



# Nightfall

*Monthly publication of the Huachuca Astronomy Club*

## May 2015

### President's Notes

Wilting wild flowers, dropping humidity, clearing skies: it must be May.

This month we still have Jupiter most of the night and Saturn rises about 9pm giving us plenty of planetary pleasure. However, for most observers I'd say May signals the time to go after those galaxies in Leo, Virgo, and Coma Berenices, along with the planetary nebulae sprinkled across the spring sky.

At the Messier Marathon held at Bob and Barb Kepple's observatory, I got an astounding view of the Ghost of Jupiter planetary nebula. A planetary nebula forms during the late stages of a sun-like star's life, when its outer layers blow off and escape into space. Those shells of gas are lit up by light from the central star. Also known as, NGC 3242, the nebula is located roughly 1,400 light-years away in the constellation Hydra. I've seen it many times and in many telescopes. It is an easy object, even in a 6" to 8" telescopes, but it takes a large scope to bring out the subtle details. The detail of the multiple shells seen through Bob's 22-inch Dobsonian rivaled any image taken by an amateur I've ever seen.

Back to galaxies, May is a great time to get lost in the clumps and chains of galaxies that reside in the constellations of Coma Berenices and Virgo. If you have a large telescope, you should be making some room in every night's viewing session to scan these areas, but a big scope is not a necessity. Telescopes in the 4" to 8" sizes can see many of the brighter members and hints of many others.

Start by getting used to finding the triplet in Leo (M65, M66, and NGC 3628), they are midway and directly between the hip star in Leo, Chertan (Mag. 3.3) and the rear-most leg (Knee?) star Iota Leonis (Mag 4). You might even see them as a smudge in your finder scope from a very dark location. Spend time looking at these three galaxies. Get used to their shapes and brightness. Use different power eyepieces and find the ones that work the best to find and examine detail. These may or may not be the same eyepiece. Do the galaxies seem nearly the same in shape? What about brightness differences between the three? Two of them were seen and cataloged by Messier, but the other, easily visible in modern telescopes, was not. Indeed, many of today's wide and ultra-wide field eyepieces can put all three in the same field of moderate focal length telescopes (2000-4000mm FL.).

Once you've become accustomed to those three, it is time to pop in your low power eyepiece and wander over to an area of sky between Denebola (in Leo) and Vindemiatrix (in Virgo). Start out at the mid-point between these two stars and just wander around, slowly moving one eyepiece field at a time. It doesn't really matter which way you start your wandering, as you will be hard pressed to find a field without a galaxy or three. You will find all shapes, sizes, and orientations, from edge on needles to wide oval whirlpools. Some will be barely visible while others will stand out brightly in the darkness. There are of course many guides, star charts, and books to help you find your way through the region, but to me, nothing beats wandering around and becoming totally lost in the realm of galaxies to get your eyes and mind accustomed to spotting these beauties. One last point I'd like to make: it is easy as it is to catch aperture fever there in the Virgo, but do not succumb too quickly. Take your time to see all that you can with smaller scopes first, because no matter what size scope you have there are always faint fuzzies just beyond its reach. Now get out there and get lost.

## May Meeting

The May meeting of the Huachuca Astronomy Club will be in the community room of the Student Union Building at Cochise College. The meeting starts at 7: PM. The meeting is free and open to the public. Cochise College is located at 901 N. Colombo Avenue in Sierra Vista.

The guest speaker will be Dr. David O'Brien, a research scientist at the Planetary Science Institute in Tucson. Dr. O'Brien will present "NASA's Dawn Mission Arrives at Ceres." Ceres is the largest body in the asteroid belt, and most of what we currently know about it is based on telescopic observations. It has a density that suggests a significant water ice content and a shape consistent with past melting and differentiation. Hydrated minerals have been detected on its surface, water vapor has been detected emanating from its surface, and thermal models suggest that liquid water could remain stable beneath its crust even to the present day. Dawn has recently been gravitationally captured by Ceres and will not begin its full orbital mapping phase until later this year, but the approach imaging is already providing new insights into this fascinating dwarf planet. Dr. O'Brien has won a number of awards, and a minor planet was renamed "O'Brien" in his honor.

We will be treating Dr. O'Brien to dinner at the Outback Steak House before the meeting (5PM). Anyone that would like to join us for dinner should RSVP to Ted Forte: [tedforte511@gmail.com] so that we can reserve the proper size table.



*NASA Dawn Approaching Ceres/Credit: NASA*

# Earth Day Solar Observation Report

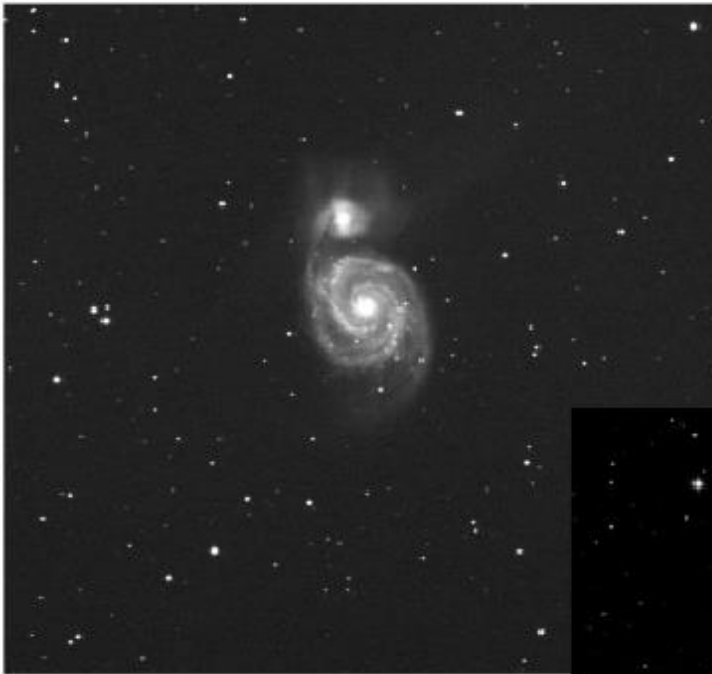
**Bob Gent**

Today, David Roemer, Nancy Hannaford, Rick Burke, Ken Duncan, Ted Forte, and I set up solar scopes at Veterans Memorial Park in conjunction with Sierra Vista's Earth Day and Farmer's Market. It would be an understatement to say the sun put on a great show for us. In the image below, you will see one of the largest prominences in recent years. As you observe the sun below, recall that it is nearly 800,000 miles across the sun. I used my cell phone camera, handheld through David Roemer's H-Alpha scope to capture the image. This may still be ongoing so check it out!

Ted put together a poster and brought copies of our petition asking the City Council to limit digital sign brightness to no more than 100 nits. We gathered a few dozen signatures. Thank you to Ted!



## Members Photos



M51  
By David Roemer



The Whale Galaxy  
By David Roemer



Markarian's Chain  
By David Roemer



## Is the Most Massive Star Still Alive?

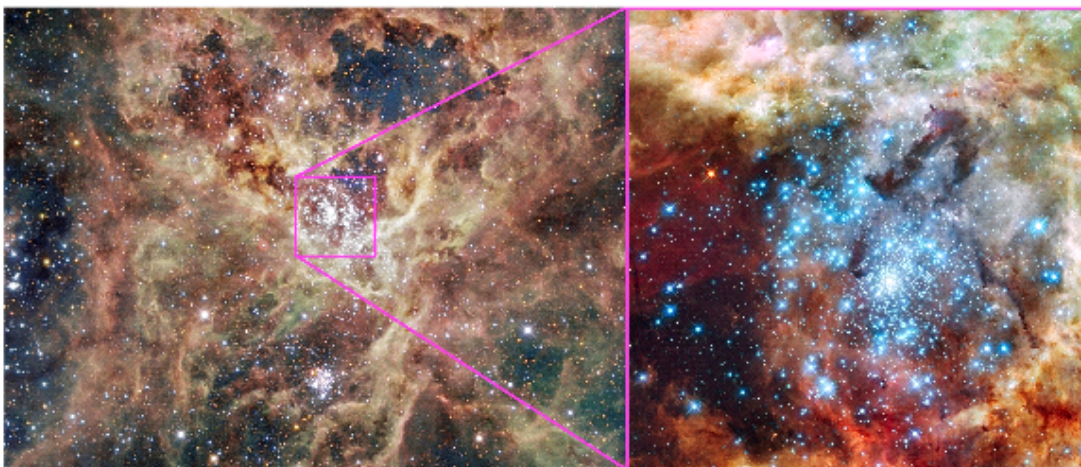
By Ethan Siegel

The brilliant specks of light twinkling in the night sky, with more and more visible under darker skies and with larger telescope apertures, each have their own story to tell. In general, a star's color correlates very well with its mass and its total lifetime, with the bluest stars representing the hottest, most massive and *shortest-lived* stars in the universe. Even though they contain the most fuel overall, their cores achieve incredibly high temperatures, meaning they burn through their fuel the fastest, in only a few million years instead of roughly ten billion like our sun.

Because of this, it's only the youngest of all star clusters that contain the hottest, bluest stars, and so if we want to find the most massive stars in the universe, we have to look to the largest regions of space that are actively forming them right now. In our local group of galaxies, that region doesn't belong to the giants, the Milky Way or Andromeda, but to the Large Magellanic Cloud (LMC), a small, satellite galaxy (and fourth-largest in the local group) located 170,000 light years distant.

Despite containing only one percent of the mass of our galaxy, the LMC contains the Tarantula Nebula (30 Doradus), a star-forming nebula approximately 1,000 light years in size, or roughly seven percent of the galaxy itself. You'll have to be south of the Tropic of Cancer to observe it, but if you can locate it, its center contains the super star cluster NGC 2070, holding more than 500,000 unique stars, including many hundreds of spectacular, bright blue ones. With a maximum age of two million years, the stars in this cluster are some of the youngest and most massive ever found.

At the center of NGC 2070 is a very compact concentration of stars known as R136, which is responsible for most of the light illuminating the entire Tarantula Nebula. Consisting of no less than 72 O-class and Wolf-Rayet stars within just 20 arc seconds of one another, the most massive is R136a1, with 260 times the sun's mass and a luminosity that outshines us by a factor of *seven million*. Since the light has to travel 170,000 light years to reach us, it's quite possible that this star has already died in a spectacular supernova, and might not even exist any longer! The next time you get a good glimpse of the southern skies, look for the most massive star in the universe, and ponder that it might not even still be alive.



Images credit: ESO/IDA/Danish 1.5 m/R. Gendler, C. C. Thöne, C. Féron, and J.-E. Ovaldsen (L), of the giant star-forming Tarantula Nebula in the Large Magellanic Cloud; NASA, ESA, and E. Sabbi (ESA/STScI), with acknowledgment to R. O'Connell (University of Virginia) and the Wide Field Camera 3 Science Oversight Committee (R), of the central merging star cluster NGC 2070, containing the enormous R136a1 at the center.

# Clear, Dark, Dry Imaging from Northern Virginia

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Edited from an article by Craig Anderson of the Northern Virginia Astronomy Club

I live in Herndon, Virginia; land of bright night skies, moist air, lots of trees, and many cloudy nights. Such an environment is just not compatible with my dream of deep-sky imaging. So, my longtime friend and astronomy partner Dave Roemer and I built a remote observatory at his home in Sierra Vista, Arizona (realizing a goal we established 2 years ago). With a roll-off roof, a 6" refractor, a quality mount, and computer control, I can log in from home, check the weather, open the observatory, initiate data collection, and still get some sleep – knowing that the imaging run will complete and that the scope will be parked safely by morning. Soon we will be completing automation, enabling the roof to close automatically when imaging is complete and if threatening weather approaches.

This article chronicles our journey from imagining what might be possible to capturing first light at our observatory, which we call RISS-Remote.

## Defining Requirements

Our first order of business was to decide what, exactly, we wanted RISS-Remote to be able to do. A core requirement was that I would be able to image remotely, from my home in Herndon, VA. This meant that I had to be able to remotely control the CCD camera and the mount - driving the need for a remotely accessible Internet connection and control computer. I needed to be able to focus remotely, too. And to monitor the position of the telescope to make sure it was slewing correctly, parking safely, and never heading for a crash with the pier.

I needed to be able to open and close the roof, either by opening and positioning a dome or by rolling a whole roof to one side. Remote control over AC power was needed, and for almost every device - even the main control computer (what if it froze and needed a reboot?). Finally, I needed a way to check the weather and monitor the sky conditions, including clouds, wind, and rain.

## Planning and Prototyping

We decided to divide and conquer to create RISS-Remote. It was agreed that I would provide the telescope, mount, imaging camera, guiding camera, control computers and other "inside" parts while Dave and Nancy would provide the land, building, and other infrastructure (outside parts). We would share the use of the observatory so we would both benefit from the investment. We also agreed that the user of the observatory would be responsible, within reason, for anything that went wrong while they were using it.

Serious planning began right away, and we decided we'd better start with a prototype to test our ideas. The idea behind the prototype was to assemble all the optical, mechanical, electrical, and control systems and to try operating them as if they were remote. This would allow us to safely test our ideas prior to actually fielding the equipment.

The prototyping was my responsibility, and I began by building up a control computer and loading it with all the necessary software for what we had planned. This software included Windows 7, TheSky6 Professional, RAdmin Server (for remote access), MaxIm DL, PEMPro, ASCOM, the AP V2 ASCOM driver, the RoboFocus ASCOM driver, the QSI and ST-i drivers, camera, and later the Flip Flat control software and drivers. I also built up a subnet on my home network that included a remotely accessible static IP address so that I could emulate connecting remotely.

Once the computer was set up and remote access worked, I integrated it with the rest of the equipment on a table in the basement. This included the telescope itself, the QSI 683wsg imaging camera with 8-position filter wheel, the SBIT

ST-i guide camera, the RoboFocus, the Flip Flat (combination dust cover and flat field device), the FOSCAM IP camera, the network switch, and a Digital Loggers power strip that allowed each outlet to be turned on or off over the internet. I also put my Astro Physics AP90 mount on the table (with plenty of clearance for slews) and cabled it up to the computer. Now I had a fully integrated set of components set up just like we planned to put them together at RISS-Remote in Arizona.

Once the prototype was assembled I began to test by “remotely” logging on to the “observatory” from a computer upstairs. I would connect using RAdmin Client through the static IP, as if I was more distant than one flight of stairs away. I practiced all the observatory operations, including slewing, opening and closing the dust cover, connecting and disconnecting the cameras, controlling cooling, focusing, imaging, and processing. (I used RAdmin because I didn’t have Windows 7 Professional, and TeamWare didn’t seem to work well for me in low bandwidth testing.)

This testing allowed for a lot of kinks to be worked out while the equipment was still within reach, which turned out to be critical because I had to make quite a few adjustments to both the configuration and the approach. For example, I found that high frame rates in TheSky6 would overwhelm the remote connection when bandwidth was low, leaving me unable to connect back to the computer until it was rebooted. This particular problem was easily resolved by changing the update rate in TheSky6, but could have been a real hassle to figure out and change remotely.



Figure 1- Testing for Fit within a Six Foot Diameter Dome

Within weeks, our prototype remote observatory was working fine in the basement. This meant that it was time to take the next step - moving it all outside and imaging for real remotely, but still just a few steps away. Using my friend Velcro, I stuck, literally, everything I could on to the control computer so I could just haul it outside as a unit for testing. Then I installed my mount on the pier in our back yard and built a bundle of cable to allow for quickly connecting everything together. I even stuck the IP camera on top of the control computer (more Velcro) to monitor slews and observatory conditions, as we would have to do at the real observatory once deployed.

Each clear night I could I’d haul the prototype outside, plug it all together, and try to operate it all remotely from my office inside. I would use the IP camera to monitor all of the slews. I’d measure network utilization and other factors to verify that this would really work when it was over 2,000 miles away. During some tests to execute actual imaging runs, and when there were problems, I’d try to fix them without going outside and touching the equipment. This was really valuable for flushing out the system and developing the necessary procedures to operate RISS-Remote safely and confidently once

deployed.

## Site Preparation

When I was about half way through integrating and testing RISS-Remote in my basement and backyard, it was time for the annual ASAE conference. I made another trip out to Arizona - this time with another good friend and astronomy buddy Ralph Jung. Ralph and I stayed with Dave and Nancy at their place in Sierra Vista. In between gawking at the ASAE vendor displays, attending the talks, enjoying the solar observing, and encouraging my friends to buy new gear, we



spent a lot of time on more planning for RISS-Remote. With the prototype well underway, it was time to focus on the site and the observatory building itself.

We considered many options for the observatory building. Initially I was in favor of a clamshell, reasoning that it could be easily opened and closed remotely and that not having to rotate a slit would be easier. Cost for a commercially available clamshell in the necessary size was fairly high, but that was offset by the fact that it could be easily installed, would be pretty secure, and would be easy to operate. The clamshell option was eventually vetoed on aesthetic grounds, which probably saved us a lot of money.



**Figure 2- Dave and Ralph Marking Surveying the Spot for RISS-Remote**

Next, we considered a more traditional dome - including another like the one already in place for RISS, up on Dave and Nancy's deck. Unfortunately, we'd need a fairly large dome to accommodate the planned 6" refractor on a German Equatorial Mount, which would be expensive. But there were a lot of advantages, including security, wind protection, and light shielding. When a used dome came available at a very attractive price, we looked at it very seriously to see if everything would fit. Fortunately, I set up a test in my basement to check actual clearances before we committed to buying the used dome. I say fortunately, because we found out that our equipment wasn't going to fit, and future upgrades to the telescope and mount (a 14" RCOS?) would likely be impossible.

All this time Dave had been researching roll-off roof options. There are quite a few private observatories in Sierra Vista, and Dave has a lot of contacts through his local astronomy club that he consulted with for ideas. After looking at various designs and implementations he came up with something new that I haven't seen before or since. He took a steel shed from a big-box store, shored it up with extra steel supports, and used garage door track, rollers, and an externally mounted opener to morph it into a roll-off observatory. Advantages included simplicity, material that would hold up well in the desert environment, and economy. This he could build quickly on a concrete pad for a very reasonable price, and this was the design he selected.

Did I mention that Dave and Nancy are really good friends? Not only did they bring in a crew to pour the cement pad, they also had a security enclosure built with high block walls and locking gates. This provides physical security and also added wind protection for the roll-off observatory - winds can get really high out there and 50+ mph gusts are not unusual. This spring the plan is to create an vegetable garden inside the security perimeter to complement the observatory and create a new feature in Dave and Nancy's yard.





Figure 3- Forms for the Roll-Off Pad



Figure 4- Cutout for Pier Base,- Note Conduit



Figure 5- Pouring the Pad



Figure 6- Pad Complete, Ready for the Shed!



Figure 7- Security Perimeter for the New Area Under Construction

## Building the Roll-Off

With the observatory pad complete and the security perimeter in place, it was time for the shed to go up. Dave selected an Arrow Shed from Lowes - reasonably priced and locally available. He had experience with a similar shed, building a manual roll-off observatory at his prior home in Santa Clara, California, and it had worked well. This project would present some new challenges because it was going to be larger, had to be sturdier, and had to provide for remote operation. He shored up the structure with extra steel 2x4s and isolated the roof from the main building. Then he installed garage door track and rollers, using fence posts for support, to allow the roof to roll on and off. Sliding doors in front, secured with a padlock, provide easy access for equipment. Grading of the cement provides for drainage, combined with grading of the soil around the pad.



Figure 8- Roll-Off Ready

## One Thing Missing

With the roll-off complete, it was time to figure out how to put it all together. We planned to integrate the new observatory and “go live” in conjunction with ASAE 2014, so I could attend the conference and we could set up RISS-Remote all in one trip. I began packing all of my equipment and preparing it for shipment, eventually sending it all via FedEx Ground with the exception of the telescope which I sent UPS in a custom made double box.

Packing and shipping was probably the riskiest part of our adventure, so I spared no expense in carefully packing everything (11 large boxes). I considered driving it down, but the time involved was more than I could spare from work. In the end, shipping worked out fine and there were no problems at all - zero damage (whew!).

Unfortunately, I learned that the pier I had ordered, a key component, was not going to be ready in time for my trip to install the equipment. Since we really needed that pier, I delayed my trip and hoped for the best. But it soon became clear that the pier would not be completed for weeks or even months. So I canceled the pier, shipped out my ATS portable pier as a stopgap, and made new airline reservations.

Upon arrival, Dave came up to Tucson to pick me up at the airport, and of course we decided to stop at a local astronomy shop, Starizona, on the way to his house. Dave needed a part for his Hyperstar, and I always enjoy stopping at a local astronomy shop! While we were there I noticed there were some piers in the Starizona showroom. Piers? I couldn't believe it - I didn't even know they sold piers at Starizona.

Dean Koenig saw me checking out the piers and came over to see if he could help. I told him what I needed, and he went in search of a tape measure. “This one is spoken for...”, “this one is too short...”, “hey, what size did you say?” Believe it or not, after ordering a custom pier and waiting weeks, there was a pier of exactly the right size right there at Starizona.

But now I needed a pier adapter, and I figured there was no hope. Dean asked what kind of mount I needed, and pointed to one he had in the showroom, and said “like that one, over there?” With a smile, he then rummaged around and emerged with a pier adapter, built as a prototype that fit the one pier he just happened to have that wasn't spoken for that was exactly what I needed. A very reasonable few hundred dollars later we loaded the pier into the back of



Dave's pickup truck and drove off to his house, hardly believing our good fortune. We now had the last part we needed (thank you, Starizona)!

## Connecting It Together

Once the pier was in place things began to come together even more quickly. The control computer was installed inside an old Craftsman tool chest to protect it against the elements (water and critters). The IP camera was mounted on the wall to the north of the pier, enabling remote views of the telescope position and verification of whether the roof was open or closed. The AP900 mount was placed on the pier. The network switch was installed and the network wiring put in place. The telescope was test fitted and cabling installed for the cameras and other equipment.

Dave and Nancy already had a router capable of supporting a static IP address and they had made prior arrangements with their local ISP, Clark Info Systems, to set up that static address when needed. I called during my trip and we set that all up. By configuring the Digital Loggers power strip on one port, the Foscam IP camera on another, and the control computer on a third we enabled remote log-on to any of these devices independent of the others.



Figure 9- AP900 Mount Installed

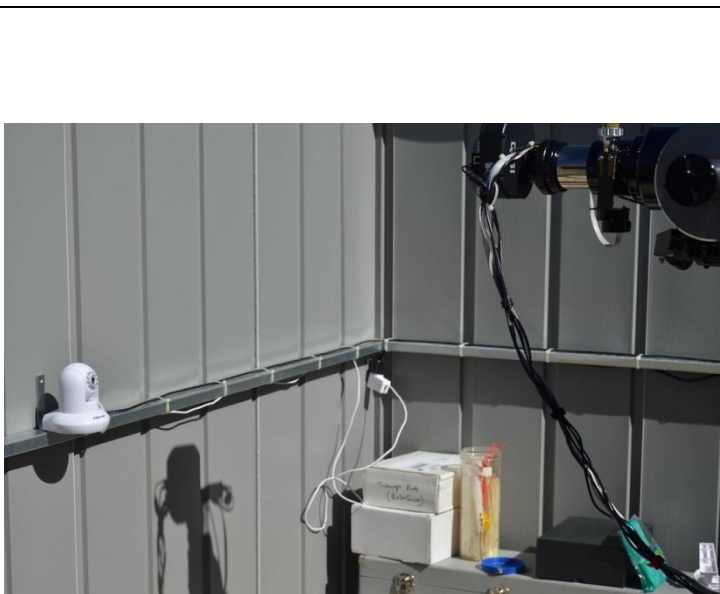


Figure 10- IP Camera for Observing Slews and Roof Status Inside the Observatory



Figure 11- Scope Mounted and Wiring in Place



Figure 12- Flip Flat as a Dust Cover on a Homemade Rail





*I definitely recommend remote power control separate from the computer for a remote observatory. This makes it possible to take a peek inside the observatory using the internal camera without powering up the control computer, for example. More importantly, we can remotely cycle the computer by cycling power to it in case things lock up. Even the computer monitor has separate power control, as does the mount, the camera, and other major components.*

**Figure 13- Digital Loggers Power Switch**

Routing all the cables turned out to be one of the major challenges during this project. We spent a lot of time with zip ties and Velcro trying to find the right balance of location and length for all the cables - winding up with quite a bundle hanging from the scope. Although we moved the telescope around and observed the cables carefully, this configuration ended up causing some serious problems later. Dave had to go out more than once and free a caught cable, and sometimes they would catch and rotate the imaging camera. This is an area to pay particular attention, and has since been redone after a near catastrophe. Thanks to a very helpful member of the local Huachuca Astronomy Club, Rick Burke, for fixing this for me and saving the day (and night).

## Motorizing the Roof

With the equipment installed and daylight remaining, our attention turned to working on the roll-off again. Since this area of the country is very dry, and because we wanted the roof to open all the way, Dave elected to mount a garage door opener outside to operate the roof. This is a bit unconventional, but has worked very well. To control the roll-off, we had selected a Foster Systems roll-off observatory card and magnetic sensors to detect whether the roof was open or closed.



**Figure 14- Modified Arrow Shed Roll-Off Observatory with Partially Complete Roof Tracks and Opener**



Figure 15- Supports and Conduit for Garage Door Opener

We laid out the garage door opener and installed additional fence posts to properly support it outside the observatory. We also trenched a line for power so that even the garage door opener could be turned on and off using the remote power switch inside the roll-off shed. This has turned out to be another critical feature, since the roof would really clobber the telescope if it closed at the wrong time. In fact, we've adopted a procedure of powering off the roof's garage door opener any time it's not in motion as an added safety measure.

Speaking of the garage door opener, there are now some metal guides on the chain track, which were not installed when the photo was taken, that prevent the chain from sagging. There's also a cover over the opener itself to protect it from rain. The door opens and closes very smoothly and it was quite a thrill to see it operate for the first time.

We had a lot of trouble getting the Foster Systems card to work correctly, and got quite frustrated with it. In fact when I left for

home we still couldn't operate the door remotely because of this problem. It turns out that we had incorrectly wired the power to that card, flipping the positive and negative connections. Fortunately, it was not damaged and worked perfectly once we connected the power correctly.

## Testing and Calibrating

We spent the next night testing everything out, sitting inside the house and "remotely" operating the equipment. Particular attention was paid to polar alignment, since that's something that can only be done in person. I used PEMPro for polar alignment, and can highly recommend that approach. PEMPro guides you through a calibration process and then instructs you how to move the mount first in azimuth and then in elevation until the polar alignment is complete. The result was far better polar alignment than I've ever achieved in the past with drift rates that appear negligible over multiple 20-minute exposures.





Figure 16- Calibrating with PEMPro on the Big Screen

We also used PEMPro to program analyze the AP900 periodic error and to program a periodic error correction curve into the mount, achieving tracking of  $\pm 0.87$  arc sec fairly easily. This has proven relatively easy to guide out so we haven't worried about refining it further.

### First Light and Finishing Up

First light at RISS Remote occurred on November 8, 2014 - just two days after I arrived on site to put it all together with Dave and Nancy. We selected M27 (the Dumbbell Nebula) as the first image because it's been a tradition of mine ever since finding it as my first deep sky object with a 6" homebuilt reflector when I was 13 years old.



Figure 17- First Light Image



Figure 18- Full Operational

Since first light we've completed automation of the roof, added a second control computer, integrated an all-sky camera, and imaged dozens of objects. We've also added the new Astro Physics Control Center (APCC) software, which adds another layer of functionality and security that made imaging Comet C/2014 Q2 (Lovejoy) easy by tracking it directly with custom rates.

Other improvements include weather stripping the gap between the roof and the walls, sealing the walls to the pad, and rerouting the cables to eliminate

the catch points. This spring Dave and Nancy plan to install landscaping inside the perimeter fence, which will include an irrigated orchard with a variety of fruit trees.



Many thanks to everyone who contributed to this project and made it a reality. Dave and Nancy for allowing this to be built on their property, constructing the gated perimeter, pouring the pad, building the shed, mixing tons of concrete for the pier and roll-off mechanism, and generally putting up with me. Thanks to Ralph Jung for inspiration, ideas, and mocking commentary comparing us to SkyNet as the level of automation increased while regaling us with photos of the Sun using his Tri-Band imaging setup. And thanks to Rick Burke and Ted Forte, members of the Huachuca Astronomy Club, for offering to be emergency responders for RISS-Remote if things go terribly wrong.



Figure 19- Craig Anderson at RISS-Remote

See more astroimages and blog for RISS-Remote at <http://riss-remote.com/>.

The original, full text (and more pictures) of this article may be found in the Northern Virginia Astronomy Club Newsletter, March 2015 issue at: [http://www.novac.com/wp/wp-content/uploads/2015/02/NOVAC\\_Newsletter\\_March2015.pdf](http://www.novac.com/wp/wp-content/uploads/2015/02/NOVAC_Newsletter_March2015.pdf).

[Since the writing of this article, we have gone through several mechanical and software upgrades, so this is very much an ongoing project. David R]

## Huachuca Astronomy Club – Board of Directors

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FOR SALE: Older Optical Guidance Systems 12.5" f/9 Ritchey-Chretien telescope. Very good Paul Jones ceramic optics, Robofocus secondary focuser, will include Takahashi collimating telescope.

Some of the image through the scope are at [Mshadephotography.com](http://Mshadephotography.com).

Contact Mike J. Shade at [mshade@q.com](mailto:mshade@q.com)

FOR SALE: Mae Childs has an 8" Celestron Nex Star Good condition with all original accessories.

Please contact Mae [maechilds2014@aol.com](mailto:maechilds2014@aol.com)

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Sierra Vista, AZ, 85650

## HAC Calendar of Events for May-June 2015

SU	MO	TU	WE	TH	FR	SA
26 Juno 0.1° North of Moon. Jupiter 5° North of Moon	27	28	29	30	1 May HAC Meeting Student Union David O'Brien 7P	2
3  11:42PM	4	5 Saturn 2° south if moon  Eta Aquarids	6  Eta Aquarids	7 Mercury at greatest eastern elongation Eta Aquarids	8 7PM MAC Patterson Obs.	9
10	11  6:36AM	12	13	14	15	16 Member Star Party
17	18  12:13AM	19	20	21 Patterson Public Night 7:45PM	22 Saturn at Opposition	23
24 Jupiter 5° north of the moon	25  1:19PM Memorial day	26	27	28	29	30
31	1 June Saturn 1.9° south if Moon	2  12:19PM	3	4	5 HAC Meeting Student Union 7P Megan Reiter	6 Venus at greatest eastern elongation.
7	8	9  11:42AM	10	11 Pallas at opposition. Uranus .05° north of Moon	12	13 Member Star Party
14 Mercury .04° north of Moon	15	16  10:05AM	17	18	19 Patterson Teacher summer workshop 7PM	20
21 Summer Solstice 12:38PM	22	23	24  7:05AM Mercury at greatest western elongation	25 Patterson Public Night 8PM	26	27
28 Saturn 2° south of Moon	29	30 Asteroid Awareness Day	1 July  10:20PM	2	3 HAC Meeting Student Union 7P	

All times MST. Join Haclist to keep up to date with all of the Huachuca Astronomy Club events  
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