CHAPTER ELEVEN

Stargate 4173 at Grimaldi Tower

Through the SBIG camera users group I have, from time-to-time, made suggestions to people wishing for views about different styles of observatories. In particular, I became involved with Bob Antol in discussing the plans he had for a grand observatory north of New York. It was to be the Grimaldi Observatory, named after his prize cat. Now, my wife has cats and one of them, Monty, a big male kitten, has a bad habit of running up your leg. Fresh off the tennis court, in shorts, he carried out this act on me—ouch! He also has the habit of walking across the keyboard while an image is downloading. My observatory would not be named after a cat! One of the joys of astronomy is the manner in which participants pull together in helping one another, and it was a pleasure to give Bob some of the pros and cons of building the Crendon Observatory.

Three years ago I had no junk-mail filter and was being inundated with the wretched stuff: one hundred a day at least. There was a mail entitled "man from Wyoming" and my finger was on the delete button when something told me to pause. It was from a man called Brad Meade who was coming to England in a few days and was thinking of building an observatory adjoining his house. He had seen my Web site and wondered if he could stop in. Of course, he was most welcome. He arrived with his delightful wife Kate and boys Sam and Tucker. After the conducted tour they did us proud at the local hostelry. Margaret and I know one other resident of Wyoming and, would you believe, Brad is on the same Board of Directors as Alan!

Brad has to be a most trusting individual, because he duly built his observatory taking my recommendation about the dome, the telescope, and the mount. Brad tells me he has just purchased a vineyard with a view to constructing a distillery. "Brad's Mead" comes to mind as a title that might be appropriate for the hooch.

Following now is an account of Bob Antol's efforts concerning the construction of his observatory (Fig. 11.1). In the next chapter is Brad Meade's account of how he built his observatory.

Figure 11.1. Grimaldi observatory.

41 degrees 36 minutes 49 seconds North, 73 degrees 40 minutes 16 seconds West Robert A. Antol.

In the Beginning

My fascination with astronomy and observing the heavens started when I was 10 years old. I am 50 years old now, so astronomy has been a part of my life for 40 years! Of course, life was much simpler in the early 1960s. An observing session back then was as simple as going into the backyard when the skies were clear and looking up.

When my parents bought my brother and me our first telescope, we couldn't believe the stark beauty of the Moon, the magnificence of the planets, and the wonders of the universe. An observing session with this first primitive telescope consisted of taking the rather lightweight tube and tripod assembly on an alt-azimuth mount out into the backyard and finding a suitable location to view an object such that it was not blocked by any trees. If we wanted to see something that was behind a tree, we picked up the telescope and moved to another location in the yard.

As I got older, the telescopes, tripods, and mounts got bigger and heavier and the accessories more numerous. An observing session now had to include the set-up and take-down phases for the tripod and telescope. The days of easily going into the backyard and observing for a few minutes were gone.

A typical session started out by hauling the 19-pound heavy duty variable-height Meade standard field tripod to the location in the yard where the observing would be performed. Then, I would go back inside the house and bring out my suitcase of accessories. If I was just observing, a single trip would suffice. But, if I was going to connect my camera, then a couple of trips were necessary to ensure I had everything I needed.

There was a final trip back to the house to haul out the 33-pound Meade LX-50 8-inch Schmidt–Cassegrain telescope. Before mounting the telescope on the tripod though, I would first level the tripod head and polar align the tripod to the best of my ability. I would also set the tripod height to a comfortable viewing level. When satisfied, I could lift the telescope into place and lock it onto the tripod.

The telescope's built-in bubble level was very helpful in fine-tuning the tripod legs so the telescope was perfectly level. Polar aligning was then performed and when all was perfect, observing could then begin.

The total elapsed time for the set-up procedure was about 15 minutes, and an equal amount of time was needed for the reverse process of taking everything down and stowing it away. This meant a 5-minute observing session would require a total of 35 minutes of time including set-up and take-down, so it was hard to justify a short observation session.

There had to be a better way. I had always thought that a permanent mounted polar-aligned telescope in an outdoor building would be the most convenient thing to have. Researching this idea would eventually lead to the construction of the Stargate 4173 at Grimaldi Tower Observatory.

Use a Roll-Off Roof?

Prior to deciding on a dome, however, I seriously considered building a roll-off roof observatory. A roll-off roof is basically a small shed with a removable roof. In actuality, the roof is not removed but is rolled off to the side on rails connected to the shed structure. My initial plans called for a one and a half story building. The bottom floor would be considered the "warm room" or the "control center." I imagined myself walking down the stairs after several hours of observing in the cold and entering a room that housed a microwave oven. Making a piping hot mug of cocoa and sitting in a soft recliner would help take off the chill before I walked back up the stairs into the cold evening for continued viewing.

This was an interesting idea, but I began running into problems as I sketched out initial designs on paper. My desire to have a refrigerator, microwave oven, and a soft recliner dictated the size of the room. For mounting the telescope, I had envisioned a solid concrete pier shooting through the center of the first floor room. The pier, in addition with everything else I required, forced the room to be larger. A larger room dictated a larger building footprint, which resulted in a larger roof. As the roof got larger, it got heavier. I then had to devise a plan to roll a very heavy roof onto the side rails. Plus, as the roof got heavier, the supports for the side rails got more massive. What was this final structure going to look like?

The Dome

With the many unanswered questions regarding the one and a half story roll-off roof observatory in the back of my mind, I happened one day to see an Ash Dome observatory advertisement in *Sky & Telescope* magazine. I was very impressed with the overall look of the dome. I have always liked observatory domes; but never thought that I would actually own one. With the realization that personal-sized domes were available, I began rethinking my plans regarding the roll-off roof. The first task to be completed was to test the waters with my wife, Barb, to see if a dome in the yard was a possibility.

As it turned out, my wife was very receptive to the idea of replacing the roll-off roof design with the dome. I showed her the Ash Dome advertisement. She liked the classic look and thought the idea was really cool. Fortunately for me, "convincing the better half" was a non-issue. For anyone else thinking of building an observatory, though, you definitely need to have your significant other involved and in agreement with the plans for your structure.

Visiting an Ash Dome

I sent off a request to Ash Dome for information regarding the dome: what sizes were available, what were the costs, shipment details, etc. Shortly thereafter, I received an e-mail with answers to all of my questions, including a list of nearby Ash Dome owners along with their dome locations. To my delight and surprise, one of the local colleges had three Ash Domes of different sizes.

I called the astronomy department at the college. They told me free observing sessions were held every clear Wednesday evening. I thanked them, but told them I wasn't interested in looking through their telescope at night, but rather wanted to come see their domes in the daylight. At first, they thought this was a strange request, but I told them of my plans for designing and building an observatory, which included the incorporation of an Ash Dome. The astronomy professor understood and agreed to have one of his grad students provide us with a private tour of the domes.

We drove to the college and met with the grad student, who gave us a tour of each of the three domes; one was manually operated while the other two were motorized. The Ash Dome was amazing! There is nothing quite like standing inside the observatory and seeing the actual dome. It is very impressive. For anyone interested in building an observatory, I recommend being able to see, touch, and experience the dome you plan to purchase ahead of time.

In addition to just "seeing" the domes, we also received some valuable information on the "workings" of them. One thing we learned was the importance of ensuring that the lower aperture door of the dome, when opened, would have sufficient clearance for proper 360 degree rotation to avoid obstacles. A design flaw with the college building required them to have to raise the lower aperture door to avoid collision with the entrance way structure. I believe the most important aspect, though, was getting the actual feel for how much room was available inside the different-size dome structures.

Concept

After seeing the Ash Dome in person, we were convinced the dome was the observatory type for our yard. The roll-off roof design would have been nice, but we were both happier with the dome. The next step was to select the location in the yard for the dome and decide if the observatory would be ground level or one and a half stories—similar to our roll-off roof plans.

Our house is a two-story colonial situated on a hill. There was one ideal location in our backyard for the observatory, but if selected, we would have had to sacrifice a beautiful tree. Preserving all of the trees meant selecting a location that was not entirely suitable for astronomical observing. We knew what we wanted, but we were having a difficult time in arriving at a mutually acceptable location for the structure. As we continued to think this through, an idea surfaced for mounting the dome on our existing garage. This was promising in that the observatory gained height and reduced obstructions; plus, no trees would be lost.

We also thought it would be extremely convenient to be able to enter the dome without having to go outside. This attraction convinced us to abandon the stand-alone observatory concept. We wanted to devise a plan that incorporated the dome into our house.

One problem with building the observatory atop the garage was losing a car space as a result of the telescope pier. It would be possible to build the Ash Dome on top of the garage without the pier, but the vibrations to the telescope would make the observatory useless (at least from an imaging point of view).

Design

Since the pier was a definite requirement, we started to search for other alternatives. The next idea in the evolution of our observatory design was to extend the back of the garage sufficiently to accommodate the pier without interfering with the interior of the existing garage and then mounting the dome above that central spire. This idea had real promise. So we began sketching out some pictures of the back of our house with an attached dome.

We knew there were still many architectural issues to be addressed, but we also knew we were getting closer to our final design. Prior to deciding on the extension behind the garage, we walked around our house trying to envision what it would look like if we added the observatory to different sides of the house. We also drew a sample floor plan layout of this proposed extended garage, depicting what we had in mind.

After continued discussions, we arrived at the preliminary design that would form the basis of our observatory—a full room extension behind the garage with an attached tower and the dome mounted atop the tower. We still ended up sacrificing that one tree, but the many benefits of the design outweighed that loss.

Additional Research

The Internet is a fantastic place to find other Ash Dome owners. When I found someone who had been through the process of ordering, assembling, and eventually using the dome, I would contact him or her and ask many different questions. Almost everyone I contacted responded with helpful information. A very common question I asked was, "If you could do it all over again, what would you do different?" Their responses definitely helped me in revising and finalizing my own plans.

One very useful resource during my early research was the Ash Dome Web site (http://www.ashdome.com/page5.html). This site has pictures and Web site links of what other Ash Dome owners have done. I discovered one dome, in particular, that impressed me since it was mounted atop the house similar to what I intended to do. That dome of interest was the Crendon Observatory owned by Gordon Rogers and located in the United Kingdom.

After visiting Gordon's Web site, the immensity of the project I was about to undertake really hit home. There were many unanswered questions I still had, and I wondered if my efforts would result in an observatory as beautiful as the Crendon. The only way to get some of my questions answered was to contact Gordon.

He was extremely helpful and answered all of my questions. I e-mailed him several times with different queries. In many cases, his responses prompted me to rethink some aspects of my proposed design. This, in turn, resulted in even more questions. Some of the answers he provided to me played a crucial role in the finalization of my own plans. For anyone considering building a first-class domed observatory, here is a list of questions to consider (similar to what I asked Gordon):

- If you could do it all over, would you still purchase the Ash Dome?
- Did you either heat or air condition your observatory?
- Are you happy with the size of the dome you purchased? If you could do it over again, would you go with a smaller, same size, or larger dome?
- What is the height of the walls?
- How do you gain access to the observatory?
- What kind of pier do you use?
- If the pier is concrete, how is telescope stability?
- Do you have any additional information or helpful hints that might aid me in the design of my observatory?

The Town Code—Know It Ahead of Time!

Every state, every town, every city, every village has their own unique set of rules associated with building on land you own. These rules are in place to protect you—and your neighbor. The construction of a domed observatory is unique enough to warrant a pre-investigation into the town code so you will know whether or not you have the right to build. Check with your town hall on the appropriate steps you need to take in order to get the proper permissions.

I live in the state of New York; the county of Dutchess; the town of Beekman; the hamlet of Poughquag. In Beekman, there is an official town zoning code available online for anyone to review. The recommended steps for any construction project include:

- Draw a sketch of your project and get pre-approval to continue.
- Work with a licensed architect to develop detailed construction plans.
- Obtain official town approval and building permits.

Plans (Architectural)

Our town would not grant a building permit for a project of this size without the submission of a licensed architect's drawings. The phone book was a good place to start the search. But, not surprising, we didn't see any architect who advertised that they specialized in the design of home observatories. However, we were fortunate in that a friend from work recommended an architect they had worked with on some home improvements and were happy with the results. We set up an appointment with that architect so we could explain what we had in mind.

Prior to our initial meeting with the architect, another friend gave us some more good advice. Whenever you work with an architect, be sure to get what you want—not what the architect "thinks" you want. In the end, we were very lucky in the selection of our architect. He not only gave us what we wanted, but provided suggestions and improvements that we didn't think of.

Our architect was Dan Contelmo from Architechniques, now doing business as Millbrook Architects. For our initial meeting with Dan, I had the brochure from Ash-Dome as well as some hand-drawn sketches of our ideas. We walked around the yard and showed Dan where we wanted the new addition. I then provided the requirements for the dome. My initial requirements ended up driving both Dan and I crazy. I wanted a 12-foot diameter dome, a full-size door to enter the observatory room, and the wall height was limited to 5 feet 2 inches. I explained to Dan the line of reasoning behind this decision. If you had standard 8 foot high walls and you wanted to look at something near the horizon, you would not want to climb a step ladder in order to peer through the eyepiece. The telescope height had to be comfortable for viewing all portions of the sky. With my list of requirements in hand, Dan returned to his office to design his preliminary sketches.

When we next met with Dan a few weeks later, he had several different options for gaining access to the observatory room given the parameters he had to work with. The first sketch had a submarine-type hatch with access via a ladder. This provided the maximum amount of usable floor area in the observatory, but we rejected this idea immediately because we knew we would have difficulty gaining access to the room as we got older. Plus, it would be very difficult to haul the telescope up the ladder and through the hatch. Finally, not all visitors to our observatory would be able to comfortably enter and exit the observatory via the ladder.

The next sketch had a full-size door that would open into a pit in the room. A set of stairs would bring you out of the pit into the observatory. This gave easy access to the room for anyone of any age. But, a full-size door is close to 3 feet in width. Carving out a pit in the observatory room to accommodate the door plus a railing (so you wouldn't fall into the pit) took up too much space. Considering we only had a 6-foot radius to work with, this plan left very little room next to the telescope.

Another sketch was a twist on the previous concept. Once you were in the observatory and had the door closed, a drop down panel would be lowered covering the pit. This would provide maximum floor space, but also trapped you in the observatory. It would be awkward for additional people to enter once the panel was in place.

After seeing the difficulties Dan was having, I realized some problems would go away if I relaxed some of the initial requirements. I didn't want to increase the wall height, so I checked the price list in the Ash Dome brochure to see how much more it would cost to increase the dome diameter from 12–16 feet. The difference in price was manageable, so I asked Dan if it would help if we went to a 16-foot dome. His eyes lit up with this change, and he immediately began sketching some new possibilities.

Barb looked at my 8-inch telescope and commented, "Isn't a 16-foot dome rather large for the 8-inch telescope?" I calmly replied, "Yes, so I'll have to buy a larger telescope!" It was finally out in the open. My ulterior motive was finally exposed. There is a lesson to be learned here: If you want a larger telescope, convince your spouse that you need a larger diameter observatory dome first. The newer and improved larger telescope will naturally follow.

With the new parameters to work with, Dan came back with a wonderful solution. Originally, the lower room of the tower was only going to be accessible from the outside and would be used as a storage room. Original plans also called for a door set into the far wall of the rectangular addition to open onto a stairway that would ascend to the observatory. The switch to a 16-foot dome dramatically altered these plans—for the better!

Dan's new plans resulted in merging the octagonal room (i.e., the lower room of the tower) with the rectangular addition. No longer would the octagonal room be considered a storage room only accessible from the outside. Now, this uniquely shaped room would be part of our living quarters. Entrance to the second floor observatory would be through a door in the lower octagonal room. The purpose of the door was to act as a temperature isolation barrier separating the observatory from the house. The stairs to the observatory would hug the inside four walls of the tower, eventually bringing you almost 180 degrees opposite the starting point. This design, incorporated with the 16-foot dome, provided plenty of space around the telescope.

It was essential that the pier be totally isolated from the building structure so this was one very important item I wanted to see very clearly stated on the plans. Dan accommodated this request by adding this:

Note:

Do not bear or connect any framing members on concrete pier.

Provide an isolation joint between the concrete pier and the slab.

Town Approvals

With the architectural plans complete, it was now time to get the town's approval and to obtain the building permit. I dropped off two copies of the plans with the town and asked them to contact me if there were any questions. The first question they asked was if I had a builder yet. I was hoping to get approval before selecting a builder. However, the town would not review and approve the plans and issue a building permit without having a builder selected. I also had to provide proof that the selected builder had sufficient insurance to cover the possibility of any "on the job" accidents. They didn't seem to have any other concerns, so I was encouraged by that. Approval appeared to be just around the corner. I couldn't believe how smooth everything was going so far.

But, as you will see, the seemingly smooth road ahead would have some curves and bumps.

Selecting the Builder

Just as architects don't advertise a specialty in designing observatories, builders don't either. So, I asked our architect to recommend a list of builders. Since the architect works on a daily basis designing homes and doing home improvements, it was natural to assume they knew who had the skills to tackle the job that I was pursuing. I was provided with four possible candidates. It was time to begin the interview process.

All four builders were contacted by phone. Three of the builders returned my calls. The fourth builder was knocked out of the bids right away since he didn't respond. Not returning a phone call from a prospective client just isn't indicative of good business practice.

Individually, the remaining three builders came over to the house, and I showed them the architect's drawings and the location in the yard for the construction. They all took their copies of the plans with them and indicated to me that it would take one to two weeks to analyze and determine a price for the project.

During one of our early meetings with the architect, we asked if there was a formula that could be used to estimate the cost of the project—sort of a "ballpark figure." He told us a certain dollar value per square foot based on the building materials we had in our plans. We computed the number and it turned out right about what we had intended to spend. Things looked pretty good. If the actual bids were close to that ballpark figure, we would be set.

Within a week, the first builder called with his bid. The bid he provided was 25 percent higher than what we had budgeted based on the architect's estimate. We were devastated. My dream of having a first-class domed observatory attached to a two-story tower incorporated into a new addition for our home was looking as if it would be just a dream. In order to afford this project, we were going to have to scale back some of the features to bring the price more in line with our budget. Would all three of the builders come in with bids this high? We would have to wait for the next bid.

A week later, the second builder called us. When he told us his bid, our spirits lifted. His bid was right where we thought it would be; right where we hoped it would be. This builder was Ed Peterson of Peterson Home Improvement.

The third builder never called us back with a bid. We started with four prospective builders; talked with three of them; and heard back from only two. One bid was exorbitant, while the other was reasonable. Various friends who had recently dealt with contractors warned us to be prepared to spend between 10 and 30 percent more than the original quoted price due to possible unforeseen costs. We asked Ed directly if the price he quoted was the price we would pay or if this number could change. Ed gave us his word that the price quoted was the price we would pay, barring any changes we introduced after contract signatures.

As it would turn out, Ed was true to his word. The quoted price was indeed what we paid and the workmanship was excellent. Our decision to work with Ed and his crew was a good one and one we did not regret.

Now that we had a builder, it was time to re-approach the town for final approval.

Getting Neighborhood Approvals

Unfortunately, approval was not immediate. I went down to the town hall and told them I had everything they requested and was ready to pick up the building permit. Not so fast, I was told. The town informed me I needed to present my plans to the Architecture Review Board (ARB). This was news to me. I questioned them as to why I wasn't informed of this esteemed body when I first presented my plans. The response I got back was simple—this board was newly created! I kept my composure and asked specifically which codes were in violation and why these plans needed to go before this ARB. They told me there were no specific violations, but because my planned addition was "different," further review along with neighbor approval would be required.

I pointed out that my observatory would look just like a silo. We live in a rural area and, fortunately for me, there is at least one silo within a half mile of the town hall. They acknowledged this was in my favor and indicated the review board would likely not have any issues. Therefore, I asked if it would be acceptable to submit written approval from my neighbors in lieu of having them attend a town meeting. They agreed that would be sufficient, and if I submitted the written consent from my neighbors, I would not have to go before the ARB.

I went home and created a single page document with the architect's depiction of the final project and the following text:

We (our name and address) have plans to build an addition onto the back of our house and will be abiding by all zoning regulations. The addition will be attached to the back of the garage and will extend into our backyard. We will also be incorporating an astronomical observatory built on an octagonal structure located on the Southwest corner of the new addition. The architect's proposed views of this project are included below.

Your signature on this note indicates that you concur with these plans and have no objections or concerns.

I printed up the correct number of copies and then went door to door to meet with every neighbor whose property was adjacent to ours. I obtained the five required signatures without any difficulty at all. As a matter of fact, our neighbors were all very interested in the project and couldn't wait to see it completed.

The very next day, I took the five signed letters down to the town hall. That did it! The town was ready to issue me my building permit to begin construction on my observatory. I informed Ed I had the approval, and he gave me a date as to when his crew could begin construction.

Construction

The actual start date for the project arrived pretty quickly. The crew assembled their equipment and supplies in the backyard and began work on the 4-month project. Chalk lines were drawn on the existing house foundation and on the grass showing the footprint of what would be my dream observatory. Up to this point, we only had artistic depictions of the project on paper in an architect's line drawings. Now we were able to actually see how much of the yard was going to disappear under the outline of the new addition.

The Foundation

A back-hoe was used for the job of neatly digging a trench whose depth would extend below the frost line. This trench would form the foundation of the new construction. The design of this project called for a 16-foot diameter octagon attached to the corner of a rectangle. This was easy to draw with an architect's CAD (Computer Aided Design) program, but digging 135-degree angle trenches using a back-hoe was no simple matter. Tom, the mason who was in charge of laying the cinder block foundation, was also the back-hoe pilot. He was an expert who commanded the machine to perform the delicate maneuvers needed to match the architect's plans.

Upon completion of digging the intricate trench system, the tedious job of laying hundreds of cinder blocks was begun. It took a total of two weeks for the blocks to be properly positioned along with the pouring of the concrete sub-flooring. If it seems that two weeks is an inordinate amount of time, you have to realize that the blocks at the corners of the octagon had to be cut at 45-degree angles with a diamond blade (see Fig. 11.2).

Dome Delivery

In the meantime, Ash-Dome was building my dome at their manufacturing facilities in Plainfield, Illinois. Ash-Dome assembled the dome at their plant and made sure all of the holes lined up, all of the pieces fit together properly, all of the electrical motors were operational, etc. When they were satisfied the dome "worked," they took it apart and packed it on a large 16 foot long by 6 foot high by 5½ foot wide pallet that weighed 2,800 pounds. This pallet was then loaded onto an 18 wheel semi-truck for its cross-country trek to be delivered to my home in New York.

Figure 11.2. The foundation footprint of the addition for the observatory.

The trucking company only provided roadside delivery to the base of my driveway, so I wondered how I was going to get the dome off of the semi and placed in my backyard near the construction site. I posed this question to Ash Dome, and they were able to offer a solution, since many of their customers faced this similar problem. The solution was actually quite elegant in its simplicity; it employed the use of a flat-bed tow truck. I asked the local garage if I could hire their flat-bed tow truck for an hour. When the semi carrying the observatory pulled up in front of my house, I phoned the garage and told them I was ready for them. The flat-bed came to our house, backed up behind the semi and raised its bed to the same height as the trailer. Then, the tow cables were strapped to the 2,800-pound pallet. The flat-bed driver activated the winch to begin pulling the observatory pallet out of the semi onto the back of the flat-bed.

Once the pallet was completely on the back of the flat-bed, the tow truck with the dome package aboard was driven to the back corner of the yard. The tow truck then angled the flat-bed and very carefully lowered the pallet onto the ground. Fortunately for me, the back-hoe that was digging the foundation of the addition was at work in the yard. The back-hoe attached a chain to the pallet and assisted the tow truck in gently lowering the pallet. Without the back-hoe's help, the pallet would have dropped to the ground a little harder, since it was basically sliding off the back of the tow truck. Without incident, the dome was safely tucked away in the corner of the backyard, waiting for the day when construction of the tower was complete and assembly of the dome could begin.

Figure 11.3. Arrival of the dome package.

Figure 11.3 shows the dome package arriving from Ash-Dome by way of an 18 wheel semi truck. A flat-bed tow truck pulls the pallet off the semi for transport to the backyard construction site.

Installing the Pier

One of the aspects that made the project so unique was the 2-foot diameter concrete pier that could not touch any part of the structure. Tom devised a simple but very effective way to construct this pier. Instead of building a custom form, he used a road culvert with very high crush strength. This was important as the culvert would be placed vertically on end and filled with concrete. It was vital that the culvert did not crack or break open during the concrete fill process.

The installation of the pier began with the digging of a square hole that was 5½ feet deep and located in the center of the octagon foundation. In this hole, concrete was poured to form a slab that was 5 feet long by 5 feet wide by 1¼ feet in depth. There was a cross-hatching of #4 rebar every 6 inches, positioned 5 inches above the bottom of the slab. Sticking out of the center of the slab were four #5 vertical rebar with a minimum 16-inch bend embedded in the slab. The imperial definition of a #4 rebar is.5 inches in diameter while the #5 rebar is.625 inches.

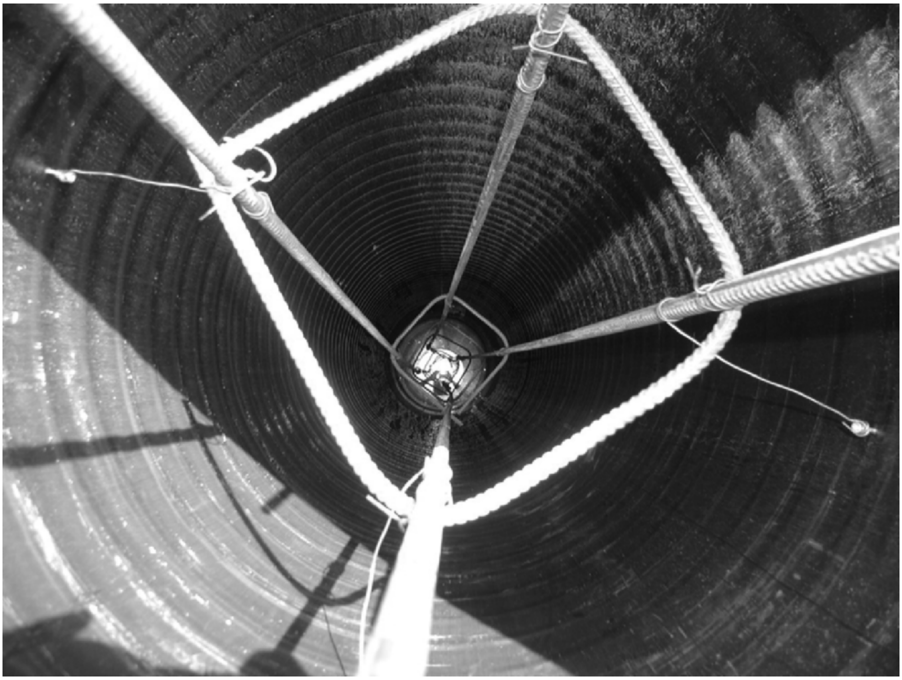

Figure 11.4. The rebar inside culvert pipe.

The four vertical rebar required a minimum of 4 inches from the outside of the concrete pier. These vertical rebar were attached with #3 horizontal rebar separated every 16 inches. A #3 rebar is.375 inches in diameter. After the slab cured, more vertical rebar were added for height, with a minimum 3 feet overlap between sections (Fig. 11.4).

Once the internal skeleton was constructed, the road culvert was lifted by the back hoe and centered in place over the rebar. Three wooden beams were then attached to the outside of the culvert and screwed to stakes buried deep in the ground. Tom very carefully ensured the culvert was in the center of the octagon, perfectly vertical and securely braced (Fig. 11.5).

Scaffolding was then constructed around the culvert, allowing one to see down the center from the top. Everything was in place for the fill process to commence.

Tom constructed a ramp next to the pier so the back-hoe would have sufficient height for his plans. When the cement mixer truck arrived, he attached a hopper to the end of the back-hoe. One of his helpers was positioned at the top of the scaffolding while the second helper lingered near the base of the pier with a rubber mallet. The back-hoe swung the empty hopper over to the truck to be filled. After the hopper was filled, the back-hoe very carefully lifted it above the top of the pier where the lever was engaged to dump the concrete down the culvert shaft. While the back-hoe returned the hopper to be refilled, the helper with the rubber mallet would continuously pound on the side of the culvert to remove any trapped air bubbles in the concrete (Fig. 11.6).

Figure 11.5. The pier tube prior to insertion of concrete.

Figure 11.6. The back-hoe delivers concrete to pier by way of hopper.

Since the pier was resting on the slab 4¼ feet below ground and rose through the first floor, which had 10-foot-high ceilings and extended through the floor of the observatory, the culvert pipe used was over 17 feet in total length. To fill the tube, it took Tom close to two dozen repetitive trips from cement mixer to pier top and back.

When the culvert was topped off, we all had to work fast because it was critical for the last step to be done correctly. I requested the design of the concrete pier to neck down from 2 feet diameter to 1 foot diameter for the top 2 feet. This was accomplished by placing a 2 foot long by 1 foot diameter Sonotube atop the filled culvert pipe. The Sonotube was then hand filled with concrete, smoothed, and leveled. The next task was to mount a steel plate with 3 J-bars into the Sonotube. The steel plate had to be perfectly level, and it had to point at Polaris. When finished, a Pier-Tech 2 telescoping pier would be bolted to this steel plate. However, details for this part of the story will come later.

Here is how I managed to point a steel plate at Polaris in the middle of the day. During one of the previous clear nights, I took a compass with a rotating bezel and pointed it at Polaris. I then spun the compass so the magnetic needle lined up with true north. This was a simple way to know exactly where Polaris was during the day. Standing atop the scaffolding, all I had to do was abut the compass (which had a flat side to it) against the steel plate and point the needle to magnetic north. Adjusting the plate in the wet concrete allowed me to pre-position the plate correctly. A bubble level was used to level the plate. When the concrete cured, I would have an extremely level, stable, and polar-aligned plate ready to accept the Pier-Tech 2.

Building the Dome

The construction of the addition went without incident (Fig. 11.7 the interior of the new addition with tower and pier in the background). After the octagonal tower was constructed and after the roof was in place on the addition, it was time to construct the dome. I volunteered to take vacation from work to help the carpenters assemble the dome. This was a once in a life-time project and I wanted to be a part of it. Fortunately, Ed did not have any problems with allowing me to help. And since this was volunteer work, I was not on Ed's payroll.

The 16 foot Ash Dome took a total of 5 days to build. There were three of us working on this, but a fourth person was used during some of the steps. Here is a breakdown of the 5 days of construction:

Day 1: Dome skirt
Day 2: Dome panels
Day 3: Rails
Day 4: Shutter doors
Day 5: Motors and control boxes

The Ash-Dome came with a 56-page assembly instruction manual—11 pages of text and 45 pages of drawings. I made additional copies of this manual for everyone involved with the assembly. I deemed it important that everyone had read and understood all of the steps involved. On page 1, there was a cautionary statement: "Do NOT

Figure 11.7. The interior of the new addition.

attempt to assemble an Ash Dome unit during periods of high or gusting winds." If you ever plan to assemble one of these, you will want to heed this warning.

Day1 : Dome Skirt

The first major section of the dome to be constructed was the dome skirt. This is a circular wall assembly that has wheels inserted into a rail system allowing the dome to continuously spin. The wall plate assembly consists of circular segments which, when fastened together, form a continuous circular base plate with the dome roller fixtures attached. This was also one of the challenges the architect had to solve—how to mount a circle onto an octagon. The solution was to circumscribe the circle around the octagon. This would then allow rain to roll off the circular dome and not cause any water pooling problems.

The carpenters mounted 1½ inch thick by 14 inch wide top plate boards around the top of the octagonal walls of the tower. There were two layers of top plate boards glued together in an overlapping manner, resulting in a 3-inch-thick bonded plate. To circularize this, a custom jig was constructed that was centered at the concrete pier. A router was attached to the end of the jig and was used to cut a perfect circle the same diameter as the dome base plate. When the routing was complete, the result was a 3-inch-thick top plate with a circular outside shape and octagonal inside shape that was firmly attached to the top octagonal walls of the tower.

The dome base plate was attached to the top plate with ½ inch diameter bolts. At the center of each of the octagonal faces and under the top plate, a 3-foot long 5 inch by 5 inch by ½ inch steel angle iron was connected to each of the vertical walls. The dome base plate was then connected with a vertical lag bolt through the angle iron. This design provided more than sufficient strength to connect the 2,800-pound circular dome to the octagonal tower walls with no fear of high winds blowing the dome away (Fig. 11.8).

The entire dome base plate had to be perfectly level so the dome would spin with ease. The dome roller shafts were installed around the base plate so the dome support rollers (or wheels) extended over the edge of the structure. A total of 28 wheels were installed around the circumference of the ring.

The dome track rails were installed next. These semi-circular segments were installed over the rollers and connected together to form a perfect circle that freely revolved. The dome skirt was then bolted to the dome track. The skirt was made of 14-gauge galvanized steel that sat on the outside edge of the dome track rail.

The last part of the dome skirt assembly was the installation of the azimuth drive gear rack. This was attached to the inside of the dome skirt. The square holes in this rack allowed the azimuth motor teeth to easily spin the dome.

Figure 11.8. The dome skirt will allow the dome to easily spin.

At the end of the first day, a shiny circular ring had been successfully installed atop the octagonal tower. Despite its size, the ring could be spun easily with just the push of a finger.

Day2 : Dome Panels

The second day of dome construction was by far the most memorable. This was the day the structure actually began to look like an observatory. This was the day the dome panels would be installed.

There were three of us working on this phase of the construction. We set up scaffolding inside the observatory room. Unfortunately, the stairs to gain access to the observatory had not yet been installed, so the only way to gain access to the second floor room was via an extension ladder. The pallet with the dome parts was in the corner of the yard approximately 30 feet from the base of the tower.

Tom, the foreman and master carpenter, and I were positioned atop the scaffolding. Joe, the youngest carpenter and most energetic, was given the task of bringing each dome panel from the corner of the backyard to the scaffolding on the second floor of the tower. The dome panels for a 16-foot Ash-Dome are a little over 8 feet in length, and each panel is numbered and must be installed in a very specific sequence.

Since this was early on in the construction phase, the windows and doors were not yet installed. Joe would pull a panel off the pallet, carry it to the base of the structure, and pass it through the window opening in the first floor of the tower. Then he would go around the tower to the sliding glass door opening in the new addition to enter the building. Once in the lower tower room, he would grab the panel, carry the panel up the ladder, and pass it to Tom and me, who were atop the scaffold.

Each panel sits flush on the outside trim angle of the dome skirt. Tom stood on the scaffolding in the center of the dome cylinder and held the top of the dome panel while I aligned the screw holes in the dome skirt assembly. While I was aligning the bolts and tightening the nuts, Joe would descend the ladder and return to the dome pallet for the next panel.

The bottom of each successive panel was entered into the top of the preceding panel's rib. The panel was slid downward through the interlocking rib joint until it came to rest in a position on the dome skirt assembly. Based on Ash Dome's suggestion, the lubricant we used to make the panels slide more easily together was Ivory liquid soap. Oil would stain the roof panels, while a clear liquid soap would wash away in time.

While Joe was bringing the next panel for installation, I would tighten each panel in place. Since the dome could not support itself early on, Tom had to hold the top of the panels to provide support. It wasn't until two thirds of the panels were in place that the dome could actually support itself.

The repetitive process of installing the 35 dome panels took the entire day. When we were installing the last panel, the sky turned dark and the winds started to increase in strength. Then it started to rain, accompanied by lightning and thunder.

There were some final nuts and bolts that required tightening before we could conclude for the day. All three of us were working in the open metal dome structure with rain coming down, wind blowing, and lightning in the area. It was a little scary as we wondered if the unfinished dome could withstand the gusting wind or, worse yet, if we were going to become human lightning rods. Fortunately, the dome, though still incomplete, held up rather nicely under the increased winds, and we were able to complete the day's work without incident.

At the conclusion of the work day, the construction crew and I gathered in the yard and admired our handiwork. We were in awe of what we had accomplished and were amazed by the sight of the glistening dome towering over the house.

We were also covered with Ivory liquid soap from the lubricating process. You would think three grown men working in the hot July sun all day would reek of sweat. On the contrary, we all smelled Ivory clean.

When Barb came home from work, she couldn't believe how much we accomplished that day and how different the project looked. The observatory dome was visible for the first time from the front yard. It was an impressive sight. Barb also complimented me on how nice and fresh I smelled.

Day3 : Rails

Installation of the rails, or shutter track system, was the activity for the third day. Each shutter track rail is made up of two quarter circles of fabricated track. These quarter circles are bolted together and then raised into position over the top of the dome. After being connected to the dome, the upper shutter door will ride these rails while opening and closing. But, since the dome contains ribs and is not perfectly smooth, the track does not hug the exterior of the dome. It rides over the tops of the ribs at non-uniform locations along the length of the track. Ash Dome created unique spacers known as trim angles that had to be individually bolted into place between the shutter track and the dome at the rib intersection positions. The tedious process of bolting over four dozen of these trim angles into place is what took most of the day.

The motor bar was also installed at the top of the dome. The electrical motor to control the opening and closing of the shutter door was also mounted on the motor bar at this time.

At the conclusion of the day, the dome had its shutter tracks and was ready to accept the installation of the upper and lower shutter doors.

Day4 : Shutter Doors (Upper and Lower)

Day 4 was devoted to the installation of the upper and lower aperture shutter doors. Before Ash-Dome shipped the 2,800-pound pallet with the 16-foot dome, I asked them what the heaviest piece was. Of the hundreds of pieces, the single heaviest piece was the upper shutter door, weighing in at 180 pounds. I shuddered at the thought of how we were going to raise a 180-pound door over 25 feet to the top of the tower and install it on the shutter track rail system.

Actually, Tom devised a very simple solution to this problem. He had a rope and a manual winch with a ratchet. The winch was attached at the motor bar installed the previous day at the top of the dome. A long rope was threaded through the winch and dropped to the ground where the upper shutter door was tied. On this day Eric, another one of the carpenters, was enlisted to assist with the dome assembly.

Eric and Joe were positioned on ladders along the side of the tower. Their role was to safely guide the shutter as it was raised up the side of the tower. Tom and I were in the observatory room and would pull on the rope to raise the shutter into position. The idea was to raise the shutter over the open aperture. When safely stowed and locked into position (held firm by the rope and winch), the rollers were inserted into the shutter tracks, the mounting fixtures were slid over the shaft of the rollers, and the fixtures were attached to the shutter. There are only six of these rollers required for a smooth operation. When all of the rollers were in place, the shutter section was slid upward so the shutter drive track was positioned over the upper drive gear unit. Once the track and gear teeth were properly meshed together, the shutter door would not move unless commanded to do so by the motor.

The lower shutter door, considerably smaller and lighter, was easily installed. A similar set up with the rope and winch was used to raise this smaller door to its correct position. Instead of rollers that rode the tracks, the lower shutter door was attached to the bottom of the dome by a hinge.

Day5 : Motors and Control Boxes

The end of the dome construction was definitely in sight as dawn came on the fifth day. The last items to install were the azimuth motor to rotate the dome and winch motor to open and close the lower shutter. The upper shutter door motor had been installed during an earlier step. Connecting all of these motors together were two control boxes that contained the operational logic. Ash Dome did a very nice job of ensuring that you could not close the upper shutter door before the lower shutter door was properly stowed. The control boxes were designed to only let you operate the dome in a safe manner. The remote controls for the dome operation also communicated with the control boxes.

Attached to the dome skirt were three power contactor bars. The main power was transferred to these contactor bars through floating power pads. Power to the control box for the upper aperture door motor and lower aperture door winch was obtained from the main power bus through the pads and onto the contactor bars. Then, no matter how the dome was last positioned or even while the dome is rotating, the aperture doors could be electrically operated because power continuously encircles the base of the dome.

Figure 11.9 shows how the winch motor (left) lowers and raises the lower shutter door while the control box (right) controls manual and remote operation of both lower and upper aperture doors.

Ash-Dome offered an option that would allow the shutter doors to be manually operated, but I did not select this capability. The reason why will be explained later.

At the end of the day, the aperture door weather seals were in place, the lubrication of all parts was completed, and the azimuth drive seals were installed. We came to the section in the installation manual that said

Construction of your Ash Dome is now complete. Congratulations!

I was elated at this point in time. The dome was done. It took 5 days, but it was weather tight, operational, and it looked good. Now it was time to put the finishing touches on the project to make it a truly first-class observatory.

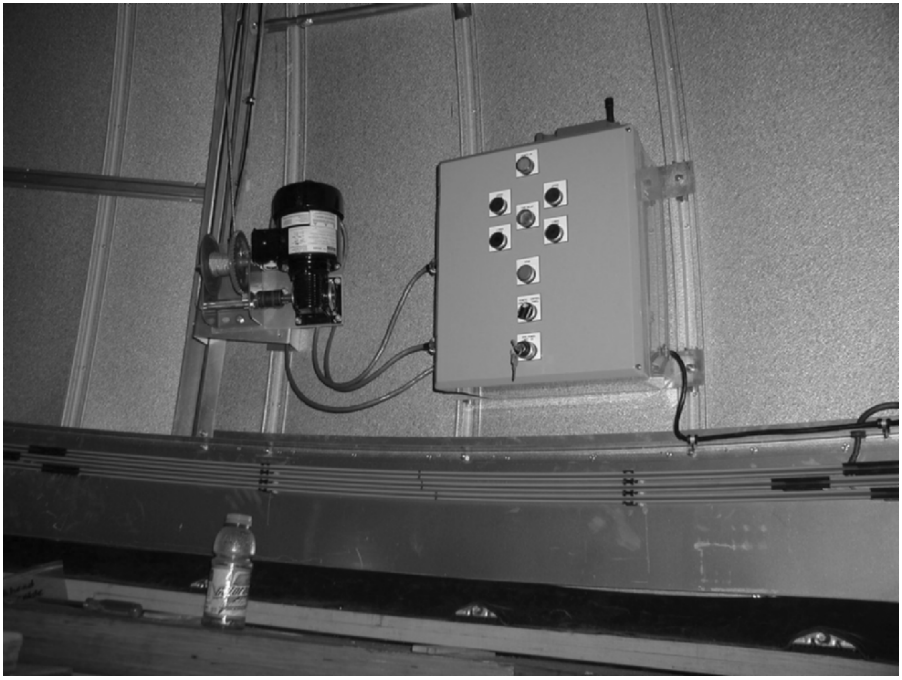

Figure 11.9. The winch motor.

Electricity

Electricity is woven into the fabric of our society, including modern astronomy. In an observatory, it is important to have a sufficient number of electrical receptacles for various types of equipment and accessories. It was time to work with the electrician, explaining my requirements. It was interesting to note that the architectural drawings did not include any electrical details. That could have been done, but I opted to meet with the electrician and explain exactly what I wanted. However, before this meeting, I spent many hours deciding what electrical features I wanted by making notes and diagrams.

Interior Lights/Dimmer Switches

Every astronomer knows that white light is bad for night vision, while red light will preserve night vision. Actually, instead of saying red light preserves night vision, it might be better to say that red light does not remove the night vision your eyes have attained. The lighting system in the interior of the observatory was therefore designed with this in mind. In order to gain access to the observatory, you enter through a door on the first floor and climb a set of stairs that hug the inside four walls of the tower. The stairwell contained four lights: two red lights and two white lights. Two separate switches would control each set of colored lights. The switches would be positioned in three different locations: at the bottom of the stairs outside the observatory entrance door; at the bottom of the stairs inside this door; and at the top of the stairs at the observatory landing. A dimmer switch would also be installed upstairs for the red light system.

A dimmer switch is a must for any observatory. Invariably, the brightness of the red lights should be controllable. I find it very useful to start the observing session with the red lights on full. This allows my eyes to begin their night vision adjustment. It doesn't take long when I begin to dial down the intensity of the red lights with the dimmer.

In the observatory, there is a window on each face of the octagon. The eight windows let in sufficient sunlight so electric lights would not be required during the day. An additional benefit the windows offer is the ability to cool the dome during the warmer months.

A light would be installed above each window: four red lights and four white lights alternating every other window. Because the walls were lower than standard height walls, I selected outdoor deck lights that were encased in a metal frame. This would help prevent damage to the light bulbs should anyone bump into the lower mounted fixtures. Again, two separate switches would be installed to control the different colored lights. The switches would be positioned in two locations: at the top of the stairs and at the base of the telescope. Thus, if you are observing and need to turn on any lights, you do not have to cross the room to accomplish this. A dimmer switch was installed for the red lights in the main observatory as well.

With this lighting design, it is very easy to turn on a light, either red or white, before ascending the stairs. Once in the observatory, another set of switches allows activating and dimming the set of red or white lights for the room.

Light Control

During the holiday season, Barb thought the observatory tower would look nice if every window contained an electric candle. I agreed with her and did not object to her design request. However, this meant I had to devise a way to easily turn off every lighted candle prior to the start of an observing session. Under every window in the observatory room, I placed an electrical receptacle. I requested the electrician to have the lower receptacle to always be "hot." The upper receptacle, however, would be controlled by a switch. By designing the receptacles this way, Barb could have her electric candles, which would turn on automatically when it got dark outside. Whenever I wanted to observe, I would simply turn off the switch to those receptacles to easily extinguish the electric candles.

Electric Telescoping Pier

While designing the wall height in the observatory room, I needed to arrive at a height that would allow me to see objects near the horizon comfortably. I also required the telescope to be at a comfortable viewing height for objects straight overhead. The telescoping Pier-Tech 2 offered a perfect solution to these design issues.

The Pier-Tech 2 is an electro-mechanical telescope pier. It was designed for the observer who wishes to raise and lower the pier by a push of a button. By pushing the button on the hand controller, the pier will raise an additional 20 inches in height. The precision vertical adjustment keeps the telescope polar aligned and level while keeping the target within the field of view. The Pier-Tech 2 lifting capacity is 215 pounds.

If you are interested in designing a first-class observatory, a pier similar to this is a must. Having one allows you to raise the telescope to easily view objects directly overhead without having to strain your back and be a contortionist. Plus, you can easily and comfortably look at objects near the horizon by positioning the telescope to the desired height.

We have also found this to be very convenient for visitors to our observatory. The telescope can easily be lowered for smaller children and raised up for adults, allowing comfortable viewing for everyone.

The Pier Octagonal Base

The concrete pier emerging from the observatory room floor presented an interesting aesthetic problem. When you enter the observatory room, the first thing that catches your eye is the immensity of the 16-foot diameter dome. All visitors to the dome are amazed at being in a room with a hemispherical roof that is 14½ feet high. Next, the eye is drawn to the center of the room where the telescope is located. The telescope, of course, is mounted on the Pier-Tech 2 (Fig. 11.10). The Pier-Tech 2 is bolted to the steel plate that is firmly affixed into the top of the concrete pier. One foot of the concrete pier is above the floor of the observatory. Seeing the exposed concrete just wasn't visually appealing. Therefore, I decided to build a pier base to hide the top portion of the concrete.

Being somewhat handy with woodworking, I wanted to build a base for the pier that would fit with the décor of the observatory room. I was originally going to build a simple cubical box to hide the top of the concrete pier. However, Barb suggested another alternative. She thought it would look nicer if the "box" was octagonal in shape to match the shape of the room.

My first inclination was that building an octagonal box was going to be rather tricky. However, after discussing the details of construction with a friend at work, the task turned out to be actually simpler than I had first thought. The octagonal box was constructed out of oak. Each edge was cut to 22 degrees 30 minutes. The edges were joined together using a biscuit joiner. The top of the box was composed of four pieces of oak joined together and cut in the shape of an octagon. The top edges were routed to soften the appearance of the box. In two faces of the box sides, I cut square holes. The first square hole housed a quad receptacle so I would have electrical power at the base of the telescope. The second square hole would be used for the light switches. I also have an Ethernet cable at the base of the telescope for communication with the control room, also known as the warm room, which is located on the first floor of the tower.

I made the box large enough to easily accommodate four coasters. I find this a convenient place to rest a steaming hot mug of cocoa in the winter or refreshing iced tea in the summer (or perhaps even a snifter of brandy year round).

Figure 11.10. The Pier-Tech 2 telescoping pier.

In the top of the box, I drilled four holes for the bolts of the Pier-Tech 2 to go through. With this design, the pier octagonal base box covered the top of the concrete pier but still did not make any contact with the telescope or concrete at any point, again achieving the requirement that no part of the structure touch the concrete pier. Finally, the box was stained and finished to match the window trim and railings.

Vibration Test

When Ed and his team were finished with construction, it was time to mount the telescope on the Pier-Tech 2. But before doing this, Barb and I decided to do the vibration test. We filled a glass with water and placed the glass on the top of the Pier-Tech 2. I then placed a flashlight next to the glass so the beam would shine through the glass and reflect off the bottom of the water. With everything set, Barb and I then began jumping up and down on the floor next to the pier. It was the strangest dance I ever did with my wife. However, we were both very delighted to see the water remain flat as a sheet of glass. We both knew the design of the building and pier column were isolated from each other, but this test proved the construction had indeed been done correctly. We had a pier completely isolated from the structure and extremely stable.

Finishing Touches

There are several other amenities that were added to provide that additional "touch of class." This section will discuss those final finishing touches.

Carpet

The floor of the observatory room was padded and carpeted with wall to wall indoor/outdoor carpet. There were several reasons for the carpet. First, when you are observing, the padded carpet is more comfortable to stand on for considerable periods of time. It also offers more warmth during the winter season. And finally, if ever I drop an eyepiece, instead of it shattering or becoming damaged, there is a greater chance it will bounce and survive unscathed. It is highly recommended for anyone designing their own observatory to consider adding carpet.

Computer and Telephone

I pre-wired the observatory for both computer and telephone. About the only wiring I did not bring up to the observatory was the television cable. And that was because the views through the telescope are more impressive, more incredible, and more soothing than anything available on TV.

Thermostat for Heating and Air Conditioning

The observatory room has its own thermostat to control both heat and air conditioning, but this was not done for the comfort of the observer. During observing sessions, you do not want to attempt to alter the temperature of the room, since the viewing would be severely degraded by heat current eddies. The temperature of the room should be the same as the outside temperature. However, during periods of excessive cold, heat, or humidity when we are not observing, it is desirable to have the ability to pump a bit of warm or cool air into the observatory for the benefit of the equipment.

Music

I really enjoy listening to music while observing, and I took this into account while designing my observatory. Two in-wall speakers were embedded between the studs during construction. The music system located in the new addition has a switch that allows me to pipe music just downstairs, just in the observatory, or in both rooms. I love to play planetarium music, which is the perfect musical accompaniment while observing the heavens.

Wireless Thermometer

In the first floor room of the tower, there is a thermometer that displays the temperature of the observatory room via a wireless thermometer. This enables you to get a good idea how to dress before you ascend the stairs. Of course, the beauty of an attached observatory is that it is very easy to come back downstairs and grab an extra sweater if it is cooler than expected.

Rolling Desk

Every telescope has accessories such as eyepieces, solar filters, camera attachments, etc. For my observatory, I purchased a seven-drawer office chest on wheels. This serves as a mobile platform that not only stores all of my telescope and camera accessories but also acts as a desk for my laptop when I connect it to the telescope. I simply roll the desk near the telescope, pull up my folding chair, and start the imaging process. At the conclusion of an imaging session, the desk is rolled back to its parking location.

Swiveling Floor Loungers

Another useful item to have in the observatory is a five-position swiveling floor lounger. We have a pair of these on the floor and have discovered they are extremely comfortable. The five position adjustment allows four different angles of recline or you can set it completely straight. These are great to relax on while viewing a small portion of the sky through the aperture opening or to use while reading a book on a weekend afternoon during the warmer months.

Control Room

The room below the observatory is called the control room or warm room. It is octagonal in shape and has a 2-foot diameter concrete telescope pier going from floor to ceiling in the center of the room. We decided to surround the concrete cylinder with sheet rock. This serves two purposes. First, the room looks much nicer with the concrete hidden and second, no one can accidentally bump into the pier to transfer vibrations to the telescope. This was the finishing touch to truly isolate the pier from the structure.

Dan, the architect, jokingly suggested that the concrete pier be wrapped with rope from floor to ceiling to make the world's largest cat scratching post. It would have been a novelty, and our cats would have loved it. However, if they decided to use the post while I was imaging, there would have been noticeable vibrations, so I laughingly rejected this suggestion.

Three of the walls in the control room are floor to ceiling oak book shelves. This allows ample room for storage of astronomical reference manuals, observer guides, almanacs and other space related books. The fourth wall contains a built-in desk with additional book shelves above it.

Someday I may decide to use the control room for remote viewing via the computer. Right now though, I much prefer being in the dome and observing directly through the telescope no matter what the temperature is. However, the control room does serve as a very nice home office.

Generator

I could have ordered the manual override controls from Ash Dome. However, since I didn't, the opening of the upper and lower shutters on the dome and the rotation of the dome is dependent on electricity. What would happen if the dome were open and there was a power failure? Or, more importantly, what if there were a major power blackout and the skies were black to the horizon because no one had lights? In either scenario, it would not be possible to close or open the dome, respectively because the power was out. We already had a generator, so the dome controls and telescope power were wired so they could be independently powered via that generator. I would simply have to start it up, flip a switch, and the dome would be fully operational.

Visitor's Log

We have a visitor's log book and request that every visitor to the observatory sign it. When visitors come down stairs after viewing, I ask them to sign, date, and if they wish provide comments on their experience. The most common comments are Wow!, Fantastic!, Awesome!, Cool!, Beautiful!, Amazing!, Incredible!, and my favorite "The only difference between men and boys is the price of their toys!"

First light for our observatory was October 28, 2005. My entry to the visitor's log was

"First Light"! Absolutely fantastic! Viewed Polaris, Mars (almost at opposition), Ring Nebula in Lyra, double star cluster in Perseus. Simply wonderful!

And this was followed by my wife's entry:

"What a beautiful evening! Our dream has come true."

Many thanks to my wife, Barb, for helping my dream come true.

Naming the Observatory

The observatory needed a name. This was not something to be taken lightly. Barb and I thought about this very carefully. We finally decided upon calling our observatory "Stargate 4173 at Grimaldi Tower." We chose this name for the following reasons:

Stargate

This observatory is a gateway to the stars. And I have been a science fiction fan for most of my life. Stargate was the name of a popular 1994 science fiction movie and subsequent TV series. Since science fiction was the major force that got me interested in astronomy, Stargate seemed apropos.

4173

The latitude and longitude of the location of the observatory is 41 degrees 36 minutes 49 seconds North, 73 degrees 40 minutes 16 seconds West. The degree portion of the coordinates, 41N 73W, was selected to uniquely identify our observatory.

Grimaldi Tower

Most people assume our tower was named after Francesco M. Grimaldi, who was an Italian physicist and astronomer, and author of a map of the Moon which was used by Riccioli as a basis for his nomenclature. However, that was not the reason the name Grimaldi was selected. Three weeks prior to the beginning of construction, one of our precious cats passed away, due to complications from feline HCM (hypertrophic cardio myopathy). His name was Grimaldi, and in his memory we named the tower after him.

As a personal side note, our other two cats are named Copernicus and Tycho. All three of our cats were named after craters on the Moon. So, in a sense, our cat Grimaldi was named after Francesco M. Grimaldi.

The finished observatory can be seen in Fig. 11.11.

Figure 11.11. Grimaldi observatory ready to observe the sun.

Personal Observations: Dome versus Roll-Off Roof

Here are some personal observations regarding domed observatories versus roll-off roof observatories. I do not have a roll-off roof, so comments relating to this style are my opinion only.

Advantages

Dome: A dome says "an astronomer lives here." A dome offers better protection from the wind. This is important for both the observer and camera equipment attempting to capture an image without worry of wind-induced movement. Since we live on a rather windy hill top, this influenced our decision to select the dome. There is also little to no dewing problems, as the dome helps protect everything contained inside. Also, the lower aperture door serves as a light shield and additional wind block.

Roll-Off Roof: You have complete access to the entire sky above. You can operate several instruments at the same time in the roll-off roof environment. Construction of a roll-off roof can be less expensive as compared to the domed observatory.

Disadvantages

Dome: You do not have complete access to the sky. You are viewing only a fairly small portion of the sky through a slit in the dome. This is not great if you want to view a meteor shower or follow the space station or shuttle. To see another portion of the sky, you must rotate the open aperture to the field of view of interest. Also, you are primarily limited to a single instrument located at the pier location.

Roll-Off Roof: You are more exposed to the wind and stray light. You need twice the amount of space because you need to roll the roof to another position for storage. There is a greater chance that rain will blow in along the sides as well as at the ends of the roof. The roof requires a detailed design analysis to prevent it from blowing off in both the open and closed positions.

Would I Have Done Anything Different?

This has been a common question from visitors to our observatory. Would I have done anything different if I could do it over again? The answer is simple—no, except to have built it sooner so I could have more time to enjoy it. There was a lot of thought and research that went into the planning and design of the Stargate 4173 at Grimaldi Tower Observatory. I spent about two years thinking about the design. If you want a first-class domed observatory, take the time to thoroughly think through all of the options available to you. By doing so, the end result will provide you with years of satisfaction.

Additional information and images of Stargate 4173 at Grimaldi Tower can be found at the Web site: http://www.stargate4173.com/

Resources

The following were very helpful to me during the time I was thinking about the design of my observatory.

[1] Patrick Moore (Ed.) (1996). *Small Astronomical Observatories*, Springer-Verlag London Limited.

[2] Patrick Moore (Ed.) (2002). *More Small Astronomical Observatories*, Springer-Verlag London Limited.

[3] Amateur Astronomical Observatories at http://obs.nineplanets.org/obs/obslist.html