



SARA NORTH OBSERVATORY DIRECTOR'S REPORT

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I. Introduction.

"the best laid plans of mice and men often go astray" (Robert Burns)

Above is the perfect quote for summer shutdown this year! As director of SARA North, I tried to insure that everything went smoothly during this years busy summer shutdown. We planned a variety of upgrades and improvements to SARA north, and with past experience, I knew that things would take longer than we expected, and be more complicated than we anticipated. Among the issues we intended to address were the following:

- Mirror re-aluminization
- Replace back end of telescope with new instrument selector and filter wheel
- Replace and upgrade control cards and relays
- Install new mirror cover since the old one failed to be robust enough
- Send the Apogee CCD in for needed repair

If this weren't enough, we also needed to make some steady progress on SARA south. All of this work, excluding CCD repair, rested on the shoulders of Peter Mack and ACE.

Knowing that things tend to creep up and take longer than anticipated, I made a point of staying in contact with ACE, inquiring about the status of the various projects. I also tried to make sure everyone was on the same page about mirror re-aluminization which we decided would be done in Tucson rather than up at Kitt Peak as had been done in previous years. The major deciding factor in doing the re-aluminization in Tucson was the timing of re-coating the mirror *during* August shutdown. Kitt peak was fully booked during that summer shutdown, but the mirror lab supposedly wasn't! Also, the mirror lab was cheaper than Kitt Peak. Knowing that ACE was operating shorthanded, I really tried to stay on top of things on this end, making sure nothing was forgotten or slipped through the cracks. I made a point of visiting Peter in his workshop in Tucson during my REU observing run and everything seemed to be in order. I actually saw some of our equipment being fabricated in Peter's shop, mainly the mirror covers for SARA north and

the instrument for SARA South! Peter noted that work on the SARA north instrument was started, but was awaiting SARA shutdown for parts that would not be replaced. I was primed for a smooth, intensive refurbishment of SARA North. *Then the plans went astray. It was reminiscent of a Lovecraft novel as the helpless stranger passes over the bridge from a normal existence into the mouth of madness.* I am still not quite sure why, but when mid July rolled around, we were suddenly told that the only time the mirror lab could re-aluminize the mirror was in mid-July! It came as news to me, as I thought we had pre-scheduled the event early in June to be done during normal August shutdown, and used the mirror lab precisely because we would not have to lose observing time with them. Although it is still not clear why, it turns out we had no choice, so we shut down the observatory in mid-July to get the mirror removed and transported by ACE down to Tucson. The re-aluminization actually ended up costing \$500.00 more than expected since the mirror lab spontaneously raised their prices, catching us totally off guard. Unfortunately, we had no choice at that point and we paid the higher price. Not a deal breaker, but a further annoyance that not only did we lose observing time, but also it was more expensive than we had been told. Peter did say that the mirror was refinished very nicely and we will have brand new shiny mirrors when we open again.

ACE also assured me the early shutdown was a positive thing since they needed the equipment from the telescope to incorporate into the new control system. This added time would be beneficial to getting the telescope back in action in September. As the month of August progressed, I became increasingly uncomfortable when the telescope was not being reassembled. To be fair, ACE was under severe time crunch problems caused by the Korean telescope, and the fact that they were short-handed and other local dynamics. The end result however, is that the instrument holder for the back of the telescope was still being fabricated as August ended. In anticipation of not opening in time for Bill Keel's public program, I informed Bill of the problem and he formulated plans B and C which he eventually had to utilize. Once ACE shipped the Korean telescope, they worked extremely hard on SARA and the telescope began on-site observer operation on September 21. The moral of this story is, that no matter how much you plan and how vigilant you are, unexpected delays can still happen.

In retrospect, we now have an updated telescope with shiny clean mirrors, brand new mirror covers to keep them clean, a totally refurbished and updated automation system, and a new, hopefully more efficient method for mounting the CCDs. The new single filter wheel contains essentially all of the filters we need, and the tertiary mirror, long suspected of contributing to poor image quality, has been abolished from the system. Hopefully our images will be of much higher quality now.

For all of the surprises and delays, Peter Mack and ACE for worked very hard on refurbishing the telescope, and in Peter's words, "We are getting practically a new telescope for very little actual cost", as the refurbishment required doing much more than was originally anticipated.

SARA SOUTH

SARA South director Ron Kaitchuck and I agreed that this single report will encompass both telescopes this time since there is actually little to report on the SARA south project since the last board meeting. SARA South is progressing, albeit not at the breakneck pace we wished for. Delays prevented ACE from going down and taking off the parts they needed before summer shutdown at Kitt Peak. The SARA North work has taken much longer than anticipated which further impacted the ACE availability for SARA South work. However, the instrument selector and many of the pieces needed for the SARA south project are nearly completed in the ACE workshop. During my REU visit, Peter showed me the control system in progress. The current plan is still fluid, but Peter may visit SARA South in early October before finishing out the Korean telescope to bring back the pieces he needs to work with and taking some equipment down with him. Then perhaps November he will go back to SARA South and finish the work so we could be observing by as early as November. However, see quote at top of page 1.

II. Research at SARA.

- I wanted to mention a few outstanding research highlights in this report. Bill Keel used SARA to observe “Hanny’s Voorwerp”. The area was discovered in SDSS images and the SARA images were the first images to probe the nature of that area of sky. One idea is that the “Voorerp” could be the light and ionization echo of a dormant quasar. The story was picked up by several press sources, and a proposal based on the SARA observation netted Bill’s group 7 orbits of Hubble time. The SARA images were instrumental in narrowing down the wavelength range of a strong emission line before spectra were obtained.
- Bev Smith and The ETSU group published a paper in the June 2008 issue of AJ on ARP 285 containing SARA H-alpha images, GALEX UV data, and Spitzer IR images. The accretion tail was detected in the SARA images. The reference is: ‘Stochastic ‘Beads on a String’ in the Accretion Tail of Arp 285’, by B. J. Smith, C. Struck, M. Hancock, M. L. Giroux, P. N. Appleton, V. Charmandaris, W. Reach, S. Hurlock, and J.-S. Hwang (2008), A. J., 135, 2406. The astro-ph link is: <http://xxx.lanl.gov/abs/0803.4218>
- Terry Oswalt participated in the discovery and characterization of a large planet orbiting an extreme horizontal branch star. These unique results, which relied heavily on observation made at SARA, were published in *Nature*, Sept 13, 2007.
- The latest issue of JSARA will contain the papers of this year’s crop of REU students. All of the research presented by the interns was outstanding and will be featured in the latest issue of JSARA

III. Telescope Usage.

Bill Keel has taken over scheduling for the SARA telescopes since Ron Kaitchuck has taken on the observatory directorship for the SARA South observatory. Bill has done an excellent job is smoothly transitioning to the Alabama calendar.

I am very pleased that observers have been much more diligent in submitting observing reports after their nights, but we are not yet perfect. From examining the April through July reports, the following resulted usage is reported. *Special thanks to Bill Keel for compiling and sending me this information quickly.*

Observing Statistics

| Month | Nights Observed | Nights wiped out | Hrs. Observed | Hrs. Lost Weather | Hrs. Lost Mechanical |
|-------|-----------------|------------------|---------------|-------------------|----------------------|
| March | 23 | 6 | 143 | 37.5 | 27.3 |
| April | 15 | 3 | 189 | 26.5 | 17.4 |
| May | 12 | 11 | 68 | 74.5 | 47 ¹ |
| June | 20 | 5 | 132 | 35 | 25 ² |
| July* | 6 | 5 | 6 | 32 | 0 |

¹ Three consecutive nights lost due to Dome Malfunction

² Two consecutive nights lost due to lightening strike

* Mirror removal on July 6.

IV. Telescope Problems.

RADMIN is the default program for SARA operation. The **Mirror Petals** have been re-designed by ACE after many hours lost due to the mirror covers malfunctions, not to mention the dust accumulation on the mirror because we could not close the covers remotely for most of the semester.

Dome cameras – Both dome cameras were in working order at the time of summer shutdown.

Most of the problems discussed in previous reports may well be fixed by the new automation system. This includes the poor tracking west of the pier that has plagued us since first light. Peter is installing torque motors to try to smooth out tracking in the problem regions of the worm.

V. Instrumentation.

- Cameras

1. The U42 CCD camera was sent back to Apogee immediately after observatory shutdown in mid July. The complaints were numerous and included:
 - Latent image problem
 - Lack of cooling power
 - Ice crystals on edge of field
 - Light leak
 - Seeming gain drift

I attempted to delineate the problem to Apogee techs in a very specific E-mail after polling SARA observers. The response I received from Apogee was less than satisfying. After they received the CCD, days passed and I called several times before actually reaching the tech analyzing our camera. Of course he asked the question, "What is the problem with it!" So I once again went over the multiple complaints. During the third week in August, when I still had gleaming hope our telescope would be in operation starting September, I contacted them again. The camera was on its way back to ACE, and he had found and fixed a short in the electronics. Enclosed in the shipping box was an explanation I had failed to obtain from the tech at Apogee. "Loose solder joint on chamber wire causing intermittent connection to CCD pin. Wire solder joint repaired. Chamber and chamber lid passed validation procedures. Excessive condensation residue found on CCD. CCD was cleaned and

camera

was fully tested." On his first night, Ron reported the following:

"A new problem: There is now an intermittent bright column that runs down the center of the image. I have not yet seen a pattern as to what makes it come and go.

was

Old temperature issue: The camera will not go below -17.5°C . I was able able to get it to -20° but it wouldn't stay there.

Light leak: There is a significant light leak in the camera. I was able to isolate the location of the leak to shutter itself. Light is somehow getting in around the shutter leaves. I recommend that we avoid taking bias and dark frames if there is significant light coming through the telescope. One way to avoid this problem is to close the mirror petals.

We need to discuss as a group what the next step is with this camera should it prove not to be good enough for our purposes.

2. Finger Lakes camera with SITE chip is our backup camera but it hasn't been used very much lately as our primary camera has been doing well. It has a notoriously high dark count and some imperfections that make it less desirable than the U42, but is still a viable science instrument.

We are in desperate need of a new CCD camera which will cool to a lower temperature and that has a lower dark current than the Apogee cameras. Estimates from a number of vendors have been received and we finally decided on a Bob Leech camera, in spite of the nearly \$73,000 price-tag, and were ready to buy one when added uncertainties in the SARA south budget became worrisome. We decided to put off the major purchase until we could determine the budget was solid enough. After our last REU meeting, Rico Ignace has volunteered to try and spearhead a proposal to buy some new cameras. Thanks Rico!

- **Computing facilities**

The SARA telescope control computer is new, along with the new operating system, new control cards, new wiring. The “make-over” was so intense, that as Peter puts it “we have a completely new telescope, except mirrors and stepper motors.” Early reports from on-site observer Ron Kaitchuck indicated the system looks very good.

- **Weather Station**

The weather station was hit by lightening in late June and was totally incapacitated. Peter Mack and ACE removed the pieces and sent them back. The weather station was replaced free of charge by the company. The new all-sky cam also worked very well most of the period with a few weeks of down time. The web site address for the weather station is: <http://www.saraobservatory.org/wx/sara.html>.

- **REU Program -**

The past REU program seemed to go very well, with lots of great interns and great research. Thanks again Matt! I think the REU students had a great time on-site and I was proclaimed the best REU on-site mentor since I got the students personal tours of the WIYN, the 4-meter and the Solar telescope in one visit!

- **ROA's** - Our group of ROA's are exceptional. I would like to formally thank Elaine, Chuck and Roy for their excellent work in the past months. It is always a pleasure to work with them, even though the telescope is operating so efficiently only rarely does there need to be much interaction. Unfortunately, Elaine Halbedel has given up her duties as SARA ROA because of increased activity demanded by her “day job” at the RGT telescope. Everyone at SARA will miss Elaine as she was an excellent ROA for us. Thanks Elaine!! As a result of Elaine’s departure as ROA, we will lose a huge chunk of “overnight” ROA coverage. I anticipate this to be a topic of considerable discussion at this board meeting.

VI. Future.

These are some of the challenges we face starting this week and in the near future.

1. ***SARA South CTIO 24-in.*** The dome has been replaced and we now await Peter to go down and take out the mirror, remove all of the motors and prepare for installation of the automation system.

2. ***Image quality improvements SARA North.***

No one has investigated alternative funding for secondary mirror fabrication.

This

is a major project and someone who is interested needs to be the driving force behind this project if we really expect developments. The board should consider hiring an optical expert to evaluate the current SARA 0.9 after the back end replacement and the air conditioning are in place,.

VII. Summary.

Action on the following items:

- 1) SARA south automation order with Peter
- 2) SARA North and South CCD camera proposals

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