The SARA Observatory
Southeastern Association for Research in Astronomy

SARA NORTH OBSERVATORY DIRECTOR'S REPORT
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by
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I. Introduction.

"Develop success from failures. Discouragement and failure are two of the surest stepping stones to success."

- *Dale Carnegie*

It is fair to say that following the last directors report the situation at SARA North was fraught with problems and challenges. As discussed previously, there were many problems with the system drive, the dome control, and the auto-guider stage. We lost numerous nights all the way through new years due to system failures. My personal feeling is that due to over-commitment of ACE (Peter being out of town) and the personnel situation at ACE, the system was installed but not properly tested. I would have wished ACE would have put people out there to use the telescope for several nights before releasing it for remote observing instead of trying to diagnose problems on the fly. Some of the newer members of SARA had become a bit discouraged with the telescope and system. However, out of the discouragement, the many lost research nights, and the failure of many of the systems we thought we had upgraded, has come an even more powerful and successful telescope!

We stuck with it, and ACE has stuck with it. My first night when everything was working well was nearly ruined because I overexposed my primary comparison stars, not expecting the enhanced sensitivity! The re-aluminization of the primary mirror and the removal of the tertiary mirror from the light path dramatically increased the light throughput. Although I don't have any quantitative data to prove it, I know that in 30 second exposures we overexposed stars that were never previously overexposed in 60 second images before the overhaul! I have also been able to achieve smaller FWHMs with the new system. The auto-guider also seems to be performing better in this configuration! Thus, out of the frustrating winter of 2008-2009 where I made more phone calls to ACE and SARA than I did my mother in Indiana, we have a much better research instrument.

There are still problems, and challenges, but for the most part we find ourselves back in business again.

On a different topic, I want to commend Rico Ignace of ETSU for writing the MRI proposal in order to get much higher quality CCD cameras for the two SARA sites. Regardless of the outcome of the proposal, Rico has shown that even someone who doesn't rely on SARA observations to do his/her research can contribute greatly to the overall welfare of SARA. Now if we can get those members who do use SARA observations to contribute at that level, we would be in great shape as a consortium. Thanks Rico!

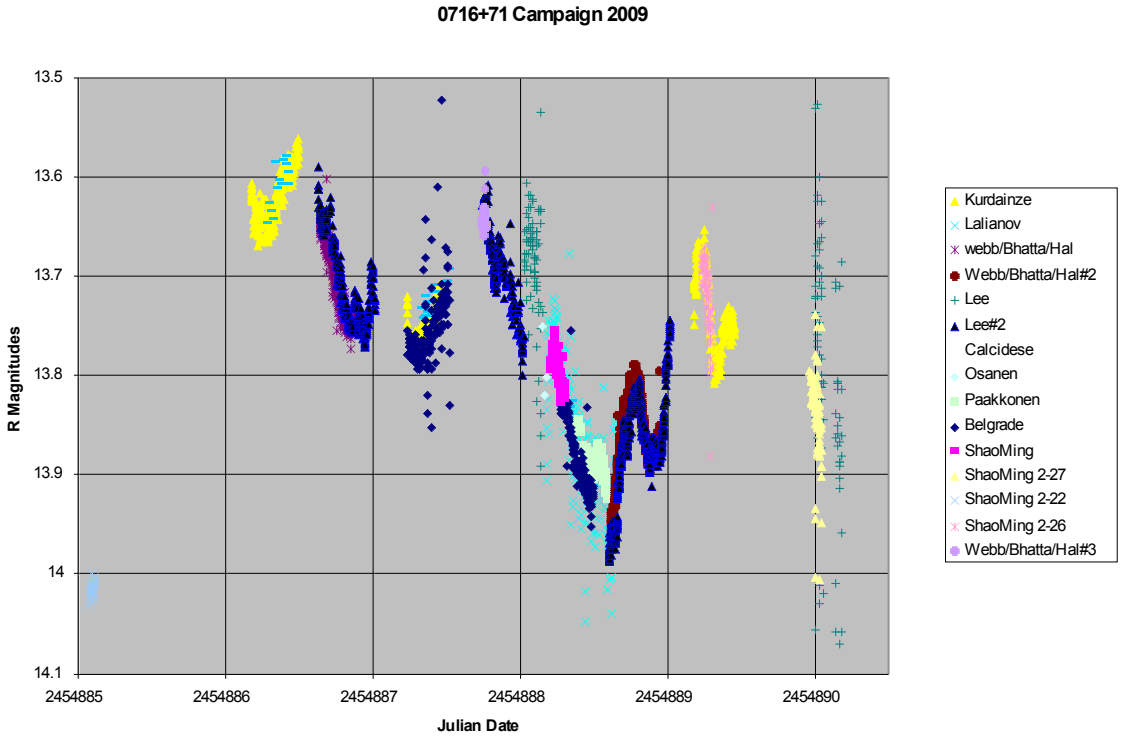
We are hoping Clemson can "stabilize" their membership and I want to recognize Dieter Hartmann since I know he has gone many extra miles to insure Clemson stays in SARA. We should also recognize Terry Oswalt's patience, diligence, and work in keeping all of these budgetary issues straight: not an easy task. With budget crises at most SARA schools there may be more battles in the future. All in all, this was a difficult situation and I am proud of how my SARA colleagues responded.

There will be a report later on by Ron Kaitchuck but I will sort of sum up the status of SARA south here. At this time, the dome has been completely replaced and the communications lines have been run to the dome. Peter and ACE engineers made the first visit to SARA South in late October and brought back some of the equipment. Since they have an identical telescope in their workshop, they didn't need to bring as much back as they originally intended, but could fabricate pieces based on the telescope they have access to in the lab. I actually saw the SARA South control crate nearly finished back in July of 2008. We are one visit away from first light. We hope much has been learned from the last six months of SARA north, and that the SARA south system will be completely debugged before ACE turns it over to us for remote operation. This is an exciting time!

II. Research at SARA North

- I am pleased to describe some research that is anchored with SARA observations, but encompasses observatories around the world. Our on-going micro-variability studies of a list of Blazars at FIU led us to wish nights were substantially longer than 12 hours! Our proposal to NASA to send up a huge reflecting mirror to occult the Sun for 24 hours was not well received (especially by environmental activists) so we did the next best thing. We contacted the WEBT group, led by Massimo Villata in Italy. It is a group similar to WET, but specifically for Blazar observations. We proposed doing a 24 hour observation of Blazer 0716+71, a Blazar that shows micro-variability over 90% of the time. Thanks to generous SARA colleagues Bill Keel and Ken Rumstay, I was able to secure three consecutive nights at SARA during the proposed campaign. We were able to obtain good micro-variability observations at SARA on two of the three nights, the middle night being clouded out. The telescope performed beautifully all three nights. We also got responses from 35 observatories in 15 countries around the

world, encompassing longitudes spanning the globe. Observatories in Korea, China, Russia, India, Finland, England and of course the US participated and we managed a ***continuous*** 36-hour light curve. Below is a preliminary plot of the data. We are currently working on understanding the calibrations of each data set in detail.



Continuous SARA-WEBT light curve of 0716+71

III. Telescope Usage.

This is a difficult portion of the report to write. The problems with the telescope have really had a significant impact on observations even when we were technically "observing", and incomplete observing reports didn't help. Bill Keel sent me the statistics he has compiled and they are presented in Table 1 below. Column 1 lists the Month, column 2 the nights observing reports were filed when observing had taken place. Column 3 is the number of nights in that month (potential nights) minus the nights we did observe. Since there were times when we had no CCD, or the telescope was out of commission for dome problems and observers knew ahead of time there was no chance of observing, sometimes observing reports were not filed. That complicates the tracking of the problems after the fact. I urge everyone, if you are assigned a night, file the observing report, even if there is no chance of observing! So the "Nights Lost" could include cloudy weather or technical problems. In Column 4, Bill calculated the "known" hours that observations were obtained on clear nights. In September, data was taken for nine hours of the 19 hours observing was possible giving a "Mechanical efficiency" of

59%. Again, many more of the nights that were lost were due to mechanical failure, but few reports were filed so this is actually a "best case" number. March is the only "normal" month with fewer technical problems prohibiting observations.

Observing Statistics

Month	Nights Observed	Nights lost	Hrs. used/Hrs possible
Sept	2	28	9/19 (47%)
Oct	13	18	66/111 (59%)
Nov.	17	13	76/133 (57%)
Dec	10	21	73/89 (82%)
Jan	9	22	54/94 (57%)
Feb.	16	12	50/60 (83%)
Mar	4	9	22/22 (100%)

IV. Telescope Problems.

The problems encountered after the summer shutdown/refurbishment/re-illuminization were numerous and severe. I will mention a few of them here.

- The mirror was apparently not set in the cradle correctly and was actually stuck. Matt Bradstreet tried to set the mirror properly and a small piece if the inner surface of the central hole broke. It should have no optical side effects, so once the mirror was properly set it solved the horrible image problems.
- The tracking kept spontaneously shutting off. Observers tried to pin down the conditions under which the telescope broke track, but it was difficult to isolate the probable cause. ACE ended up fixing some stretched wires that were first thought to have been causing the problem, then they changed the encoders, and finally they replaced the telescope control computer. The "breaking track" problems are mostly solved, but there may be a lingering problem still there.
- The dome several times literally took off and spun wildly out of control. No remote buttons would stop it. Again, ACE ended up changing some encoders and other electronics and we feel the dome problem is now fixed.

The dome problem and the tracking problems accounted for most of our lost nights. At one point the telescope was out of commission for a week awaiting Peter to return from a trip abroad. Now that these major issues have apparently been resolved I will point out a few minor issues that haven't yet been resolved.

- Every time ACE crashes, or we have to restart ACE, MAXIM DL also dies and takes with it power to the cooler. So the CCD warms up. There seems to be no way around this. Someone needs to look into this issue. As crash that should only take up 10 minutes could ruin a whole nights observing, since new

calibration images should be taken after the CCD warmup! This is a real time-consuming problem.

- The CH filter does not appear in the CCD "sequence" menu in ACE. You can get the filter in the light path, but if you want to use the sequence menu to automate the process, you cannot use the CH filter. This is a programming fix, but for some reason has yet to be made. We need to push this to get the situation taken care of since some users cannot do their science because of a simple oversight in the selection menu.

- A related problem is that the ACE "sequence" menu always reads the CCD out 1x1 regardless of what the observer prefers or what is set in the "simple" menu. I too have fallen into the trap of taking calibration images with the 2x2 clicked using the "simple" menu, then I switched to the "sequence" menu to take the science images and found out later my calibration images are 2x2 and the science images are 1x1. This is not a night killer, but a definite nuisance, especially considering 1x1 produces very large files.

Finally, as a result of many of these bugs and problems, people using SARA North have to stay on top of the situation and be prepared for the various things they might encounter. ACE feels observers have observer training is very important so ACE can respond to real serious problems, rather that lead an uniformed observer through some known steps. This is precisely why I ask observers to call me first, before calling ACE directly if there is any question. ACE has fielded many calls for help for things that the observer could have known, had they been keeping up with the observer reports. When the telescope is operating normally, this is not as much of a problem, but when the telescope is experiencing challenges, we as observers must stay on top of things to maximize our telescope time and only call ACE when it is necessary. Peter and Josie make it clear that they SHOULD be called if the need should arise, and they are very willing to help as much as possible, but this process can be much more effective if the observers are well trained.
This is one of the reasons for having this board meeting in Tucson, so Peter can update us on what we should know, and also enable us to go back and train the other observers on what they should know before using SARA.

V. Instrumentation.

- **<u>Cameras</u>**

    1. U42 CCD camera is currently performing well. I have contacted APOGEE about a cooler upgrade that they have been working on, and it is now available. Tim Puckett sent me the following information about the upgrade. "The price to add the deep TEC cooling to any of the Alta cameras is $1950. The upgrade will cool the 42-40 chip down to -70c below ambient." I personally feel this is worthwile, even after we order the CCD cameras that will result from Rico's NSF proposal! (positive thinking!)

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. It well probably be the first science camera on the SARA south telescope.

3. Rico Ignace of ESTU did a heroic job in putting together a very competitive MRI proposal that was submitted to the NSF in January. The proposal included funds for two high end CCD cameras and a spectrograph for SARA north. If successful, we will be ordering two really significant CCD's from Bob Leech, and the spectrograph.

- **Computing facilities**

  After the refurbishment, some of the problems might have come from the new telescope control computer. That computer was replaced, along with several encoders in an attempt to fix the drive and dome problems. Also we recently had to replace the dome UPS system. The computer should be in great shape for the next six months.

- **Weather Station**

  The new weather station is working well, although on occasion it is not properly updating on the web site. The web site address for the weather station is: http://www.saraobservatory.org/wx/sara.html. ***OBSERVING NOTE***: For observers who notice this site is not updating, one can always find the actual weather station output in the ACE system. Click on the "Observatory" tab in the ACE window, click on "weather station" and a window pops up showing you the actual weather readout. This info is exported to the web site, and sometimes the exporting process freezes up. If the weather station is indeed functioning at all, the ACE window should have the correct values even if the web site is not updating.

- **All Sky Camera-** The all-sky camera has been functioning well. It is very nice to be able to see the sky while observing. It would be nice to be able to set it to automatically update, but frankly that would be shutter wear and tear when it is not really necessary, so in my opinion it is fine the way it is. ***OBSERVING NOTE:*** Occasionally it does refuse to operate, and it is necessary to go to the ACE computer, open an internet browser window, click on favorites and open the "APC_rack_PDU" web site. From there you can cycle the power on and off for the all-sky camera and it usually comes back up. This is a common thing that some observers do not know!

- **Dome Cameras -** The dome cameras are very useful and have been functioning very well.

- **REU Program -**

We are looking forward to yet another outstanding REU group.

- **SARA North ROA's –** In addition to Chuck and Roy who are doing excellent jobs as our ROA's, we have added a new ROA into the mix, Robert Martino. We want to welcome Robert to SARA. In addition, we are planning to honor Elaine for the great work she did for us at the meeting (secret surprise!). We truly appreciate all of the ROA's.

VI. SARA South Observatory Report

March 21 2009
by
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The modifications to the 0.6-m SARA-South telescope are nearing completion. We will all get a full update from Peter Mack at this meeting. We may be within a few months away from "first light."

I have been in communication with Chris Smith, the new director of CTIO. I sent him some questions about technical and ROA support. I have copied a portion of his response below:

> Yes, I'm sure we can work something like what you suggest out here for the SARA-South telescope. We regularly provide this sort of technical support to a wide variety of tenants on Cerro Tololo. We are slightly different than KP in that we do have night-time electronic maintenance support, so technical support can usually be supplied until around midnight local time if needed. We can probably do the regular ROA support with one of our night assistants. We operated another robotic telescope in this way for many years, with the telescope sending a "request to open" to the 4m telescope operator, who approved it and also took care to close it when closing the 4m dome in bad weather.

I am hoping the details of our arrangement with them can be worked out before Peter makes his final trip to CTIO.

VII. Future.

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

1. ***SARA South CTIO 24-in.*** We are hoping that we are within a month or so of "second light" and beginning of remote operations at SARA South.

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. This may be much less important with the new "straight through" optics.

VIII. Summary.

In spite of a difficult winter, spring has arrived.

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