

The TCAA's Early Observatories

*detailing the making of the SGO at
Funks Grove Nature Center*

Robert Finnigan

January 6, 2015



Above two views of the Fissel Farm's "Beehive Observatory" opened June 1964.

Below the Finnigan Observatory at Downs, IL, from where our 10-ft Ash dome came.



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Construction of Sugar Grove Observatory: 1998-2001

Editor's note: Much of the commentary about the construction of Sugar Grove Observatory comes directly from *A Brief History of the Twin City Amateur Astronomers 1960 – 2010* written by TCAA Historian Carl Wenning. Many of the articles and images come from *The OBSERVER*.

In his January 1998 "Presidential Letter," Avo Vill pointed out that the Sugar Grove Nature Center (SGNC) at Funk's Grove was just starting to be developed, and that the possibility of a TCAA observatory on site existed.

SGNC was to be established on an abandoned farmstead about five miles south-southwest of Shirley, Illinois. Later that month, Avo (assisted by the efforts of Sandy McNamara, Mike Rogers, and Duane Yockey) solicited the Funk Family Foundation with the idea of erecting a public observatory augmented with regular public programs. A formal proposal was made to the SGNC Board on February 10, 1998, with approval coming shortly thereafter. As part of the agreement, the SGNC would help with some of the construction materials.

Following the observatory proposal approval, William Carney, Duane Yockey, Dan Miller, and Mike Rogers moved the 10-foot Ash dome from storage at Game Designers Workshop to temporary storage in the white barn at SGNC. William and Avo cleaned and painted the dome while it was held in storage there until such time as the observatory was ready for its installation.

By March 9, an architect by the name of Don Gronert developed initial drawings for a modest observatory, and later that same month an inaugural members-only observing session took place at SGNC. Over the course of the year, the rather simple plan developed by Avo had "exploded" to become a \$100,000 facility with a spiral incline for use with the disabled, and included an adjoining building that would contain a meeting room, storage space, sleeping quarters, and restrooms.

This was a great expansion over the original plan of developing a small observatory. Within a short time, the club came to understand that only a smaller structure could ever be built in light of club limitations, and the grandiose design was dropped in favor of a smaller, simpler and more realistic facility.

The final placement and style of the observatory were dictated by solutions to requirements set by the SGNC Board during 1999. The TCAA initially had planned a shorter building a ground-level dome with attached warm up room, or even a roll-off attachment, but this was not consistent with the SGNC's vision. The club needed to blend the observatory's appearance with the "farm" look of the Nature Center. The final SGO design was a compromise a silo effect that would blend in with "the look" of the Nature Center. It's placement was dictated by a need to eventually interface it with an instructional area the SGNC Board was planning to build next to it, and the height was dictated by the need to see over the adjoining buildings because it was so close to them. It still had a computer room, storage room, and observatory areas, but they were stacked instead of being spread out into a larger ground level complex.

Construction of the Sugar Grove Observatory (SGO) began in a snowstorm on March 11, 2000, with just over \$1,000 in the club's treasury. Avo, Bob, Mike, Dan, and Allan Timke were at the core of the building activity, as was former club member Jim Baker.

Taking a strong lead was Vice President Vince Burdette (owner of Holder Construction Company and a project manager at the time for a large development at State Farm) who obtained the assistance of several trade unions before he left to head up a construction project in Argentina.

He also was able to get lots of material donations, as well as many of his crew to volunteer hours for the framing of the building including bringing in scaffolding for the initial framing of the building. Sugar Grove Nature Center provided the rough-hewn hardwood siding. The construction crew working on Sugar Grove Observatory from the TCAA was Avo Vill, Bob Cuberly, Mike Rogers, William Carney, and Duane Yockey who were there for a lot of the beginning foundation work. With the departure of Vince, Jim Baker took over the leadership on the project and immediately worked to install the stairs.

Evidently, there was disagreement about the stability of the column put in place to hold the telescope. The pier was a narrow, 20 foot high, unsupported vertical concrete column prone to vibration. This disagreement led to two members departing the project and, ultimately, the club. Dan and Michael took care of supervising and doing much of the remaining construction. They donated their weekends, evenings, and often their personal funds to finish the structure. They spent most of the summer of 2000 doing the interior work. They, along with their families, laid the flooring and smoothed and sanded the walls and painted them. Sandy McNamara and Jean Memken did much of the plastering and painting in the building. They, along with Brian Barling, helped Mike and Dan put up interior paneling. Roy Lawry helped out with painting, and paid for the Tyvek for the outside. Other members contributed time and energy as well.

SGNC provided for the hardwood exterior covering to give the SGO a consistent look with the rest of the Nature Center buildings. A crane was arranged to place the reassembled 10-foot Ash dome atop the structure. The construction job was completed by the next January, but the opening was delayed until the February Annual Meeting that would be held at SNGC.

The first telescope housed under the SGO's 10-foot Ash dome (that had been in place originally at the Marie Antoinette Observatory at Downs since 1977) was Mike Roger's 1978 vintage 14-inch Celestron Schmidt-Cassegrain. The observatory saw "first light" at the February 20, 2001, Annual Meeting. The night was clear and cold, and the guest speaker for the evening was astronomer Dr. James Brown from Millikin University adapted an imaging camera to the telescope.

From start to finish, the construction job took only about ten months. So fiscally responsible and generous (in time, talent, and treasure) were those who constructed the observatory, that its construction hardly affected the balance of the club treasury. From the time of its proposal to its completion, the time involved in the negotiations for and construction of the SGO took three years of concerted effort. The club finally had its replacement for the *Beehive Observatory* that once stood on the Fred Fissel Farm. Duane Yockey was the first official key holder.

The 12-inch Meade LX200

By August 2001, it was clear that trouble was brewing with the C14 telescope's declination motor. A suggestion was made to replace Mike Rogers' personal 14 inch Celestron with a club owned 12-inch Meade LX200 "GoTo" telescope. With the advent of GoTo capacity, it was becoming very easy to find celestial objects using a microprocessor driven instrument. All that would be required is pointing the telescope at two known stars, centering them in the eyepiece, pressing an "align" button, and from there the telescope would automatically find any object in the system's database of thousands of objects that currently were above the horizon.

This certainly was more appealing than pointing a telescope via finder and then using star hopping techniques to find the object – at least to some members. Few members at this time were sufficiently well informed about the use of setting circles, so a GoTo telescope was a big deal given several club members' previous experiences with Mike Roger's 8-inch Celestron GoTo telescope acquired in the late 1990s. The membership agreed to purchase such a telescope for SGO. Fundraising for a new telescope began during December 2001. Within a month \$1,000 had been raised, and within two months a total of \$2,000 had been raised from the membership toward the \$4,250 purchase price.

A short term bridge loan was provided by Dan Miller to cover the rest of the purchase price as fund raising continued. The new telescope was ordered in February 2002 and arrived in March. It was installed in the SGO during June 2002, and was returned to Meade the next month due to a problem with the focuser. Michael Rogers' C14 was reinstalled temporarily so it could be used with the summer public observing sessions. The 12-inch came back from Meade in August and was reinstalled in September 2002. Due to continuous fund raising and a very generous membership, the loan note held by Dan Miller was paid off by November of that year. 13 members of the TCAA contributed at grand total of \$2,975 to the purchase of the telescope. The rest of the funding came from the club treasury.

With the reinstallation of the Meade LX200 telescope, problems were noted with the vibration of the pier. When the telescope was moved, vibrations were clearly visible through the eyepiece of the telescope; nonetheless, the vibration quickly stopped. Despite this fact, efforts were made to stabilize the pier. A network of steel cables was attached to the pier just under the dome floor. These cables were run to the outer wall of the observatory in the hope of reducing the vibrations. They had the unfortunate effect, however, of transmitting vibrations of people moving around inside the observatory to the telescope. The cables were removed shortly after this connection became apparent. By the summer of 2003 Carl Wenning returned to active participation in the club and noted in *The OBSERVER* that the telescope's optics were not as good as he had expected. Still, it was too late to do anything about it as the initial warranty on the instrument had long since expired. He further noted that for a viewer working alone, the pier vibration, while unfortunate, was not all that deleterious to visual observing. He noted too that once the telescope had reached its intended target, the vibration quickly damped out and that the viewing quality while limited by the quality of the telescope itself returned.

Despite these problems, several TCAA members made regular use of the SGO to conduct visual observations. Astrophotography was "out" due to the problems associated with the pier and the fact that the telescope used an altazimuth mount. This latter circumstance resulted in field rotation during long exposures making anything but the simplest forms of astrophotography impossible. Still, William Carney, Carl Wenning, and a few others observed with renewed vigor as time and sky conditions permitted.

It was no longer unusual to see hitherto unviewed objects, or to see many dozens of objects during a single evening. Amateur astronomy had really begun to change again with the advent of the GoTo capacity of this telescope. Writing in the September 2003 issue of *The OBSERVER*, Carl Wenning noted,

Unfortunately, the telescope didn't produce all that clear of images planets that evening. Mars, for instance was somewhat nebulous, even when great care was taken to assure the best focus. Jim had set up the club's 10-inch reflector outside the SGO providing an image of Mars that just blew away the image produced by the 12-inch.

The image in the 12-inch showed none of the extremely sharp detail visible through the 10-inch. In fact, I have to admit that the 10-inch showed the very best images of Mars I have ever seen. Perhaps the 12-inch didn't perform as well as the 10-inch due to thermal currents exiting the dome

Before I can make a better judgment of the quality of the 12-inch optics, I really do need to spend more time with them. Does anyone else have a similar concern, or did I just have a "bad" night? Third, the mount of the 12-inch is admittedly wobbly. After viewing through the telescope I noted the high frequency of vibrations that supposedly are related to the tall concrete pier upon which it rests.

The discussion about fixing the wobble in the main pier has gone on for quite a while, but I feel now that one very important fact has been overlooked and didn't become clear to me until I had an opportunity to do some real observing with the telescope. The frequency of the vibration is probably too high to be accounted for by the concrete post. A long, high mass post should oscillate at a much lower frequency than what I experienced. We might be overlooking the main source of the vibration as I see it.

The high rate of oscillation inherent in the telescope is possibly due in large part to the metal platform between the telescope and the concrete pier. Above the concrete post is built a support consisting of four thin pieces of metal angle iron. Perhaps most of the wobble can be attributed to this unit. If it is, the motion can be readily damped with the use of cross braces – eight crisscrossed cables with turnbuckles on each. This would stiffen the top support greatly, and could help to suppress some if not the majority of the wobbling inherent in the telescope mount.

In conclusion, with the Meade's ease of use and great ability to find things in the sky, TCAAers should spend time observing at the SGO under clear sky conditions, regardless of the phase of the moon.

With the passing of the years, additional commentary about the SGO appeared in the minutes of the Board of Directors meetings and in smaller articles contained in *The OBSERVER*:

June 2009

LX200 the 12-inch telescope has been demounted. Due to "dangerous and unpredictable motions." A 10-inch telescope now rests in its place. William was authorized by the Board to demount the 12-inch Meade from the LX200 mount in order to weigh it. If the Board decides that a suitable GoTo equatorial head can be purchased for a reasonable price to match the weight of the telescope, the Board might opt to make a purchase. William suggested that the club look at both the Orion Atlas mount and the Celestron CGEM mount. This topic will be brought up for further discussion at the July Board meeting.

William reported that he now has recommendations about mounting the club's 12-inch Meade on an Atlas or similar CGEM mount. He noted that only a much more substantial mount such as the CGE would be suitable if one were to add options such as a guide scope, cameras, and heavy eyepieces. The Atlas is at the limit of its support range for the club's 12-inch OTA. Following a discussion it was agreed that the optical quality of the 12-inch did not merit it being positioned atop a much more expensive mount such as the CGE. It was agreed that William would attempt to find a reasonable sales price for the 12-inch on Astromart, along with its nonfunctional LX200 mount. We will wait until after NCRAL to consider purchasing a replacement telescope.

May 2010

Discussions moved to the club's LX-200 telescope and it was noted that the electronics were not functioning reliably although the OTA was still usable. We reviewed the repair history of the unit, the advisability of undertaking additional repairs, and the need for a club-owned telescope given the quality and quantity of member owned scopes. The possibility that sale of OTA was discussed an alternate way to resolve the LX-200 questions, although no formal action was taken. William agreed to investigate the cost of a replacement mount.

July 2010

Discussion then turned to the telescope in the observatory with the question of what should be put into the observatory and to what purpose. With the LX-200 inoperable, William has installed a 10" telescope for the time being. William installed dovetail mounting bracket on the 12" OTA and several members thought it could be maintained for useful purposes. It was agreed that we try to dispose of the faulty LX-200 mount, tripod, power supply and hand controller on an astronomy auction site. William agreed to post these items for sale. We discussed the inevitable vibration associated with a three story pier and the heavy-duty mount. The no-cost options including removing the mount and temporarily placing the 10" scope on its tripod to achieve greater room. Another low-cost option discussed was to place a member's scope in the dome temporarily, such as Carl's CPC-11. Dan suggested that placing a wider field instrument equipped with a laser pointer would serve as an effective outreach instrument and would be less susceptible to vibration. We reviewed the requirements for a scope located in the dome and agreed that most outreach activities could be served with modest equipment. After these discussions, the consensus was that we would investigate all these alternatives and report back. William reported that the Meade fork mount has been listed for sale for a price of \$500.

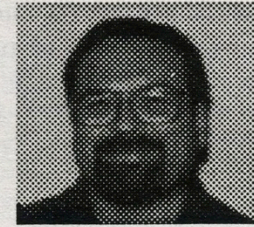
October 2010

William reported that repair on the recently donated C14 were still ongoing. William then indicated that the Meade fork mount had tentatively been sold for \$250 and that once the transaction was complete, the money would be remitted to the club. The Meade tripod and optical tube remain in the possession of the club. Dan reported that he had made good progress preparing the C-14 mount and that it would be ready to support either the C-14 or the 12" Meade tube. Since the mount handset was not available and the RA drive seemed to be tracking well, it was agreed that the drive should be made minimally functional and set up with a simple on-off switch.

By 2010 the 12-inch Meade had been sold and the SGO was vacant. New technology in the form of a guider that would make small corrections to the mount would once again make the SGO useful. A 17-inch PlaneWave telescope and Paramount Mount was installed. This made 30-minute exposures easy with the use of a new Apogee camera.

The Word From Above

— Avo Vill



A big thank you to the many people who helped with the Downs Observatory dismantling and Astronomy Day at Eastland Mall.

inary design as I would have liked.

We need some to volunteers to:

The Sugar Grove Observatory had its initial ground breaking at the Sugar Grove Nature Center. Unfortunately, there is a *slight* complication — excessive water filling up the pit. Within a week or so we hope to secure a contractor to tackle this problem. The designs for the observatory are still on the drawing board. Our architect has been tied up with other projects, and I haven't been able to complete as much of the prelim-



Move 'em out! Dismantling the Downs' dome in preparation for its move to SGO

1. Measure, cut and replace wooded boards on the 14" high round raiser (which the dome track sits on). One of the five layers of the structure was water damaged. Additionally the raiser needs to be spliced back together since the 10 foot 1 inch diameter structure did not fit in the pick up truck for transport.

2. There are several metal pieces on which the galvanized coating has failed and are starting to rust. They

continued from p. 1

need to be wire brushed and then a rust proofing paint applied.

3. There are dozens of wheels and screws that need to be cleaned, lubricated, and sorted in preparation for installation.

4. Once the foundation and detailed drawing is prepared, then the carpentry work can begin. We have had numerous people indicate their willingness to help with this as well as the local Carpenter's Union.

5. Sometime in July we will need half a dozen people to reassemble the dome.

The target is to have the Sugar Grove Observatory built by August 1.

The first public observing session at Sugar Grove Nature Center was clouded over. I thank those that turned up just in case we had any members of the public out. I'm hopeful that we will have many people show up in the coming months and that we can use the Observatory in August.



Future SGO-users standing in front of the SGO pit

As soon as the night sky clears, I

hope that you take advantage of the dark sky location at Sugar Grove Nature Center.



The dismantling crew (from l to r) Steve and Patty Blair, Avo Vill, Jim Jones, and Duane Yockey. (top) William Carney. Not pictured: Mark Cabaj, Jean Memken



SGO Update

— Michael P. Rogers

As the pictures on these pages attest, things are looking **up** for the Sugar Grove Observatory. The SGO Construction Team, led by Jim Baker and Vince Burdette, with a cast of thousands, has been laboring hard, and the results are obvious.

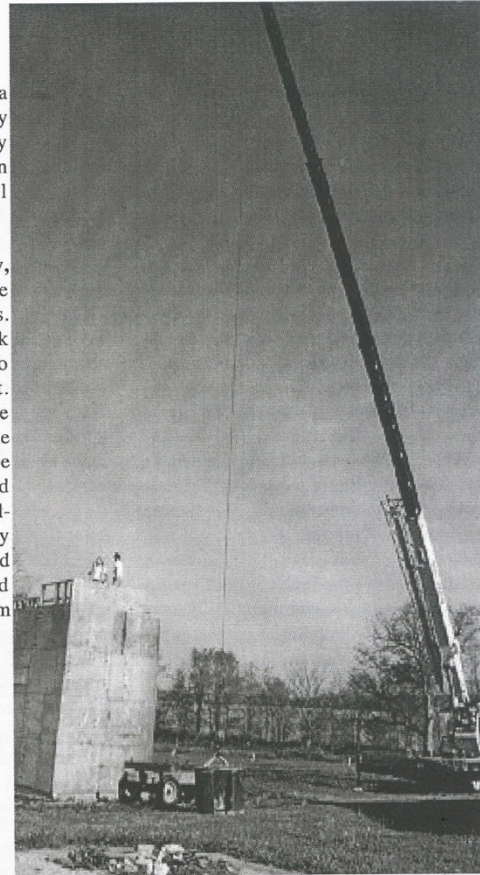
Perhaps the most exciting news since last month is that the pier is now filled with concrete: thumping the pier now produces a dull thud, rather than a hollow ring.

A Big Hook crane (and once you've stood beside one, you'll *really* appreciate the name :-)) transferred several thousand pounds of concrete at a time, via bucket, from a waiting concrete truck to the pier.

All the floors are now in place. We have stairs that you can actually walk on (although this is a construction site, so **don't** wander around unattended). The ring on which the dome will sit has been built, and we are poised to begin roof construction and electrical work.

Finally, we have stained half a forest's worth of siding, to say nothing of the interior of my lungs, on the strength of Dan Miller's incredibly useful paint gun.

One small request: we **really, really, really** could use more help from our own members. What is back-breaking work for 2 is *easy* for 4 or 5, so please consider helping out. By doing so, you'll get twice the pleasure when you use the observatory, because you'll be able to say, "I helped build this!". More than a good feeling, that represents a legacy for the community. To find out what's happening and when, check out eGroups.com (see the article on p. 3)

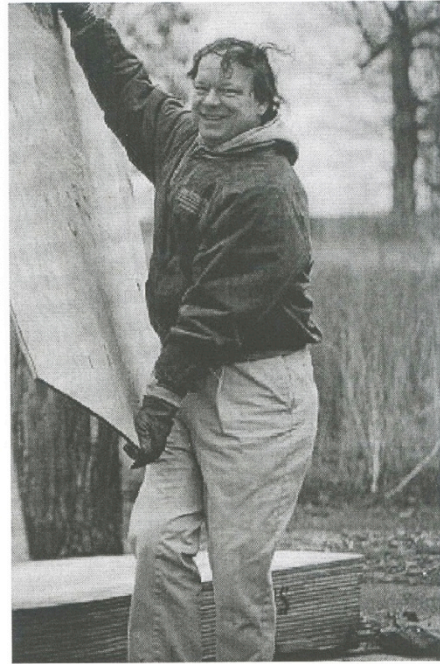
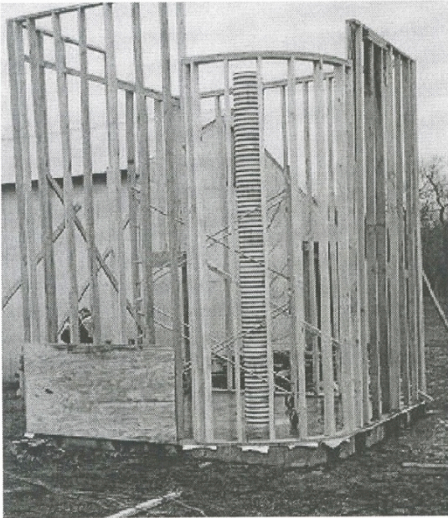


The aptly-named Big Hook, ready to heft concrete.

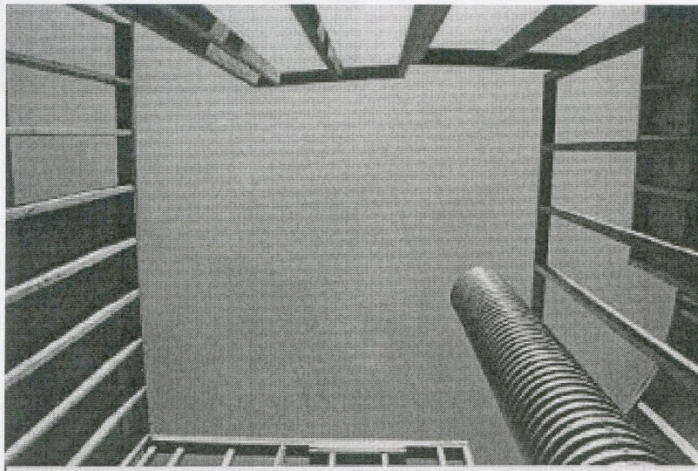
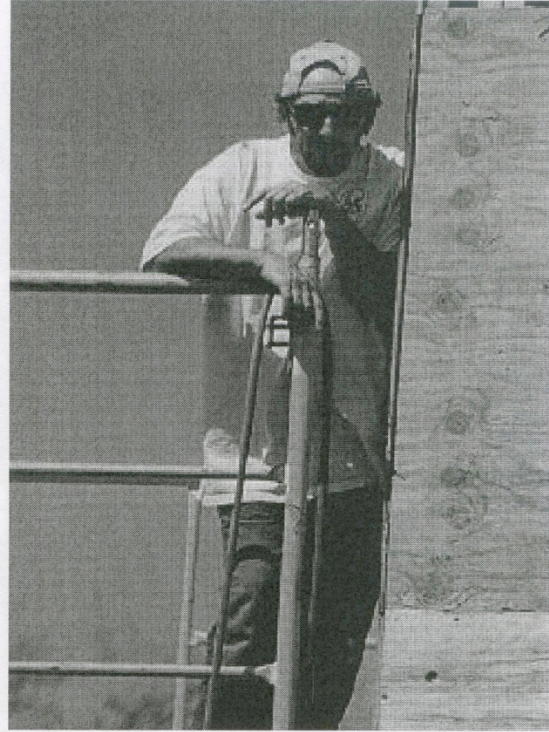
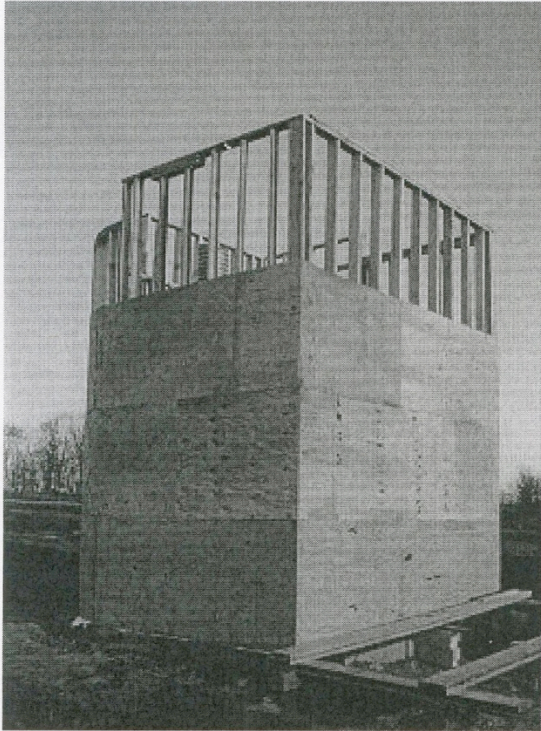


Part of the SGO Construction Team

SGO Construction Album II



—Glenys Blair



More Photos Inside

Sugar Grove Observatory Update

— Michael P. Rogers

On Saturday, March 11, in the middle of a late winter snowstorm, an intrepid group of builders and TCAA members gathered to begin construction of the Sugar Grove Observatory (SGO) at the Sugar Grove Nature Center.

The chiefs were Jim Baker and Vince Burdette; in attendance as well were several workers from Vince's company, Holder Construction: Don Frank, Steve

Gravelle, and Jon Lewis. Last but not least, we were joined by several local carpenters employed by Holder, John Spencer and Bob Moretz, of local 63 of the Carpenter's Union. In addition to Jim and Vince, other TCAAers present were Dan Miller, Bob Cuberly, Jean Memken, Sandy McNamara, and yours truly, performing assorted tasks as needed. Jeannie fed the troops, ran the daycare, and took

continued on p. 6



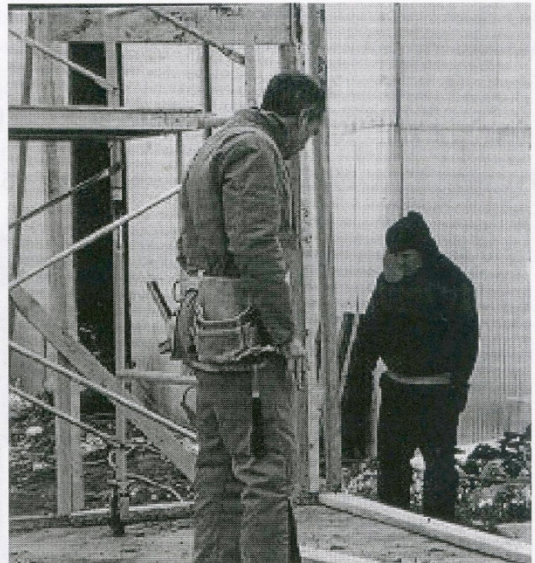
L to R: John Spencer, Dan Miller, Bob Moretz, Vince Burdette, Jim Baker, Bob Cuberly, Michael Rogers. Not pictured: Steve Gravelle, Jon Lewis, Don Frank

Construction Photo Album

— Jean Memken



Bob Cuberly, in front of a building that goes up a loooong way



Local 63 Carpenter John Spencer (at left), contemplating his next move



TCAA President Dan Miller, enjoying the late winter snowstorm

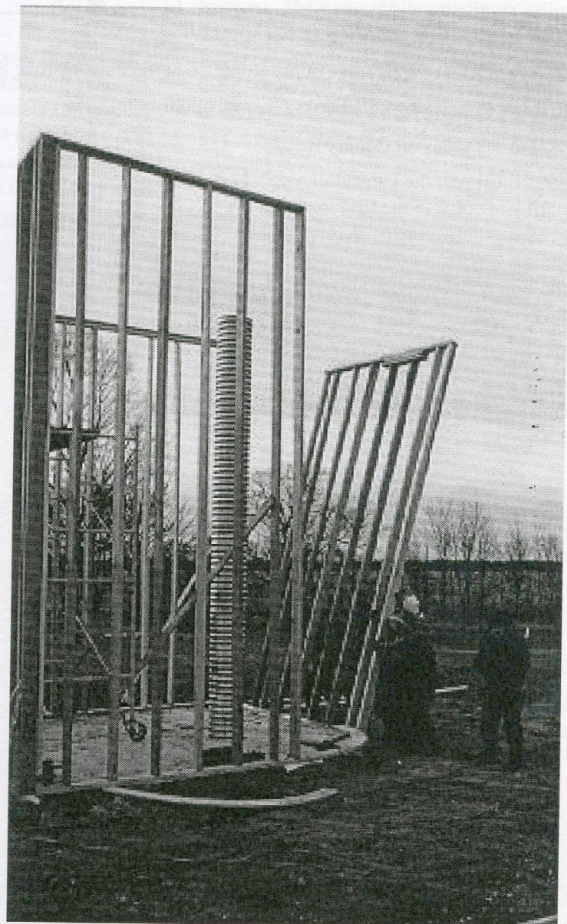
Hubble Surveys Dying Stars in Nearby Galaxy



The Cut Shop Crew: Steve Gravelle, Jon Lewis, and Don Frank



And a one, and a two, and a...



... three!

SGO Photo Album

— Michael P. Rogers

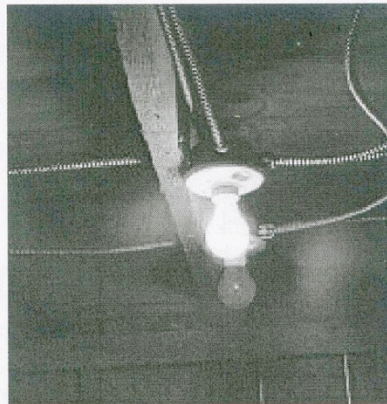
As you can hopefully tell by the accompanying pictures, we are continuing to make progress on the SGO. The accompanying images do not do justice to the observatory. Color versions will be on the web site (when I can restore my crashed server, grrrr), and of course you can always see the real McCoy during one of our many construction parties.

The picture at right illustrates a number of points: first, almost all the siding is up, but we still have a bare patch. We used up all the long siding that Mike Funk had provided us, and this is harvest time, so he's a little preoccupied. As soon as the boards arrive, we'll get them up. The electrical wiring is in place. We now have our own meter, on a separate board. We will be paying approximately \$7 per month for electricity. Notice as well that the exterior of the dome is painted white. We used a galvanized white primer, suitable for industrial use, that should last a long time, and should protect the dome from rust.

Not only do we have electrical wiring, we now have electricity! As the picture on the lower right is meant to imply, most of the fixtures are in place, and are working. This means, of course, an end to those quitting-because-we-can't-see excuses, but it seems a small price to pay for power.

We also know the identity of the mysterious electrician who has been doing all of this work. According to Dan, he is Ken McLean, who is working at State Farm for Holder Construction. Apparently several Holder employees had volunteered to help, but only Ken has stuck it out.

The electrical plan itself is courtesy of Bob Cuberly, with minor contributions from other members.



Instruction Manual

8", 10", and 12" LX200GPS Schmidt-Cassegrain Telescopes
 7" LX200GPS Maksutov-Cassegrain Telescope
 with Autostar II Hand Controller



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SHIP TO CUSTOMER NO. **A999-0**

ITEM	PRODUCT NUMBER	DESCRIPTION	SERIAL NUMBER/REMARKS	CONF. QTY. THIS ORD.	QTY. SHIPPED	MIN. QTY. BACK ORD.	CARTON NUMBER
1	RGA	REPAIRED PRODUCT SALES ORDER SPECIAL INSTRUCTIONS: RECEIVED: (1) 12" LX200CPS COMMENTS: SCOPE RA & DEC MOTORS MOVE RANDOMLY AND WITHOUT NOTICE. RUN-AWAY MOTORS IN BOTH DIRECTIONS. BECAUSE OF THE MOTOR PROBLEMS, THE GEARS IN RA ARE BROKEN DEC MOTOR GEARS MAY BE BROKEN AS WELL. HBX IS NOT WELL RESPONSIVE SCOPE WAS RECEIVED UNDER ORDER #021447. CALL TAG WAS ISSUED TO PICKUP SCOPE FROM CUSTOMER. SKY ASSURANCE #3321 3-DAY SHIPPING REC'D INTO REPAIR ON 8/21/07, PH		1	1	0	

It seems the 12-inch Meade LX200 telescope had problems from the start.

The SGO's Celestron Telescopes

On December 22, 2010, the dome at SGNC was upgraded to a Celestron Pro Mount installed on a recently donated Celestron pier. The telescope mounted atop it was the early 1970s C14 that previously had been under this same dome at Downs, IL. The club had received this telescope through a donation, but it was in very poor condition. The Board agreed to have the telescope refurbished and spent \$700 to have it entirely reworked and the mirrors re-aluminized. The telescope was mounted on the Celestron Pro mount upon return but showed that it was not up to the exacting standards required for astrophotography. Because the Celestron Pro mount was a German equatorial mount, the telescope had to be "flipped" every time it crossed over the meridian. This resulted in an unacceptably large amount of "mirror flop". The telescope would not be a satisfactory solution given the type of photographic equipment the club intended to use with it.

A newly acquired 11-inch Celestron was mounted on this pier and used along with a Star Lite Express guide camera using Maxim 5.0. It was quickly discovered that the old existing computer was not working so a Toshiba Quad core was purchased. Lee worked on polar alignment and other mount errors.

In January 2011 an 11-inch Celestron Edge was purchased and a decision was made to sell the Pro Mount, QSI camera, and the standard 11-inch Celestron to IWU. A Paramount Me mount was purchased and installed.

The SGO's 17-inch PlaneWave Telescope

During July 2011 we purchased an Apogee 16MP camera. Later a decision was made to purchase a 17-inch PlaneWave telescope for SGO; this was installed in the dome at SGNC in August 2012. We now have a Me Paramount mount, SBIG guider with a MOAG controlling a 17-inch telescope with the 16MP Apogee camera. This camera goes down to 70 degrees below ambient air temperature. It's also uses a 16MP chip with a 36 by 36mm format.

Other Equipment Today

For portable use today we have a CGEM Mount with either a 90mm solar scope with a camera for use during the day or an 11-inch Edge Celestron for night use and several other mounts and telescopes available to club members. This includes two Stellarvue telescopes and a 250mm CCA Tak. Also a vintage six-inch refractor is available for use.

In the new roll-off-roof Prairie Sky Observatory we have the CCA 250 to the south with a new Aspen camera. In east pier we have Me Mount with a new 16-inch Harmer Wynne Astrograph telescope set to arrive some time in early 2015. It will be outfitted with an 8300 SBIG camera. On the west pier we have the C11 Edge for visual use. In the north pier we have a 1600 Astro Physics mount capable of carrying 200 lbs. and a 20-inch PlaneWave telescope with another Aspen Camera.

For correction we have three sizes of Flatman screens including 6 inch, 13 inch, and 24 inch formats. We have 2 MOAG'S for use with the larger telescopes. Each can use either a SBIG guider or the Starlight Express guider. We have a Hotech collimator to adjust collimation on any compound telescope.

Among our expertise we have Lee Green, Tony Cellini, Tim Stone, Carl Wenning and Craig Prost – all are experts in the astro photo field willing and able to help answer and train anyone interested among the TCAA's 40+ club members.

Members with their scopes come to the public events. Carl has a 18-inch Obsession, Lee Green has a C14, Tony Cellini has a solar scope on a mount, there are several additional C11 Celestron and other telescopes in the club; not all show up at all events. So, at any public event we usually have about 15 scopes of several sizes set up in the parking lot.