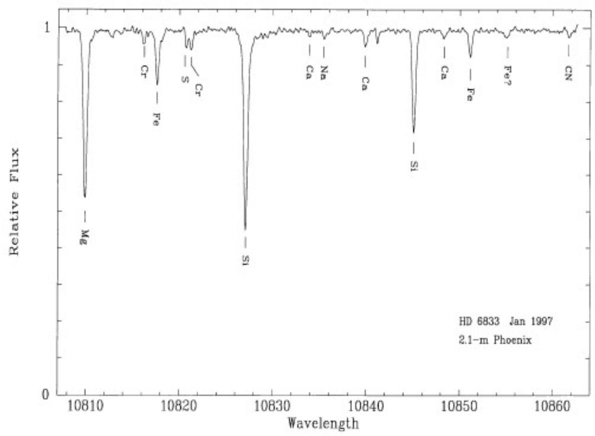
Phoenix News

Status Update

As of the end of January 1997 Phoenix has been used in four shared-risk user runs. The weather in January has not been kind with nearly 75% of the time lost to bad weather. These runs plus two test and evaluation runs in fall 1996 have produced much additional information on the instrument since the last *Newsletter*. Due to the complexity of the instrument, there is still a lot that is not known. Overall, the shared-risk users have been excited by the performance of the instrument. In the figure we present a high quality spectrum that resulted from the shared-risk time.

We are continuing to debug the instrument. In particular, while the dispersion is 1.5 km/s per pixel, the current resolution is 5 km/s (R = 60000, full width at half maximum of unresolved absorption lines), somewhat less than the desired resolution of 3 km/s over 2 pixels (R = 100000). During the next year we expect to work on understanding the collimator focus and imaging.

There has been insufficient test time to adequately determine limiting magnitudes throughout the range of operating wavelengths. The integration time in the 35m region is limited by the sky spectrum that appears in emission. Because this background is thermal, its level, and thus the maximum integration time, is a function of the ambient temperature. During the September 1996 engineering run, the maximum integration time was 1 minute at 4.6m. Stars as faint as 4th magnitude have been successfully observed at 4.6m. At 3.6m the maximum integration time in January was 20 minutes. In the 1-2.5m region we observe a background due to a light leak of roughly 1.5 ADU/s. We intend to attack this annoying problem aggressively. Limiting magnitude for high signal-to-noise in the K band appears to be in the 8-9th magnitude range, but still has not been tested in detail. At the short wavelength range of performance, the limiting magnitude at 1m is in the 6-7 magnitude range. The decreased performance in this region is due in part to a falloff in reflectance of the visual/infrared dichroic.



Caption: Spectrum of the metal-poor giant HD 6833 (m_J = 4.64) observed by Sneden et al. in the vicinity of 10830 using Phoenix on the KPNO 2.1-m. The spectrum represents a total of 4 hours of integration under mixed conditions on the nights of 20 and 22 January 1997 UT; it has been smoothed using a 3-pixel boxcar to yield an effective resolution ~ 33000. After division by a standard to remove telluric lines, the S/N is about 300. One may contrast this to the spectrum of this star obtained using NICMASS at the CoudÃ© Feed (NOAO Newsletter No. 34, pg. 35)

A manual is being prepared. We plan to update the Phoenix web site http://www.noao.edu/kpno/phoenix/phoenix.html with this manual and a current set of tables and illustrations. A test run in late January at the 4-m should provide additional information on the performance.

Availability

Phoenix will be available on both the 2.1-m and 4-m telescopes in the fall 1997 semester. Users wishing to use the 4-m should justify this choice. Two pixels on Phoenix are 0.7" on the 2.1-m but only 0.4" on the 4m. The widest slit available in Phoenix is 4 pixels. Given typical seeing of ~ 0.8" in the 2m region, a gain of roughly 1 magnitude in limiting performance in the 1-2m region is expected with the widest slit. However, this gain will not be realized in poor seeing or with the more narrow slits. Also, since the scale is smaller at the 4-m, the slit is proportionately shorter, about 30", compared to 1' at the 2.1-m. The other significant difference between these telescopes is that the 4-m permits instrument rotation and offset guiding over a wide field. Therefore, projects with optically invisible targets, but visible stars within the 4-m guider field, would benefit from use on this telescope.

Phoenix has an internal dichroic that permits viewing of the on-axis field in visible light using a CCD camera mounted on the instrument. A mirror can be folded into the beam behind the slit to image the field in the infrared. The slit can be removed to view the entire field, about 1' diameter. The acquisition procedure is to acquire the infrared source through the open aperture, rotate the observing slit into place and center the transmitted image, and then guide on a visible object in the CCD camera field. Tests show that flexure between the visual and infrared image is not measurable at the one pixel level.

Future Plans

The NOAO long range plan calls for Phoenix to be sent to CTIO for two years starting in July 1998. Future shared use with Gemini is also expected.

Additional information can be found on the web site (http://www.noao.edu/kpno/phoenix/phoenix.html) or by contacting hinkle@noao.edu.

Ken Hinkle, Dick Joyce

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Update on ONIS

In the September 1996 *NOAO Newsletter*, we announced the availability of a new near-IR imager with low-dispersion spectroscopic capability as part of a mutual agreement between MDM Observatory, Ohio State University, and NOAO. Since that time, this instrument has been used twice on the KPNO 2.1-m for testing and engineering runs. These runs were quite successful in evaluating the mechanical and electronic interfacing of the instrument to the telescope as well as the performance of the Aladdin InSb array. The results of these engineering runs may be accessed at the Web site http://www-astronomy.mps.ohio-state.edu/~isl/TIFKAM.

OSU is currently installing the f/16 camera assembly and a grism for moderate-resolution spectroscopy in the H band, and working on optimizing the performance of the InSb array to minimize some trails seen on bright objects. These should be complete before the first scheduled run in mid-March.

The announcement of availability generated an enthusiastic response from the user community, with a request of 88 nights (22 on the 4-m) for shared-risk observing in the spring 1997 semester. We were able to schedule 36 nights (15 on the 4-m). We remind users that this instrument is shared with MDM, which faces similar pressure to schedule infrared programs during bright time, so a limited number of nights can be scheduled at KPNO. A number of programs were scheduled with the backup instrument IRIM because of this limitation.

A final note on the instrument designation. The official name of the instrument is TIFKAM, and it is referred to as such in the Web documentation. We have adopted the shorter acronym ONIS (OSU-NOAO Imaging Spectrograph) to fit within the constraints of the scheduling database and request that it be designated as such on your observing proposal.

Richard Green, Dick Joyce, Darren DePoy

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Electronic Proposal Submission

We are strongly encouraging all observing proposals for the fall 1997 semester to be submitted electronically. Last semester almost all investigators submitted proposals via e-mail. This procedure is not only more convenient for observers, but greatly increases our efficiency in dealing with the large number of proposals.

We are in the process of implementing a new database for the TAC and scheduling process, which is described in some detail in another article in the NOAO section of this *Newsletter*. This article covers the details of proposal submission as well - we encourage investigators to read these instructions. We strongly urge the use of the *most recent* proposal forms, as this facilitates the automatic transferring of data from the electronic versions into the new database.

Dick Joyce

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Double the Data

The one trillionth byte saved by the NOAO "*Save the Bits*" archive was announced in the March 1995 *NOAO Newsletter*. It took just two and a half years for

KPNO (and NSO nighttime) observers to compile that impressive total from "first byte" on 20 July 1993. One year later, however, NOAO observers have already doubled the total.

As of mid-January 1997, the total number of NOAO science images archived is 860,000, for a data volume of 2.03 Terabytes. These images break down as 540,000 program object exposures and 320,000 calibration images. An exact estimate of the total shutter-open exposure time for the half million program object frames is not currently available - due to image header keyword issues that were resolved this year - but this should be significantly in excess of 20,000 hours.

Careful readers have noted the distinction between KPNO and NOAO observers in the first paragraph. Indeed, the big news this year for NOAO archiving is that CTIO data are now being saved from all four CTIO optical/IR imaging telescopes. The other major addition to the NOAO nighttime data stream is, of course, the first full year of WIYN operations.

A summary of the Kitt Peak archive statistics for 1996 is shown in the table below. (The "KPNO" totals include data from the NSO McMath nighttime program.) A detailed breakdown of the CTIO statistics will appear in a later *Newsletter* after all CTIO telescopes and instruments have reached full archive operation. NOAO observers flirted with archiving a full Terabyte in 1996, but did not quite reach the mark. This milestone should be easily surpassed in 1997.

Telescope	Total		Object		Calib		Exposure
	No.	Mb	No.	Mb	No.	Mb	Time (hrs)
4-m	41636	71959	28224	32177	13412	39785	1186:27
WIYN	26012	159067	9639	47816	16373	111253	1109:15
2-m	59375	38556	45684	22029	13691	16528	1024:33
CoudÃ© Feed	31029	33417	16447	11709	14582	21708	1355:21
McMath	10374	577	4009	227	6365	350	480:07
0.9-m	22579	135929	13117	72447	9462	63481	900:23
Schmidt	20764	132999	10854	59533	9910	73466	890:03
KPNO 1996	211769	572504	127974	245938	83795	326571	6946:09
NOAO 1996	283512	994145	172363	480175	111149	513972	9236:57
KPNO to date	793353	1614544	497033	752600	296320	861968	N.A.
NOAO to date	865096	2036185	541422	986837	323674	1049369	N.A.

Rob Seaman

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Instruments Available on Kitt Peak Telescopes: Fall 1997

The instruments listed below will be available for visitor use on KPNO telescopes during the August 1997 - January 1998 observing semester. Proposals for this period are due 31 March 1997. Visitor instrumentation is welcome at KPNO and can be scheduled if the instrument: a) is unique; b) is required for a project of very high scientific merit; c) conforms to block scheduling; and d) has small impact on KPNO operational and engineering resources.

SPECTROSCOPY

	Detector*	Resolution	long-slit	multi-object capability
Mayall 4-m Telescope				
R-C CCD Spectrograph (RCSP)	T2KB CCD	300-5000	5'.4	single or multi-slit
CCD Echelle Spectrograph (ECH)	T2KB CCD	18,500-65,000	2'	
IR Cryogenic Spectrometer (CRSP)	InSb (256x256, 0.9-5.5μm)	300-1500	0'.82	
CryoCam (CRYO)	Loral CCD (800x1200)	400-600	4'.5	single or multi-slit
OSU-NOAO Infrared Imaging Spectrometer (ONIS)	InSb (512x1024, 0.9-2.5μm)	1400	1'.5	
High Resolution IR Spectrometer (Phoenix; PHX)	InSb (256x1024, 0.9-5.5μm)	50,000-100,000	0'.5	
WIYN 3.5-m Telescope				
Hydra + Bench spectrograph (HYDR)	T2KC CCD	700-22,000	no	100 fibers
2.1-m Telescope				
GoldCam CCD Spectrograph (GCAM)	F3KA CCD	300-4500	5'.2	
IR Cryogenic Spectrometer (CRSP)	InSb (256x256, 0.9-5.5μm)	300-1500	1'.35	
High Resolution IR Spectrometer (Phoenix; PHX)	InSb (256x1024, 0.9-5.5μm)	50,000-100,000	1'	
OSU-NOAO Infrared Imaging Spectrometer (ONIS)	InSb (512x1024, 0.9-2.5μm)	1400	3'.0	
Coudé-Feed Telescope (see note 1 below)				
Coudé CCD Spectrograph (CF; CAM5 or CAM6)	F3KB CCD	2200-250,000	3'	
NICMASS IR Array (NMAS) (see note 2 below)	HgCdTe (256x256, 0.9-1.8μm)	7000-44,000		
Burrell SchmidtTelescope (NB: Available in August and September 1997 only. Not available after 1 October 1997)				
	S2KA CCD (3500-9700Å)	2.9 – 35 Å/pixel		

** Unless otherwise noted, CCDs have 3300-9700Å spectral range*

1: To be closed sometime in Spring '97 when fiber-feed capability from the 2.1-m telescope is available.

2: No new programs accepted

IMAGING

	Detector	Spectral Range	scale ("/pixel)	Field-of-View
Mayall 4-m Telescope				
Prime Focus CCD camera (PF)	T2KB CCD	3300-9700Å	0".470	16'
IR Imager (IRIM)	HgCdTe (256x256, 1-2.5μm)	JHK filters + NB	0".6	2'.5
CCD Mosaic (MOSA) (see note 1 below)	8K x 8K	4500-9700Å	0".26	35'.4
OSU-NOAO Infrared Imaging Spectrometer (ONIS)	InSb (512x1024, 0.9-2.5μm)	JHK filters	0".18; 0".09	3'x1'.5; 1'.5x0'.75
WIYN 3.5-m Telescope				
CCD Imager (WIYN)	S2KB	3300-9700Å	0".197	6'.7
2.1-m Telescope				
CCD Imager (DIR)	T1KA	3300-9700Å	0".305	5'.2
IR Imager (IRIM)	HgCdTe (256x256, 1-2.5μm)	JHK filters + NB	1".1	4'.7
OSU-NOAO Infrared Imaging Spectrometer (ONIS)	InSb (512x1024, 0.9-2.5μm)	JHK filters	0".35; 0".18	6'x3'; 3'x1'.5
0.9-m Telescope				
CCD Imager (DIR)	T2KA	3300-9700Å	0".680	23'.2
CCD Mosaic (MOSA) (see note 1 below)	8K x 8K	4500-9700Å	0".425	59'
CCD Photometer (CCDPhot) (see note 2)	T5HC	UBVRI, Stromgren		3 apertures
Burrell SchmidtTelescope (NB: Available in August and September 1997 only. Not available after 1 October 1997)				
CCD Direct	S2KA	3500-9700Å	2".03	69'

1: Available in Fall '97 for shared-risk observing

2: No new programs accepted

Bruce Bohannan

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Requests for KPNO Telescope Time: February - July 1997

Telescope	Nights Request.	Nights Sched.	#Request./ #Sched.	#of Props.	# Sched.	Total#/ #Sched.	#Staff Nights	%Staff Nights
4-m Dark	216	81	2.7	58	25	2.3	7	9
Bright	100	62	1.6	28	13	2.2	4	6
WIYN Dark	93	32	3.0	33	17	2.0		
Bright	20	23	0.9	12	8	1.5		
2-hour	3	2	1.5	12	7	1.9		
2.1-m Dark	92	81	1.1	21	7	3.0	1	1
Bright	223	83	2.7	50	34	1.5	27	32
Coud Feed	128	150	0.9	16	15	1.1	28	19
0.9-m Dark	96	78	1.2	17	9	1.9	2	3
Bright	71	70	1.0	11	9	1.2	28	40
Schmidt	112	69	1.6	12	8	1.5	4	6

KPNO received 252 proposals from visitors and staff combined; with multiple telescope requests, this totaled 279 separate observing runs. Of these, 17 were long-term proposals; none was granted long-term status. Seven proposals which had previously been granted long-term status were also scheduled. The estimated WIYN time does not include two synoptic proposals for which total time could not be easily estimated. The scheduled time totals include allocations of 1 (4-m), 14 (2.1-m), and 5 (Schmidt) nights which were actually scheduled in January 1997. The request totals do not include expressions of interest for the CCD Mosaic, for which 3 (4-m) and 7 (0.9-m) nights have been set aside for shared-risk observing.

Dick Joyce

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NSO Observing Proposals

The current deadline for submitting observing proposals to the National Solar Observatory is 15 April 1997 for the third quarter of 1997. Forms, information and a Users' Manual are available from the NSO Telescope Allocation Committee at P.O. Box 62, Sunspot, NM 88349 for Sacramento Peak facilities (sp@sunspot.noao.edu) or P.O. Box 26732, Tucson, AZ 85726 for Kitt Peak facilities (nso@noao.edu). A TeX template and instruction sheet can be e-mailed at your request; obtained by anonymous ftp from ftp.sunspot.noao.edu (cd pub/observing_templates) or ftp.noao.edu (cd nso/nsoforms); or downloaded from WWW at http://www.nso.noao.edu/.

Dick Altrock

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K-Line Filter

Users will be pleased to know that the NSO/SP K-line filter is back in operation after a four-year downtime. In 1992, the filter had been sent to Halle for repair of a cracked calcite polarizer. It never worked properly after it was returned. Recently we found that the thinnest element in an "Evan's split element" was rotated 45 causing the central thick element to be totally off band. We had great difficulty in de-cementing the filter because Halle used RTV-based cement that didn't readily dissolve in a wide variety of solvents.

The filter is 0.3/0.6/1.2 wide and is manually tunable. Videos of active regions show that the filter has excellent contrast. Its use can be requested by checking the "branch filter" box on the observing form.

Dick Dunn, Steve Hegwer

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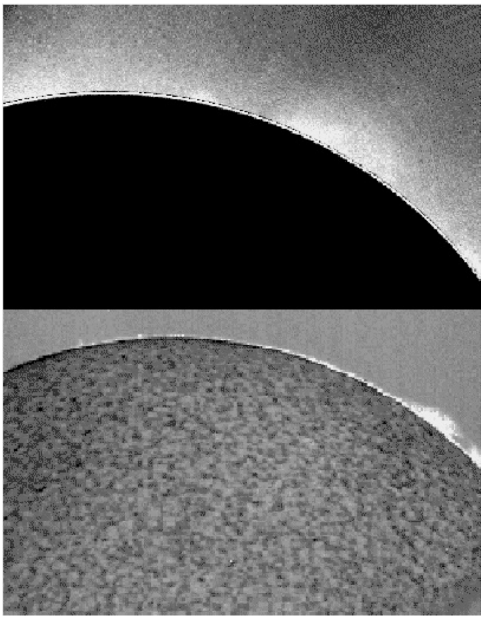
Coronal One-Shot CCD Tests

Several tests were run with the Coronal One-Shot coronagraph at NSO/SP during late October 1996. The Lyot filter pass band was measured on the ESF

Littrow spectrograph, and the orientations of the entrance and exit polaroids were determined for on-band, off-band, and red and blue wing tunings. When coupled with the proper prefilters, the Lyot filter transmits 0.1 nm pass bands centered on the green [Fe XIV] 530.3 nm and red [Fe X] 637.4 nm coronal lines, and at H 656.3 nm. The old prefilters were also tested and found to have spatial irregularities and to have drifted in wavelength.



Nevertheless, the filter system was re-installed on the coronagraph, and a Thomson 1024 x 1024 CCD was borrowed from the VTT and placed in the One-Shot focal plane. During one day of good skies, several test images were taken in the green line and H . The figure shows a sample H disk image and an occulted coronal green-line image. Each image is produced by subtracting sequential on-band and off-band CCD frames. The coronal activity was very low, and the calibrated intensity of the green line structure is about 10 millionths of the disk brightness. With a few more control systems interfaced to the instrument computer, and with a dedicated CCD detector in the film plane, the One-Shot will be capable of high spatial resolution, photometric, automated coronal imaging.

Matt Penn, Fritz Stauffer, Larry Wilkins, Steve Hegwer, Joe Elrod, Todd Brown, Ed Leon

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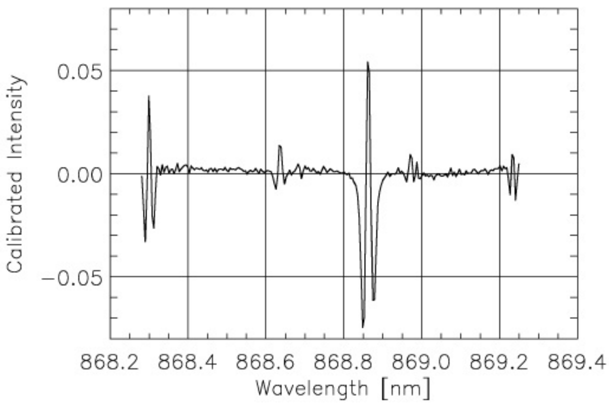
New Polarization Tests at KPVT

Test data have been taken at the Kitt Peak Vacuum Telescope to investigate linear and circular polarization measurements. First, the quarter waveplate used in the normal 868.8 nm Fe I longitudinal magnetograms was removed from the beam. The half-wave chopping retarders then analyzed linear polarization, and full spectral profiles of the 868.8 nm Fe I line (and surrounding region) were obtained. The figure shows that several lines are observed in a sunspot with strong linear polarization profiles. Maps of the linear polarization signal from the Fe I line also showed significant linear polarization in the region surrounding the sunspot. Although much calibration will be needed to remove polarization cross-talk, and changes to the polarization analyzer will also be needed, these test data suggest that the KPVT could be used to measure the vector magnetic field across the whole solar disk.



Secondly, circular polarization profiles of the chromospheric Ca II 854.2 nm absorption line were measured in two sunspot groups. Magnetograms constructed in the line wing and the line core showed significant structural differences, with the line wing magnetograms resembling the photospheric magnetogram measured in a nearby Fe I line. Work is in progress to understand how the circular polarization profile as it changes through the spectral line can be used to measure the magnetic field at different heights in the solar atmosphere.

Matt Penn, Harry Jones

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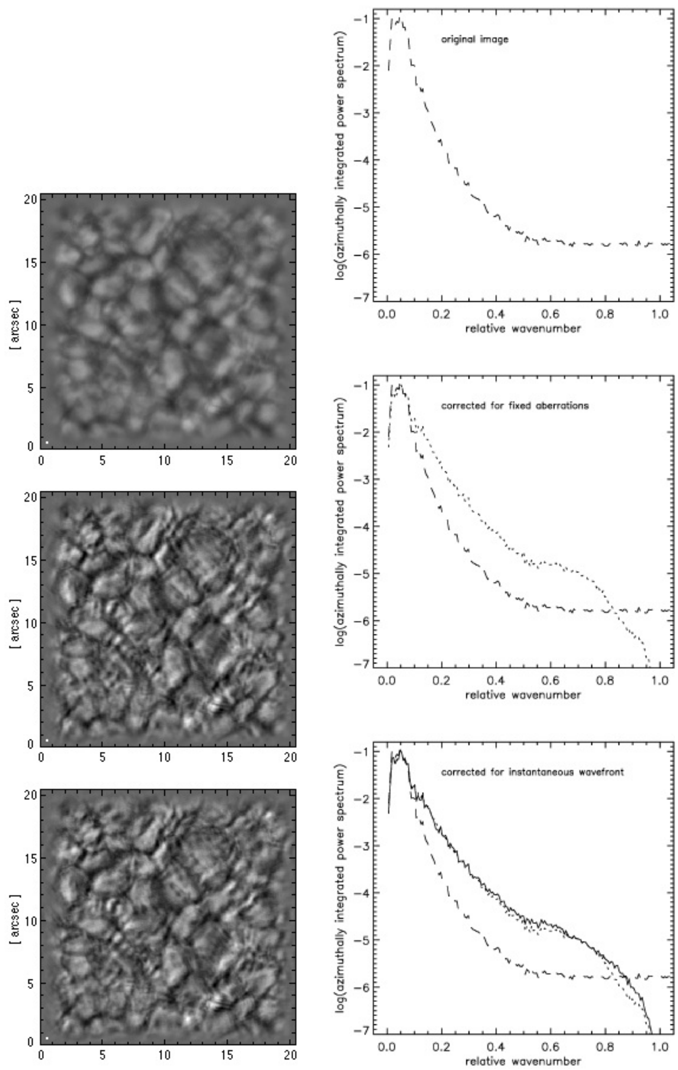
Solar Adaptive Optics

The critical challenge facing the NSO adaptive optics (AO) program at is developing a solar wavefront sensor. Solar wavefront sensing is difficult because point source sensing targets are never available everywhere on the solar disk. Most nighttime AO systems use Shack-Hartmann wavefront sensors (SH-WFS), in which a point source target (natural or laser beacon) is imaged through an array of sub-apertures. The displacement of each sub-aperture image with respect to a reference is proportional to the wavefront slope within that sub-aperture. Displacements can be measured by simple center-of-gravity algorithms or quad-cell devices. Small sunspots or pores can and have been used as SH-WFS targets: for example, the Lockheed AO system tested at NSO/SP in the early 90's was based on a quad-cell SH-WFS. Such tractable sensing targets, however, are scarce on the Sun, and laser beacons are not bright enough to provide practical substitutes. In general, solar wavefront sensing has to be performed using the granulation, an extended, low contrast and evolving structure, as its sensing target.

Two wavefront sensing approaches are currently under consideration at NSO/SP: 1) a modified Shack-Hartmann wavefront sensor that employs cross-correlation techniques to measure the displacements of granulation images formed by a sub-aperture array, and 2) a spatial filtering approach that uses a mask placed in an image plane to modify the light in a way that makes wavefront gradients visible as intensity fluctuations in a pupil plane. The latter technique, first proposed by O. von der Luehe (1988), can be understood as a generalization of the classic Foucault knife edge test, in which the "mask" is a straight edge placed over the image of a point source. Two orthogonal edges are required to measure the two components of the wavefront gradient. A complex target structure like the granulation requires a more complex set of masks. Typically the partial derivatives of the target structure are mapped in binary form on a transmissive liquid crystal screen, which is placed in an image plane. An image of the pupil is then formed on a small, fast CCD, which records the wavefront information.

There are advantages and disadvantages to both approaches. Shack-Hartmann wavefront sensors are widely used in nighttime AO, and are comparatively well understood. The low (order 2%) contrast of the granulation image formed by a small sub-aperture is not a problem. The Mark II correlation tracker recently completed at Sac Peak has successfully demonstrated its ability to stabilize the granulation image formed by a 7-cm sub-aperture - i.e., a single channel of a correlating solar SH-WFS has been implemented in hardware. To gain more detailed understanding of the SH-WFS approach, we have also recorded simultaneous SH-WFS data and granulation images. The measured instantaneous wavefronts are being used to deconvolve a time sequence of granulation images (see the figure). Matthias Roeser, (PhD student, Kiepenheuer Institut, Freiburg, Germany) visiting NSO/SP, is working on these data. Preliminary results show that the SH-WFS provides phase information with the required accuracy. However, a SH-WFS for a solar AO system operating on granulation requires the implementation of high-speed cross-correlation algorithms. Although the hardware needed to do this is now commercially available, the bandwidth requirements point to a massively parallel system, which would be very costly.

In principal, the "LCD Knife-Edge" approach offers an elegant and inexpensive solution, since much of processing is performed optically rather than digitally. Wavefront slopes are directly coded as pupil plane intensity variations by the appropriate mask. No sub-apertures are involved. Theoretical studies and simulations performed several years ago at NSO/SP by J-M. Conan and R. Radick did suggest potential problems with sensitivity and resolution when granulation is used as target structure. Engineering issues such as noise due to the refresh cycle of the LCD and the imperfect contrast of the LCD mask pose further practical problems. As a first step towards an experimental concept validation, we performed an experiment about a year ago that simultaneously measured wavefront slopes with both a correlating SH-WFS and a Foucault knife-edge test, using sunspots and the planet Venus as high contrast targets. The wavefronts measured were virtually identical (Rimmele and Radick 1996). In December 1996, observations were made aimed at proofing the actual "LCD Knife-Edge" approach, using an active matrix LCD computer display as the focal plane mask. The optical experiment at the VTT was designed and set up by R.B. Dunn.



Caption: Preliminary results of reconstructing granulation images using wavefront measurements from a Shack-Hartmann wavefront sensor. The raw image (top), taken with a 8 ms exposure time, has been deconvolved with the instantaneous point spread function derived from the SH-WFS data. The reconstructed image is shown at the bottom. The center image shows the same image corrected for the fixed aberrations of the telescope, showing that during moments of excellent seeing the fixed aberrations can be the dominant source of image degradation. The line plots next to the images show the corresponding radial power spectra. A relative wavenumber of 1 corresponds to the theoretical telescope resolution.

Various target structures (sunspots, pores, and granulation) were observed, and various approaches for generating a mask on the LCD were explored. A small-format DALSA camera was used to record the pupil images at a rate of 800Hz. The data are currently being analyzed. The principal result emerging from this analysis is that the "LCD Knife-Edge" approach encounters increasingly severe S/N problems as the contrast of the target structure decreases. With a sunspot as the sensing target, we typically achieved a S/N of 3.5. A small pore delivered a S/N of about 2. Granulation, however, produced a S/N of unity or less, even under good seeing conditions. We are currently exploring ways to improve the S/N: unless this can be done, the correlating SH-WFS may be the only practicable approach to solar wavefront sensing.

T. Rimmele, R.B. Dunn, R. Radick, M. Roeser

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First Observations with Fast 2K x 2K CCD Camera

A new high speed, high dynamic range CCD camera has been developed in collaboration with Xedar Inc. (Boulder CO). This instrument was developed for the RISE/PSPT project and uses a new Thomson 2K x 2K CCD array. NSO has purchased one 2K x 2K camera for general use at NSO/SP and plans to purchase a second 2K x 2K unit as funds become available.

The first two camera units have been received at NSO/SP and have passed preliminary tests. A detailed performance characterization is currently being performed. The 2K x 2K cameras have a linear well depth of about 200,000 e-, with a read noise of about 34 e- when operated at a read rate of 8 Mpix/s. The camera electronics allow a second fiber optic connection to a Sun/SPARC controller that will allow a total readout rate of 16 Mpix/s. The cameras can also be used in a 1K x 1K mode using on-chip binning. The data can be stored to Exabyte tape or hard disk. A fast, high capacity DLT tape drive will also be available for the 2K x 2K system. The first of these cameras is available on a shared risk basis for observations during the spring 1997 quarter at NSO/SP. The first observing run, which used the 2K x 2K camera behind the UBF to study acoustic flux events in the solar photosphere, was successfully carried out in January 1997.

Jeff Kuhn, Thomas Rimmele, Fritz Stauffer

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Global Oscillation Network Group

The Global Oscillation Network Group (GONG) Project is a community-based activity to operate a six-site helioseismic observing network, to do the basic data reduction, provide the data and software tools to the community, and to coordinate analysis of the rich data set that is resulting. GONG data is available to any qualified investigator whose proposal has been accepted; however active membership in a GONG Scientific Team encourages early access to the data and the collaborative scientific analysis that the Teams are undertaking. Information on the status of the Project, the scientific investigations, as well as access to the data, is available on our WWW server whose URL is www.gong.noao.edu.

Data Analysis

With the year-long spectra in hand, we are entering entirely new realms of sensitivity and spectral resolution. The high quality of the GONG spectra, free of temporal sidelobes, has revealed an unexpectedly rich structure of spatial sidelobes. These "spatial leaks" arise from the decomposition of the velocity field into spherical harmonics on only a portion of the sphere. In this case, the spherical harmonics do not represent a complete set, and the cross products of harmonics with different degree and order do not vanish. We will be changing the shape and apodization of the spatial area over which the images are decomposed into spherical harmonics to address this. Preliminary tests indicate that this will significantly reduce the number of spatial leaks present in the spectrum. Even so, if the remaining leaks are not correctly incorporated into the model fitting, systematic bias can be introduced in the estimated frequencies. As we are attempting to measure the frequencies to a part in 10^6, small systematic differences of tens of nanoHz just cannot be ignored, nor can subtle differences between various "peak-bagging" methods.

We have assembled a "tiger team" to attack these interrelated "opportunities." Yeming Gu and Rudi Komm have been developing methods to smooth the spectrum using multi-taper spectral estimates and wavelet denoising techniques. Frederic Baudin and David Feirry-Fraillon are applying methods developed in the context of non-imaging helioseismology - e.g. homomorphic deconvolution. Philip Stark is providing us with the latest statistical techniques, and Rachel Howe has developed a spatial leakage matrix for the GONG observations, Stuart Jefferies is contributing his deconvolution and global fit method, and his line asymmetry model. Finally, Ed Anderson has been kept very busy implementing all of these suggestions! We hope that within the next six months, a new (most likely hybrid) peak bagging scheme will become available to produce substantially improved frequency estimates with lower systematic and random uncertainties.

Other changes are also in the works for the analysis of GONG data. Cliff Toner's optimization method to determine the relative angular offsets of the cameras has been implemented. The site-to-site variations in the velocity calibration scale factor can now be removed, and a temporally varying sidereal-synodic correction is being installed. We are also investigating the effects of uncertainties in the assumed position of the solar rotation axis on the frequencies, and investigating the effect of the horizontal component of the oscillatory velocity field on the spherical harmonic decomposition. The details of the apodization and the padding of the time series are also being reevaluated.

Data Management

During the past quarter, "month-long" (36-day) time series and power spectra were produced for GONG months 13 and 14 (ending 96/09/21) with fill factors of 0.73 and 0.76. The fill factors for these two months were significantly lower than for the previous two months (0.94 and 0.82). The difference is attributed to changes in global weather patterns (including monsoons at Udaipur and typhoons at Learmonth), preventive maintenance visits to several sites, and some instrument problems. Ten-month (the concatenation of GONG months 4 through 13, the first full GONG year) time series and power spectra for spherical harmonic degrees less than or equal to 45 were produced; the fill factor is 0.87. The next GONG year products will be produced from months 9 through 18.

The delay between data acquisition and completion of the month-long power spectra, which had been about 17 weeks, increased during the past quarter (primarily, for month 15 which is still being processed) because of holidays and vacation. We received and processed 82 cartridges containing 578 site-days from the seven instruments. 383 site-days were processed through the site-dependent data reduction stages. The difference of 195 site-days is attributed to bad weather at the network sites and 81 site-days from the engineering test unit in Tucson.

During the past quarter, we serviced 20 data distribution requests for 61,427 files totaling 13.2 Gigabytes of data. The average delay between receipt of a request and shipping the media containing the data products was about 1.5 days. In addition, there were 2,378 data cartridge transactions (library check-ins and check-outs) in response to requests from the data reduction pipeline and other internal operations. The copying of new data product cartridges, the delivery of these copies to the off-site storage facility, and the testing of old media in both the local library and in the off-site storage facility continued as expected.

The Project is preparing for a reprocessing campaign that will probably begin before April to regenerate pmode power spectra from calibrated velocity images. This will apply the software updates that occurred during the past eighteen months to all previously acquired network data, resulting in a more consistent and homogeneous data set. Additional changes to the routine data reduction are also being evaluated. These include correcting the scale of the velocity images by fitting the spatially averaged velocity to the observer motion, compensating the registration of the velocity images for the difference between synoptic and sidereal heliographic coordinates, changing the spatial window function from an aperture with constant range of heliographic latitude and longitude to an aperture with constant area on the observed solar disk, apodization of the images as they are registered onto the heliographic grid, increasing the sampling of the heliographic grid to eliminate some spatial aliasing that resulted from undersampling the images in camera coordinates, and changes to the temporal gap-filling, apodization, and length of the FFT.

Network Operations

Calendar Year 1996 did not pass into history for GONG network operations without event. The first sign of trouble for the operations group in Tucson came during the early evening on 30 December. We got a call from Learmonth, where their 31 December observing day was just beginning. Their rotating waveplate (the optical modulator) was suffering electronic resyncs every three minutes. John Kennewell noted that the problem began at about zero hours UT, but we thought nothing of it for the moment. It became apparent, however, that every station in the network had begun the same behavior at precisely the same time: 0:00 UTC on 31 December. In general (though not in detail) every site would take about two images, then resynchronize to the time base.

Upon further investigation, the Tucson staff noted that the GPS receiver in our Tucson laboratory (identical to the ones in service in the field) was toggling between day number 365 and day number 366 about every three minutes. We were so proud of the way that we slid through the leap day last 29 February without incident (although we were holding our breath), but "pride goeth before destruction, and a haughty spirit before the fall."

A phone call to the GPS receiver vendor yielded a busy line. This continued for quite some time. When we eventually got through to the service people, we learned that they were having a very, very bad day as well. It seems their firmware had a bug, still not understood at that time, but clearly related to 1996 being a leap year. They were hearing from most of their customers owning that model series as time went on, but could suggest no effective solution until their analysis was complete. An attempt on our part to disable the GPS time and date-reading function was not successful resulting in more frustration.

By this time we were within a few hours of a new day in Greenwich, and could do little but ride out the crisis. Most of the sites on the sunward side of the planet were cloudy anyway (as luck would have it) by that hour. At 5:00 P.M. Tucson time (New Year in Greenwich) we began checking on the sites and shaking them back to life. Each had to be roundly slapped (reboots, generally) to return it to its duty. It took a couple more hours (between Internet problems and overseas phone connections) before we completed our rounds and everything was returned to normal.

It remains to be seen what can be made of the images that were obtained on 31 December. The tapes containing these data are just beginning to show up. This sort of very gappy coverage (missing one out of three images at short intervals) is difficult to imagine merging effectively. Time will tell.

By the way, the GONG operations group is looking for a few volunteers from our community to serve as duty responders on New Year's day in the year 2000. We're planning to be on vacation, or stalking the GPS receiver vendor.

The rest of the last three-month (and two week) period has gone very well. In spite of the one "very dark day" in December our down-time statistics improved. We lost about 5600 images due to various instrumental problems, presuming that all of the clear-weather images from 31 December have to be thrown away. This is about 1.4% of the total number of images that could be obtained, bringing the overall down-time average since full-network operations began back down below 2%.

As for the weather, some of the northern-hemisphere sites have a tough go of it from time to time during this season. El Teide lost another anemometer propeller in an ice storm, and our Big Bear maintenance trip was held up for four days as we waited for a series of snow storms to move out of the mountains of southern California. But the weather in India and Hawaii has been quite good, and Learmonth and CTIO can form a pretty good network all by themselves during the long dry days of the Austral summer.

To Be Continued...

The Project is continuing with its plans to continue the observation phase for a full eleven-year activity cycle. Tracking the evolution of subsurface changes through the cycle has been identified as a key element of NSO's long-range plan and has been warmly received by NOAO. Detailed planning is also continuing for an upgrade of the camera system to a higher-resolution format in the 512^2 - 1024^2 realm. Seeing studies using the current GONG instrument indicate that the present GONG sites have adequate seeing to support such observations, while studies using the GONG prototype show that the instrument optical system is also equal to the task. A recent test of the GONG data management system, using 1024 1024 images from the NSO High Degree Helioseismometer, demonstrated that keeping cadence with the larger data flow from such an instrument will indeed be achievable with the workstations conservatively projected to be available on the market in the year 2000. A formal plan for both the continuation and the new camera system is currently being developed.

John Leibacher

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Donald R. Farris: 1937 - 1997

We must report with great sadness that Don Farris passed away quietly at home on 26 January after a long illness. Don was the senior electronics technician for the GONG project nearly from its inception until the sites were deployed in 1995.

Don came to work at Kitt Peak early in 1974, and made his presence felt from the very beginning. He was involved in the development of the Observatory's first CCD cameras and later in the production and maintenance of the Universal CCD and Control Systems that saw service for many years at Kitt Peak and CTIO. He became well known in Chile during a trip to CTIO in 1982, a "road trip" now legendary on two continents. By this time Don had developed into one of the observatory's "super techs" - always well informed, invariably opinionated, and usually right. Don was this army's chief master sergeant, respected by his peers, and never shy about putting a junior engineer or "nomer" in their place when it was in the best interest of the project.

Don began working on solar projects in 1987. Although his primary effort was directed at GONG development, he played a pivotal role in the instrument development for all of the South Pole campaigns, and was consulted on many other projects as well.

Don's last years of service, however, were dominated by work on the GONG instruments. He poured his heart and soul into those shipping containers and their contents. The GONG instruments have proved to be highly reliable, and they will be Don's legacy every minute that they run. He appreciated that our equipment had to operate reliably if we were to enjoy the good will of the local technicians at the host observatories. The sign on the outside identifying our work as the property of the NSF, AURA, and the NOAO read "Made in America" to Don, and he took that very seriously. He would suffer no short cuts and no shoddy work where it mattered.

Don's memory will live on in his family, his friends, and his colleagues. He worked hard to pass his experience along to the next generation. His skill and pride in his work will survive in every one of us who was privileged to be "trained up" at the feet of the master.

Rob Hubbard

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Gemini Construction Mini-Update

Site construction continues to go well at both sites. The start of dome assembly on Gemini North was delayed due to bad weather in January but has progressed. Pre-assembly of the first telescope steel structures has been completed in the fabrication plant in France and testing with the azimuth drive assemblies will take place in March. The telescope will then be disassembled and shipped to Hawaii in May. The primary mirror destined for Gemini North will be completing its turn on the grinding station at REOSC in France and will be repositioned to the polishing station by April. This mirror is scheduled to ship to Hawaii in November. The mirror blank for Gemini South is scheduled to ship from New York to France in April to begin grinding.

The project remains on schedule and on budget, with first light scheduled for December 1998 in Hawaii and June 2000 in Chile. Photo updates of construction in progress are available at www.gemini.edu.

Kathy Wood

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Announcement of Opportunity

Proposals will be solicited in March for the design and fabrication of the Gemini Mid-Infrared Imager. Any US institution or company is eligible to bid. This open competition follows a conceptual design phase in which four teams presented design concepts to the USGP so that the design and cost feasibility could be assessed with respect to the requirements and available budget. If you are interested in participating in the competition please contact the USGP immediately by email (wood@noao.edu) or by phone (520 318-8175).

Kathy Wood

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New Gemini US Board Member

We are pleased to announce that Judith Pipher (Rochester) has been appointed to serve as one of the five US members of the Gemini Board of Directors. She joins the other US members of the Board, Bob Kirshner (Harvard), Bob Gehrz (Minnesota) who serves as Chairman of the Gemini Board, Bob McLaren (Hawaii), and Wayne Van Citters (NSF). The Gemini Board meets twice yearly and comprises membership from the six Gemini partner nations.

We wish to express our most sincere gratitude to Alan Dressler who completed his term on the Board. Alan has made significant contributions to the stewardship of Gemini through his position on the Board of Directors and previously as a member of the international Gemini Science Committee and the US Science Advisory Committee.

Kathy Wood

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IRAF Update

As we write this article, version 1.0 of X11IRAF is undergoing in-house testing, and the package should be available for all supported platforms by the time this *Newsletter* is printed. Binaries are provided for all Unix/IRAF hosts including SunOS, Solaris, DEC Alpha OSF1, SGI IRIX, Linux, FreeBSD, IBM AIX, Dec Ultrix, and HP/AUX. The package includes major enhancements to Ximtool plus new documentation for Ximtool, Xgterm, and Xtapemon. See the last issue of this *Newsletter* for more details about the new version of X11IRAF. The distribution can be found in the directory /iraf/x11iraf on the IRAF network server iraf.noao.edu.

After a couple of years of patches to V2.10 IRAF we finally have a date for the IRAF V2.11 release. The chief driver for the release is the upcoming Hubble reservicing mission, which if all goes well, should be over by the time this *Newsletter* is out. The new instruments, STIS and NICMOS, will be installed during the reservicing mission with observing scheduled to begin several months after the shuttle launches in February. A new version of STSDAS will be released in the spring to support the new instruments, and the upcoming IRAF V2.11 IRAF release will provide support for the new release of STSDAS. The Open IRAF NASA grant, which commenced in December, is providing partial support for this IRAF release.

In the next weeks the new IRAF system will be frozen at the application level and internal beta testing will begin. After the initial testing has been completed and any problems resulting have been identified and fixed, the system will move from our development system to our Sun servers in-house to begin rigorous user testing. Meanwhile the new expanded FITS support, including the new FITS kernel, and other system enhancements will be installed and tested on our development system before they are moved over to our Sun servers for the usual user testing. We will have more details about the V2.11 release in the next issue of this *Newsletter*.

IRAF has won a major NASA grant for the development of our image display and GUI technology. In collaboration with the Smithsonian Astrophysical Observatory, IRAF has been awarded a grant from the NASA Applied Information Systems Research program (AISR) for developing the "plug-in extensible image server". Our intention is that this new image display facility will eventually replace and supplant both Ximtool and SAOtng. The new display server will be based on the current IRAF Object Manager GUI technology and on Ximtool and SAOtng, but will be a major step beyond both.

To quote from the grant proposal: "*...we describe the next step in our plan to evolve our existing software into a fully extensible, cross-platform image display server that can run stand-alone or be integrated seamlessly into astronomical analysis systems. We will build a Plug-in Image Extension (PIE) server for astronomy, consisting of a modular image display engine that can be customized using "plug-in" technology. We will create plug-ins that reproduce all the current functionality of SAOtng and more. We also will devise a messaging system and a set of distributed, shared data objects to support integrating the PIE server into astronomical analysis systems. Finally, we will migrate our PIE server, plug-ins, and messaging software from the Unix and the X Window System to a platform-independent architecture the utilizes Tcl/Tk and Java.*" The PIE will provide the engine for the Real-Time Display being developed for the NOAO CCD Mosaic project. We are grateful to NASA for their continued support of the IRAF project.

Much effort continues to go towards development of the data handling system for the NOAO Mosaic. A prototype of the data processing software was completed last fall and was used in the last several Mosaic engineering runs. Work is underway on the messaging system and on a distributed shared image facility, which will serve as the framework for the data capture agent, real-time display, IRAF interface, and other components of the data handling system. Frank Valdes and Doug Tody are those most involved with the project at this stage. See the last two issues of this *Newsletter* for more details about the work the IRAF group is doing associated with the Mosaic project.

Mike Fitzpatrick did much of the work putting the new version of X11IRAF together and most recently has been developing a library of routines to allow host (non-IRAF C and Fortran) programs to display to image servers such as Ximtool and SAOimage. This library features high-level image display functions as well as image overlay marking, cursor and image readback, and print capabilities. A first version should be available around the time of the *Newsletter* release, and will be announced in the *adass* newsgroups. Nelson Zarate has been putting the finishing touches on the first version of the FITS image kernel as well as updating operating systems on various IRAF-supported platforms in preparation for the V2.11 release.

Lindsey Davis is continuing to work on the IRAF ASTROMETRY package and related software. Last quarter she modified the IMMATCH package SKYCTRAN task to use proper motion, parallax, and radial velocity, and to support a fully interactive image cursor and standard input mode, in which the user can enter the input and output coordinate systems, the input and output units, and the output format. She also added a new celestial pixel coordinate list matching task CCXYMATCH to the IMMATCH package. Lindsey is also continuing to investigate methods and user interfaces for local and remote astrometric catalog access and, with others in the group, to assess the requirements of the NOAO mosaic vis-a-vis astrometry software.

Rob Seaman has been working on an update to the FINDER package, which is used within NOAO for observing support for the Hydra multi-object spectrograph, as well as other astrometric work. The new version will use tasks from the IMMATCH package for performing the plate solution. User interface improvements include the ability to fit only a few stars and improve the predicted X&Y coordinates for the HST Guide Star Catalog sources. Rob is currently working on configuring the observing environment ("obsinit") for the NOAO mosaic data system. A major upgrade to the "Save the Bits" data archive software is pending that will allow STB to use writable CD-ROM disks in addition to the exabytes and DATs that are currently supported. In addition to KPNO data archiving that began in 1993, CTIO is now archiving data from four telescopes using their own STB system. A local STB system was also configured to support the SONG asteroseismology project at the KPNO CoudÃ© Feed telescope. Rob supported this project with a special purpose version of the ICE CCDACQ package that allows triggering exposures as a precisely cadenced clock interval, as well as an queued autoFTP connection to transfer the many thousands of SONG spectra to a downtown Tucson computer for data reduction and analysis.

For further information about the IRAF project please see the IRAF Web pages at http://iraf.noao.edu/ or send email to iraf@noao.edu. The adass.iraf newsgroups on USENET provide timely information on IRAF developments and are available for the discussion of IRAF related issues.

Doug Tody, Jeannette Barnes

NOAO FTP Archives

The various FTP archives for the National Optical Astronomy Observatories can be found in the following FTP directories. Please log in as "anonymous" and use your e-mail address as the password. Alternate addresses for the following archives are given in parentheses.

```
ftp ctios1.ctio.noao.edu (139.229.2.1), cd ctio
   CTIO archivesArgus and 1.5-m BME information, 4-m PF plate catalog, TEX
   template for e-mail proposals, filter library, instrument manuals, standard
   star fluxes.

ftp ftp.sunspot.noao.edu (146.5.2.181), cd pub
   Directory containing SP software and data products coronal maps, active
   region lists, sunspot numbers, SP Workshop paper templates, information on
   international meetings, SP observing schedules, NSO observing proposal
   templates, Radiative Inputs of the Sun to the Earth (RISE) Newsletters and
   SP newsletters (The Sunspotter).

ftp ftp.noao.edu (140.252.1.24), cd to one of the following directories:

   catalogs - Directory of astronomical catalogues: the Jacoby et al. catalog,
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   "A Library of Stellar Spectra"; the "Catalogue of Principal Galaxies"; the
   "Hipparcos Input Catalogue"; the "Lick Northern Proper Motion Program:
   NPM1"; and the "Coud\'{e} Feed Spectral Library."

   fts (argo.tuc.noao.edu, cd pub/atlas) - Directory containing solar FTS
   high-resolution spectral atlases.

   gemini (ftp.gemini.edu, cd pub) - The FTP archives for the Gemini 8-m
   Telescopes Project.

   gong (helios.tuc.noao.edu, cd pub/gong) - Directory containing GONG
   helioseismology software and data productsvelocity, modulation and intensity
   maps, power spectra.

   iraf (iraf.noao.edu) - IRAF network archive containing the IRAF distributions,
   documentation, layered software, and other IRAF related files. It is best to
   login to iraf.noao.edu directly to download large amounts of data, such as
   an IRAF distribution.

   kpno (orion.tuc.noao.edu) - KPNO directory containing filter lists and
   transmission data, CCD and IR detector characteristics, hydra (WIYN)
   information, LaTeX observing form templates, instrument manuals, KPNO
   observing and monthly support schedules, 4m PF platelogs, reference
   documents, and sqiid data reduction scripts.

   kpvt (argo.tuc.noao.edu) - Directory containing various KP VTT solar data
   products - magnetic field, He I 1083 nm equivalent width, Ca II Kline
   intensity.

   noao (gemini.tuc.noao.edu) - NOAO e-mail and phone lists, Royal Greenwich
   Observatory electronic mail address databases, list of areacodes and
   zipcodes for the US, various LaTeX tidbits, report from Gemini WG on the
   high resolution optical spectrograph, etc.

   nso (orion.tuc.noao.edu) - Directory containing NSO observing forms.

   sn1987a - An Optical Spectrophotometric Atlas of Supernova 1987A in the LMC.

   tex - LaTeX utilities for the AAS and ASP.

   utils - Various utilities, but only contains some PostScript tools at this
   time.

   weather (gemini.tuc.noao.edu) - weather satellite pictures.

   wiyn (orion.tuc.noao.edu) - WIYN directory tree containing information relating
   to the WIYN Telescope including information relating to the NOAO science
   operations on WIYN.

The following numbers are available for the machines mentioned above:

        argo.tuc.noao.edu    = 140.252.1.21
        ctios1.ctio.noao.edu = 139.229.2.1
        ftp.gemini.edu       = 140.252.15.71
        ftp.noao.edu         = 140.252.1.24
        ftp.sunspot.noao.edu = 146.5.2.181
        gemini.tuc.noao.edu  = 140.252.1.11
        helios.tuc.noao.edu  = 140.252.8.105
        iraf.noao.edu        = 140.252.1.1
        orion.tuc.noao.edu   = 140.252.1.22
```

Questions or problems may be directed to the following: Steve Heathcote (sheathcote@noao.edu) for the CTIO archives, Frank Hill (fhill@noao.edu) for all solar archives, Steve Grandi or Jeannette Barnes (grandi@noao.edu or jbarnes@noao.edu) for all others (and they will direct your questions as needed).

For further information about the NOAO observatories and projects see the World Wide Web URL: http://www.noao.edu/.

Jeannette Barnes

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