

Starscan

Johnson Space Center
Astronomical Society

Volume 25, Number 8 August 2009

*FORTY YEARS
AND
COUNTING!*



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(PHASES OF THE MOON AND SUNRISE/SUNSET FOR HOUSTON-18)

Un mensaje del Presidente (A message from the President)

Greetings:

A few things are on our plate this month, namely the star party at the LPI on Aug 15th. If you didn't hear, a number of us helped out the folks at UHCL for the 40th anniversary of the first moon landing. We took the liberty to advertise this star party, especially since the one for UHCL was called on account of weather. We estimated that we gave out somewhere between 120-150 fliers to anyone that expressed an interest! Many thanks to Jim Wessel who has spearheaded our renewal with the Night Sky Network. By the way, Jim will be our August speaker. He'll be taking about "The Globular Cluster Series: RA 15 through 19hrs" as well as a report from Paul Maley. The Fort trip and ADAY are not far away in October—start planning now.



David Haviland

LETTER FROM THE EDITOR By Connie Haviland

Hi Everyone!!

This month's edition includes an article about building your own observatory, yes, in your own backyard (with HOA approval). It is going to be a multi-part article in months to come. So you have something to look forward to. With that said, I hope you enjoy this month.

Enjoy.....Connie

LETTER TO THE EDITOR

Perseid Meteor Shower

Evening of Tuesday, August 11 - morning of Wednesday, August 12

9 p.m. – 5 a.m.

\$5 per person



The George Observatory will be open to the public to view the Perseid meteor shower. Telescopes will be open to the public from 9 p.m. to midnight. Meteor viewing will continue until 5 a.m. on Wednesday, August 12, weather permitting.

Barbara Wilson, Director
George Observatory
Houston Museum of Natural Science
gobserve@consolidated.net
bwilson@hmns.org
281-242-3055



Star Parties for 2009

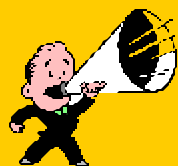
Bob Taylor

JUNE—AUGUST	OPEN
SEPTEMBER 12	MOODY GARDENS
OCTOBER 15-18	FORT McKAVETT
NOVEMBER 6	HAAK WINERY
DECEMBER	OPEN



What's Happening at the George!!!

Cynthia Gustava



Need volunteers



Friday Night Groups (all times are 19:30 to 22:30)... Volunteers for domes and deck scopes are needed. Bring those laser pointers and instruct the visitors on the constellations and bright objects! Contact Cynthia Gustava at cynm31@att.net to volunteer or for more information.

Aug 07 – Girl Scout Sky Search Overnight (Full)

Aug 14 – HMNS Member's Night – Third of the summer!

Aug 28 – Events and Adventurers (40 adults) – Building manager: Cynthia Gustava

Saturday Night Public Viewing (dusk to 23:00)... Volunteers for domes and deck scopes are needed. Contact the building manager teams below.

Aug 01 – Jessica Kingsley and Cynthia Gustava gnjkingsley2@att.net or cynm31@att.net

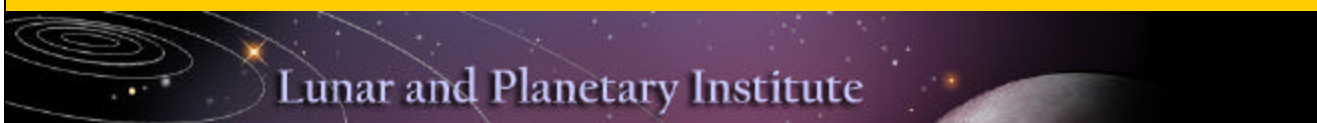
Aug 08 – Carl Sexton and Jack McKaye carlsexton@hotmail.com

Aug 15 – Tracy Knauss and Keith Rivich birdbarn2000@yahoo.com or icgalaxies@cs.com

Aug 22 – Mary Lockwood and Joe Mills mplockwood@att.net or k5jmm@yahoo.com

Aug 29 – Cynthia Gustava and Joe Mills cynm31@att.net or k5jmm@yahoo.com

August 15, 8 p.m. – Night Viewing of Saturn and Globular Clusters



September 19, 10 a.m. – 1 p.m. – Solar System Extremes

October 17, 7 p.m. – Night Viewing of the Moon

November 21, 10 a.m. – 1 p.m. – Near Earth Objects

December – No Family Space Day Scheduled. Enjoy your holidays!

Please note: Each child must be accompanied by a responsible parent or adult the entire time they are visiting the LPI.

For more information e-mail Spaceday@lpi.usra.edu or call 281-486-2106.

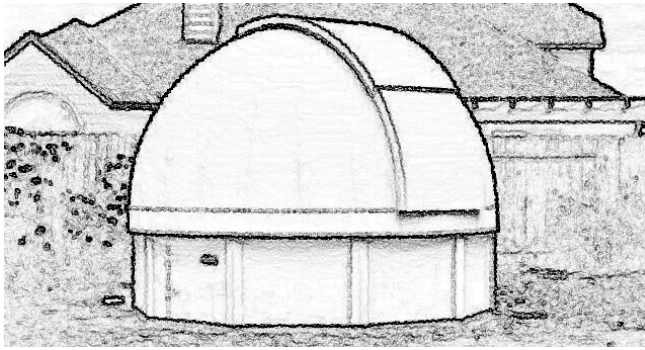
For more information, go to

http://www.lpi.usra.edu/education/space_days/

Or call Katy at (281) 486-2106

3600 Bay Area Boulevard, Houston, Texas





Building Your Own Observatory

Introduction

Many amateur astronomers contemplate constructing an observatory for the advantages of a permanent setup are as numerous as they are varied. However, a much smaller number of amateurs take the dream and make it a reality. Inexperience, expense, magnitude of effort, and community restrictions are just a few of the reasons many amateurs do not build an observatory of their own. The following discussion chronicles the building of my backyard observatory. Topics covered include: my motivation, planning/design, construction and lessons learned. I certainly make no claim that my effort is the correct way to build an observatory. However, I hope my experiences might assist others in the planning and construction of an observatory of their own.

Why Build an Observatory?

Ever since I re-initiated my astronomy hobby in 2001, I've been frustrated with several aspects of observing. Undoubtedly, setup time and the elements top my list. My most significant obstacle to observing on any given night is the time required to haul all of my equipment out into the backyard, polar align the mount, and tear everything down again. Additionally, dew formation on the telescope optics and cold temperatures has prematurely ended many viewing sessions over the years. Building a permanent home for my gear would alleviate both problems.

Early Planning (2001-2007)

I began sketching plans for a roll off roof style observatory in 2002. At that time, I envisioned a 10x15 foot structure that included a warm room. The plans were formalized but I never initiated the permitting or building process. The reasons for not starting were many. However, trepidation of a construction project this large was certainly the primary cause for my inaction.

In mid 2007 I purchased a small semi-apochromatic refractor and began experimenting in astrophotography. In order to minimize setup time, I began leaving my mount, sans the OTAs, in the backyard for several days at a time. While I protected the mount by covering it with a tarp, I needed a better, more permanent solution. The observatory was the obvious answer so I decided to tackle the project.

Planning (2008)

In the summer of 2008 I dusted off the roll off observatory drawings and started researching commercial and non-commercial personal observatories. Using the Internet, I initiated countless searches on Google's search engine. My most visited sites were:

The Cloudynights Observatory Forum (www.cloudynights.com), Observatory Central (www.observatorycentral.com), and Bill Arnett's "Amateur Astronomical Observatories" page (<http://obs.nineplanets.org/obs/obslist.html>). My research also included reading books on general and observatory construction including the Patrick Moore Practical Astronomy series, [More Small Astronomical Observatories](#).

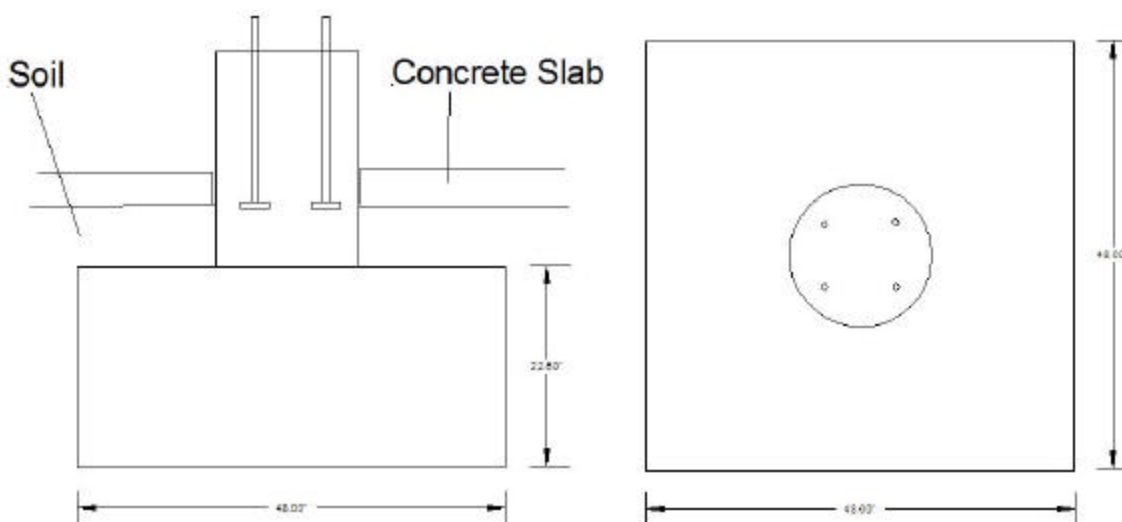
During this period I estimated construction costs and decided that I could build a traditional domed observatory at a lower expense than my original roll off roof plan. Additionally, a dome would provide better dew protection than a roll off roof.

In hindsight, I'm not sure I actually reduced construction costs by building a dome, but the dome met my goals of a permanent setup and protection from the elements in a much smaller building footprint. The roll off roof design called for a 10x25 footprint (when including the support rails for the opened roof). The dome design occupied about one half the space.

Most amateur domes I found in my research had measured diameters of 7 to 10 feet. My plans called for a small desk, a bookshelf, and storage. I also intend on having guests in the observatory for backyard star parties. I roped off a 10-foot diameter area around my backyard observing location so that I could experience the boundaries of the planned building. The space felt too small to comfortably accommodate more than three (3) people. I then expanded the area to a 12-foot diameter. At 12 feet the "building" seemed to have adequate space. Therefore, I decided my dome would be 12 feet in diameter.

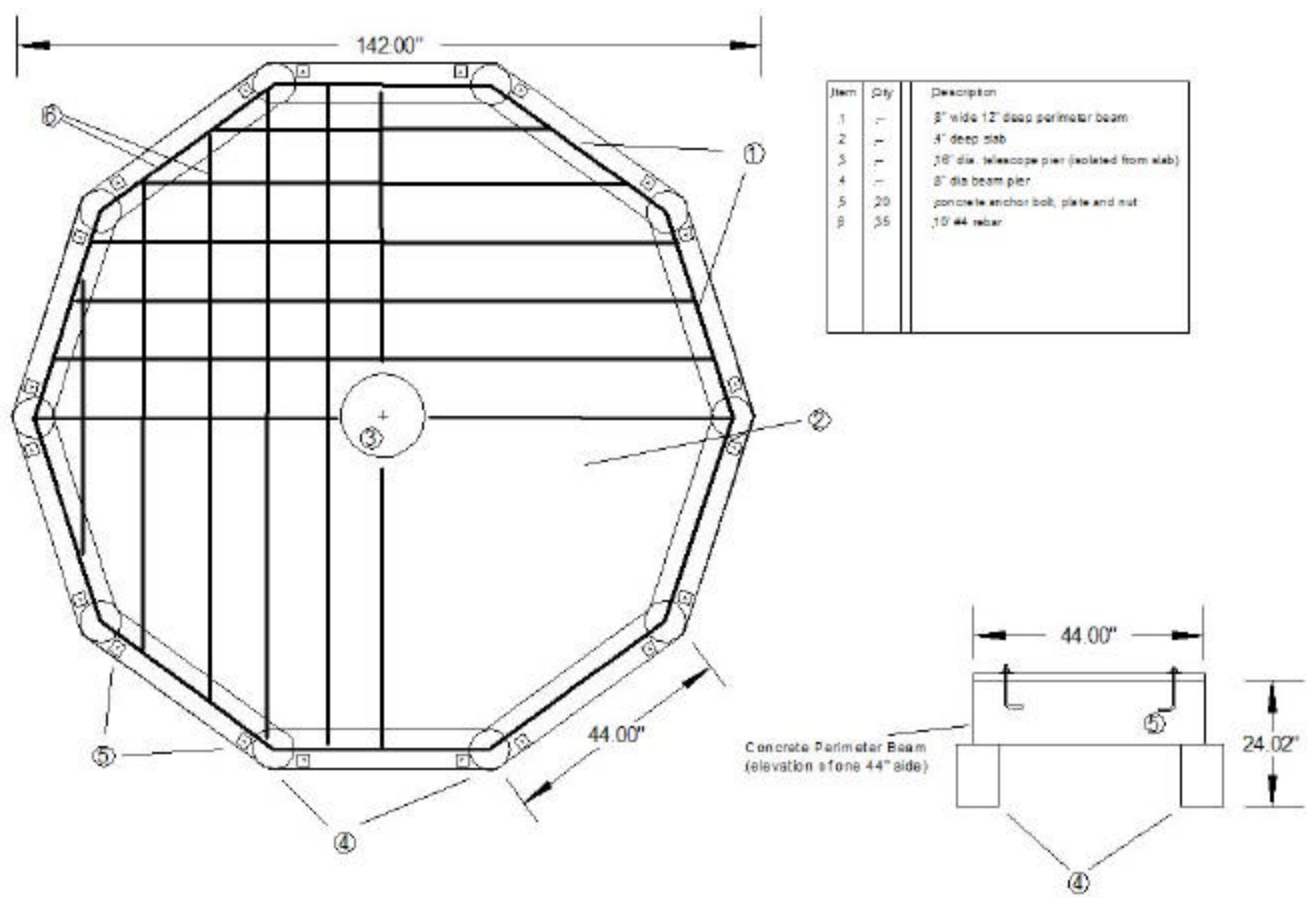
During my research, I discovered differing opinions concerning the size and materials one should use when constructing a pier for a telescope mount. Most agree the pier should act as a substantial counter weight to the mass of the mount and optics. A properly constructed pier will resist movement that is seen at the eyepiece or recorded by a camera. My research revealed the recommended mass ratio between the pier and the telescope equipment spanned a wide range. Some high-end/semi-professional observatory piers are built with a mass ratio of 1000 to 1. The lowest recommended mass ratio I found was 10 to 1. Almost all piers consist of a large concrete footing buried deep in the ground. Rising out of the footing is a column made of either concrete or steel pipe.

I chose to build a pier with a lower ratio for practical reasons. First, I wanted to limit costs. Second, stability has never been a concern of mine with my tripod and the pier will be significantly more stable than my tripod. Third, I planned on digging out the pier hole and disposing of the fill dirt by hand. The soil at the observatory location is rock hard below the initial 2-3 inches. I knew I faced a long, difficult dig.

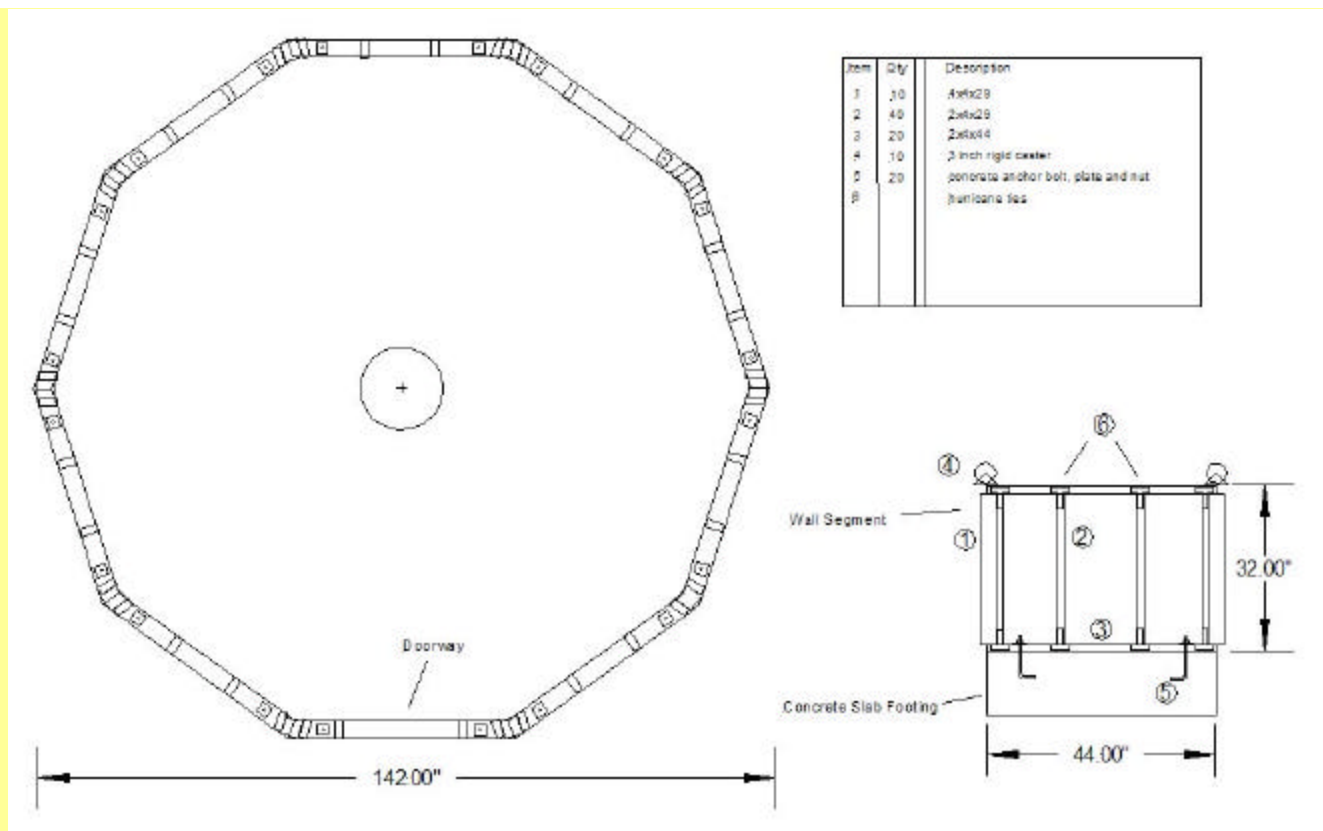


The pier design (previous page) has a mass of approximately 2500 lbs. My current mount and telescopes weigh about 60 lbs. As designed, my pier mass ratio is approximately 40 to 1. Like all amateurs, I plan on upgrading my gear and expect that ratio to drop to less than 20 to 1. Some would say that the pier is undersized. However as stated above, I am confident the pier's stability will exceed that of a tripod and I'm happy with the tripod performance. The pier includes a short 16-inch diameter concrete column that extends approximately one foot above the slab. I intend on having a steel pier manufactured to an as yet undetermined height. The steel pier will be bolted to the top of the concrete column. I will experiment with different tripod height adjustments, and when I find a preferred mount height, I will have the steel pier manufactured accordingly.

Like all buildings, an observatory needs a foundation. The common, but not universal, opinion among others is that a wooden/deck foundation is superior to a concrete slab. Consensus opinion holds that the thermal properties of a wooden foundation are better than concrete. However, wooden foundations are prone to decay from rot and termites. Equally important, a wooden foundation would raise the height of the structure by a minimum of 12 inches. My neighborhood Home Owners Association (HOA) regulates the height of accessory buildings and sheds. Not wanting to lose a foot of useable height and preferring a lasting foundation, I chose to design my observatory with a concrete slab.

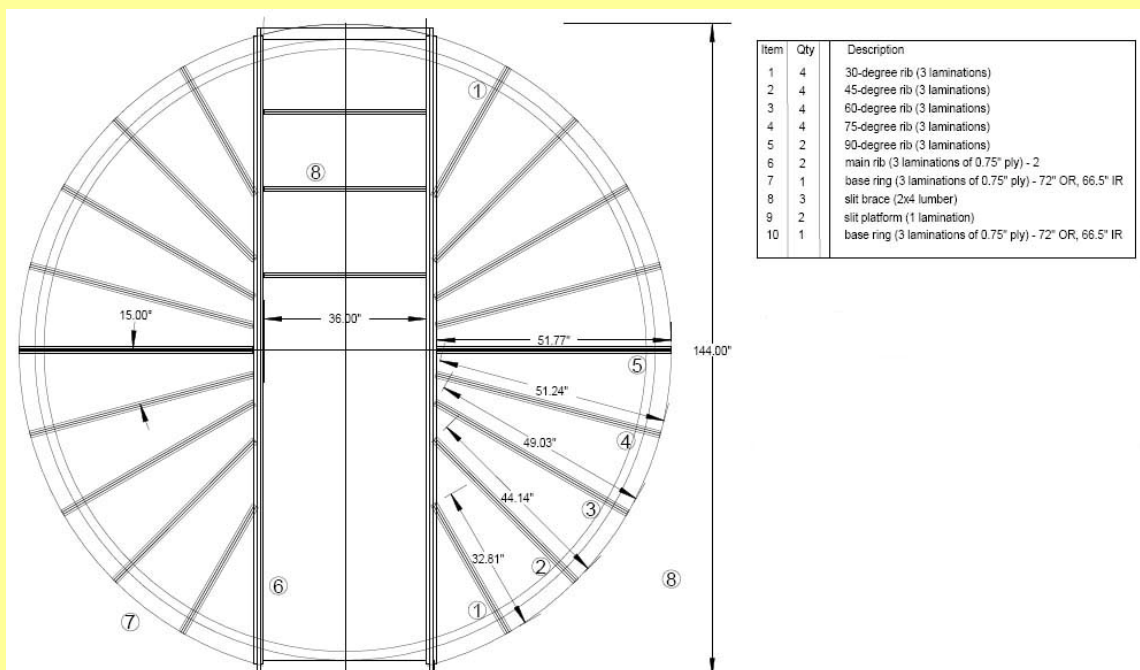


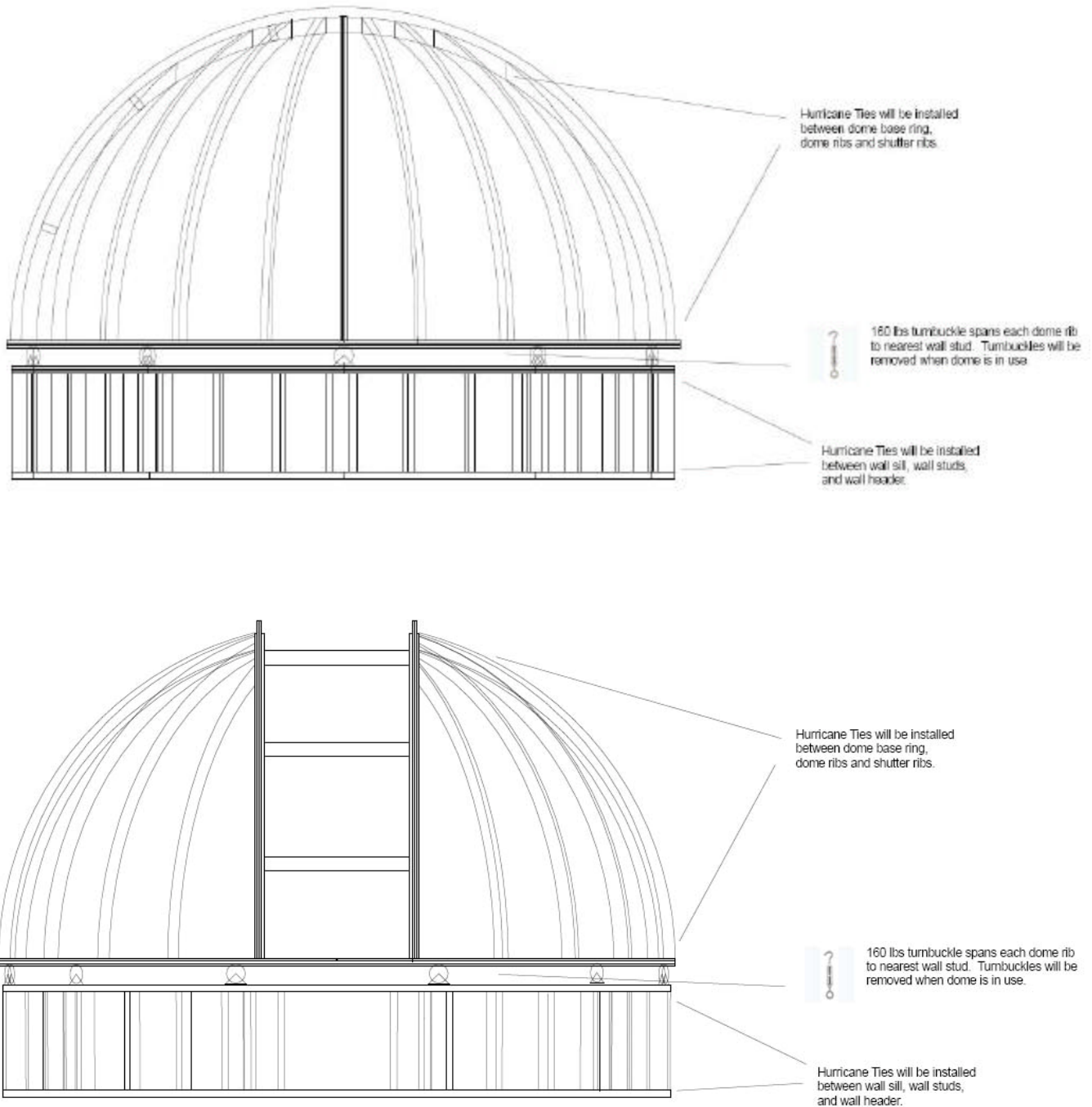
My early dome plans called for circular building with 2-3 feet high walls. I changed the design to a decagon. The decagon simplified the construction of the slab form and the structure's walls. Additionally, building materials that are appropriate for a decagon are readily available in the local home improvement store. The final design had the wall height at 32 inches. This height allowed for a very short door opening that requires one to crawl into the building.



The design of the dome was inspired by the drawings of Charles W. Baetsen (<http://www.geocities.com/va3ngc/Astronomy/Projects/ObsDome.html>). The dome ring and ribs are constructed by laminating arcs of $\frac{1}{2}$ and $\frac{3}{4}$ inch plywood. The plans call for the dome to be skinned with hardboard and a waterproof coating of elastomeric roof paint (both readily available from the local home improvement store).

The dome ring consists of 3 laminations of $\frac{3}{4}$ inch plywood and is 5.5 inches wide. The slit arches are made with 3 laminations of $\frac{3}{4}$ inch plywood as well. The dome slit opening is 36 inches wide and extends 16 inches beyond zenith. Each rib consists of 3 laminations of $\frac{1}{2}$ inch plywood and is 3.4 inches wide. The ribs are placed every 15 degrees and are spaced 16 inches apart at the dome ring.





The design has the dome rotating on ten (10) inverted casters mounted at the corners of the wall header. Each caster has a hard rubber wheel (for quiet operation) and a maximum load capacity of 330 lbs. Dome rotation is captured by 5 small bracket mounted casters that ride horizontally on the inside edge of the dome ring



While the above design was virtually complete in late 2008, the shutter design was not completed until a few days before it was built (June 2009). I discovered many shutter styles while researching observatories. Some styles include:

- Split sliding (horizontal),
- Monolithic sliding (horizontal),
- Monolithic rollover,
- Split rollover (both lower and upper shutters rollover),
- Split hinged/rollover (lower shutter swings down, upper shutter rolls over),
- Monolithic hinged (entire shutter swings up or down),
- Split hinged (lower shutter swings down, upper shutter swings up), and
- Folding hinged.

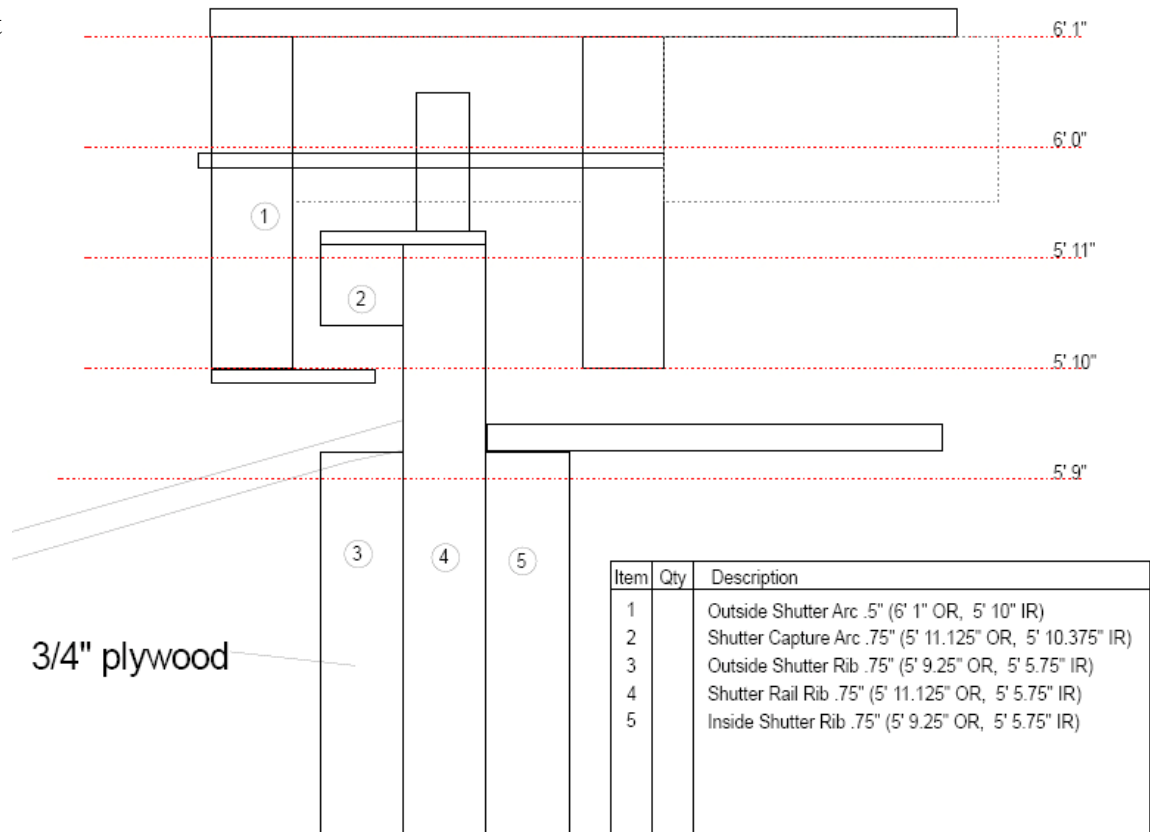
Each style has both strengths and weaknesses. Some are only practical on smaller domes. The horizontal sliding shutters require precise engineering and are prone to leaking at the seam. Monolithic rollover shutters must extend (when open) below the bottom edge of the dome in order to allow access to zenith. Split rollover shutters are an engineering challenge because they require the lower shutter to slide underneath the upper shutter

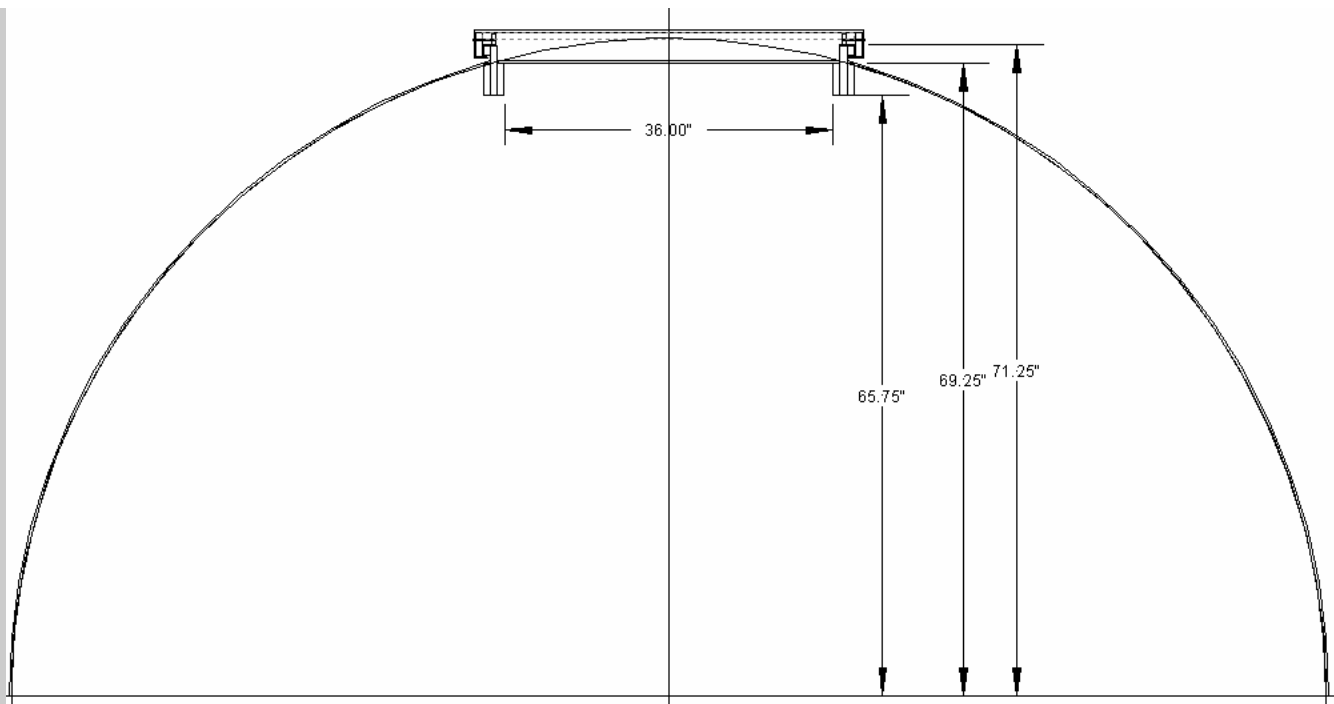
when open. Split hinged/rollover shutters are only practical on small to medium sized domes due to the stresses of the swing down lower shutter.

Monolithic hinged is only practical on very small domes.

Split hinged and folding hinged shutters are only appropriate on smaller domes. I eventually chose a split hinged/rollover style nearly identical to Charles W.

Baetsen's design.





Design and Construction Approval

A common concern when building an observatory are restrictions with Home Owner Associations (HOA) and city building departments. Numerous stories may be found on the Internet detailing difficulty in getting approval or even the forced dismantling of structures that did not follow prescribed approval processes or construction methods.

Observatories are unusual buildings and I've found that, in general, people react in two ways to the structure: enthusiastic or skeptical. I decided early in the design process that I would prepare as meticulously as possible, present the design to the HOA and city then hope for the best. The project would not begin until I had approval from both organizations. City and State windstorm building code complicated matters with the design, as continuous hurricane strapping is required from the foundation through the rafters. My design needed a removable strap/anchor that would tie the dome to the walls when the building was not in use. To satisfy the building code I proposed including a turnbuckle at each dome rib (rafter equivalent). The design therefore called for twenty-two (22) turnbuckles.

I submitted the HOA application in the fall of 2008. To my delight (and relief), I received approval a few weeks later. Prior to requesting a building permit, I met with the plans inspector of the city building department to determine if I needed to modify the design. The inspector made a few suggestions (mainly the removal of over-engineered aspects of the design). I modified the design accordingly, submitted the building permit application, and was approved.

Now the real work began.

Next month, I'll complete this article by covering the observatory construction and the lessons I learned throughout this project.

If anyone is interested in PDF copies of the design drawings, I'll bring a few CDs to the August JSCAS meeting.



The August Sky

The center of our galaxy, the Milky Way, marked by Sagittarius, the Archer, dominates the August sky. This area of the sky is filled stars, planetary nebulae, star clusters and bright and dark nebulae, an open treasure chest overflowing with sky wonders. Find Sagittarius by looking densest part of the Milky Way, just east of Scorpius, and look for the "Teapot." Lyra, the harp is high in the August sky. Find it by locating Vega, its brightest star and one of the brightest in the heavens, and look for the parallelogram of stars southeast of it. The three bright stars, Vega, Deneb and Altair make up the summer triangle.

Sagittarius Mythology—The centaurs, the half man half horse creature, were, in general, according to Greek mythology, rude, untrustworthy, violent and deceptive drunks. But one centaur named Chiron was different. Chiron was educated by the Sun-god Apollo and Diana, Goddess of the Moon and Wild Animals.

Chiron was as kind, gentle, and wise as the other centaurs were mean, fierce, and unthinking. Chiron's many skills and wisdom became so widely known that children of many a famous king were sent to him to be taught all manner of skills. Among his pupils were the mighty Hercules and Aesculapius, who became so skilled at medicine.

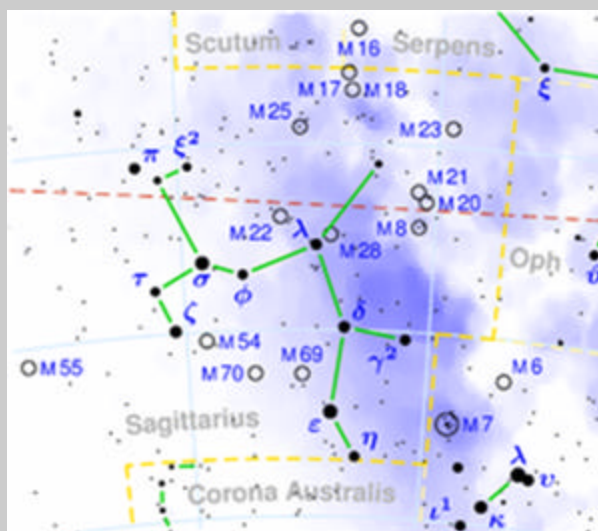
Chiron was accidentally killed by Hercules. Hercules had almost all the characteristics of Superman, but not vision. After fighting off and scattering a herd of attacking centaurs, Hercules saw a single centaur in the distance. He took his bow and fired a poisoned arrow in that direction. His aim was true, but he had not recognized the centaur as his friend, Chiron. Seeing these events and knowing of his son Hercules' sadness, Zeus gave the good centaur a resting place among the stars as the constellation Sagittarius, the Archer.

Deep Sky

M-22 - It is large, rather loosely gathered globular cluster, allowing us to resolve many individual stars across its face. Some consider this globular to be second only to Omega Centauri in beauty.

M-24 - The Small Sagittarius Star Cloud. This is a large, disconnected portion of the Milky Way. The best view comes in binoculars. NGC 6603 lies in its northeastern section.

M-20 - The Trifid Nebula. This often photographed nebula is rather faint in small telescopes, but in moderate size instruments shows a circular patch of light surrounding a double star. Tis patch of light is more or less equally divided by three intersecting dark lanes meeting near its center. A fainter region of reflection nebulosity can be seen to the north.



Solar System

Saturn and Mercury are low in the western sky. The rings of the planet Saturn will be tilted edge-on to the Earth on August 10th, making them impossible to see. Viewing Saturn with a telescope will reveal the planet without its famous rings. This rare phenomenon only occurs every 14 to 15 years.

Scared Jupiter dominates the August Sky. It will make its closest approach to earth on August 14th.

Mars and Venus rise just before dawn in the eastern sky.

August events

The Perseids is one of the best meteor showers to observe, producing up to 60 meteors per hour at their peak. This year's peak occurs on August 13 & 14, but you may be able to see some meteors any time from July 23 - August 22. The waning gibbous moon will provide some interference in the early morning, so the best viewing will be in the evening before it rises. The radiant point for this shower will be in the constellation Perseus. Look to the northeast after midnight



Folks:

In times past, people that have wanted to take advantage of the club discount have had to write their check, put it in with the renewal slip, and then either mail it to me at my home or chase me down at a meeting. In most cases, within a week, I have sent out the renewal. Sometimes, and I don't really mind, the renewals have gone out at my expense for the postage. Without hesitation, question, or fail, it is not the most efficient means to maintain club subscriptions. So as secretary, I'd like to try something new...

You get all your stuff ready for the subscription, whether it be Astronomy or Sky & Telescope, you keep it - you hang on to it. Email (most reliable) or tell me when you see me that you want to take advantage of the club discount for either or both of these publications and that you need a supporting letter. What I'll do is get the letter together and email the "letter from the treasurer/secretary" back to you as a PDF. You print it off, and enclose it with your renewal. For this to work your computer must have Adobe Reader (which is free) and a means to print it. I would like this procedure to become the "Standard Operating Procedure" for Astronomy/S&T discounts through JSCAS. For those still not in the computer age, we can process things as we have in the past.



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David Haviland

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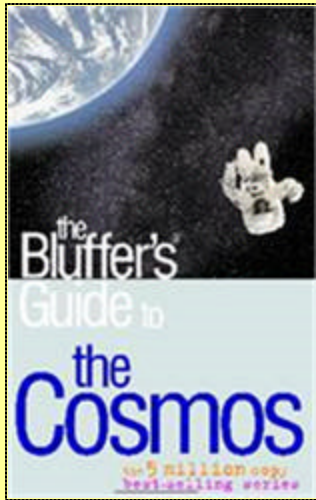
Members' Gallery—AUGUST 2009



STS-127, provided by Ann Micklos

Have You Bluffed About the Cosmos Today?

Massachusetts author pens guide to the universe for the uninitiated
Somerville, MA (6/21/09)



Need a quick cosmic refresher to help you celebrate International Year of Astronomy events? Get the latest title in the five-million copies sold, bestselling Bluffer's Guides series, *The Bluffer's Guide to the Cosmos®*, by Daniel Hudon. Written with comically cosmic humor, this ninety-six page guide will arm you with enough astro-ammunition to rocket you into bluffing stardom. From the big bang to dark energy, from life on Mars to why Pluto got kicked out of the planetary club, it's all here—and written in a light, witty style that will keep you zooming through the pages. How far away is space? How long would it take you to travel across the Milky Way galaxy if you traveled at the speed of light without stopping for fuel, coffee or bathroom breaks? Which kinds of stars would singe your hair if you stood too close? What color is the universe, really? With this book, you'll have all you need to know to appear more in touch than you really are. Hudon, a natural sciences lecturer at Boston University, recognizes the need to write about the grand facts and ideas of the universe in a way that doesn't intimidate readers. Instead, he lets them in on the game by alerting them to jargon and inside jokes. "The Bluffer's Guides take a light-hearted look at the subject, yet there is a good

deal of useful information," writes *The Sunday Independent*.

The Bluffer's Guide to the Cosmos, ISBN: 978-1-903096-42-0, published by Oval Books (London, UK) is available through special order at local bookstores and through Amazon.

Provided by Daniel Hudon

Light pollution:

Any adverse effect of artificial light including sky glow, glare, light trespass, light clutter, decreased visibility at night, and energy waste.

.Do you have a question about light pollution, protecting the night sky, or IDA's resources? **Get Help from IDA** <http://www.darksky.org/mc/page.do?sitePageId=56399>

Photograph © [Phil Hart](#)

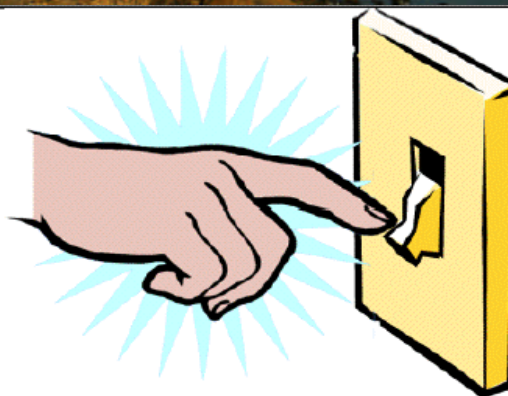


Help turn off the lights...

Join the
International Dark-Sky Association (IDA)

<http://www.darksky.org>

"To preserve and protect the nighttime environment and our heritage of dark skies through quality outdoor lighting."



Brazosport Astronomy Club

Meets the Third Tuesday of the month, 7:45p.m.

At the Planetarium

400 College Drive

Clute, Texas (For more information, contact Judi James at the Planetarium 979-265-3376)

Fort Bend Astronomy Club <http://www.fbac.org>

Meets the third Friday of the month, 7:00 p.m.

First Colony Conference Center

3232 Austin Pkwy

Sugarland, Texas

Houston Astronomical Society <http://spacibm.rice.edu/~has>

Meets the first Friday of the month, 8:00 p.m.

University of Houston, University Park

Science and Research Building, Room 117

North Houston Astronomy Club <http://www.astronomyclub.org>

Meets the fourth Friday of the month, 7:30 p.m.

In the Teaching Theatre at Kingwood College

20000 Kingwood Drive

Kingwood, Texas

Galveston Stargazers

Meets the first Wednesday of the month At Home Cut Donuts, 6807 Stewart Rd, Galveston, TX

From 7PM to 9PM.

Contact: Jim Gilliam at Jim.Gilliam@dars.state.tx.us or

At (409)795-3620, M - F, 8AM to 5PM

Houston

Area

Astronomy

Clubs

Starscan Submission Procedures

Original articles of some relation to astronomy will be accepted up to 6 p. m. (18:00 hrs) on the 25th of each month. THE most convenient way to submit articles or a Calendar of Events is by email and is preferred, but hard copies (CD, disk) are also accepted. All articles must include author's name and phone number. Also include any picture credits. Word, WordPerfect, and text files will be accepted. I have set up a special email account so that I can keep all of the Starscan articles, pictures, information, etc, separate from all of the other email I get. This makes it much easier to edit and set up the Starscan

Please send all submissions to:
conniesstarscanaccount@gmail.com

The author of individual articles bears all responsibility for publishing any e-mail addresses in the article on the World Wide Web

Johnson Space Center Astronomical Society

2008-Club Officers

President – David Haviland
Vice President – Chris Randall
Secretary – David Haviland
Starscan Editor – Connie Haviland
Star Party Chairperson –
Librarian – Bob and Karen Taylor
Historian – Chris Randall
Scientific Expeditions – Paul Maley
Web Master—Chris Randall

SIGS

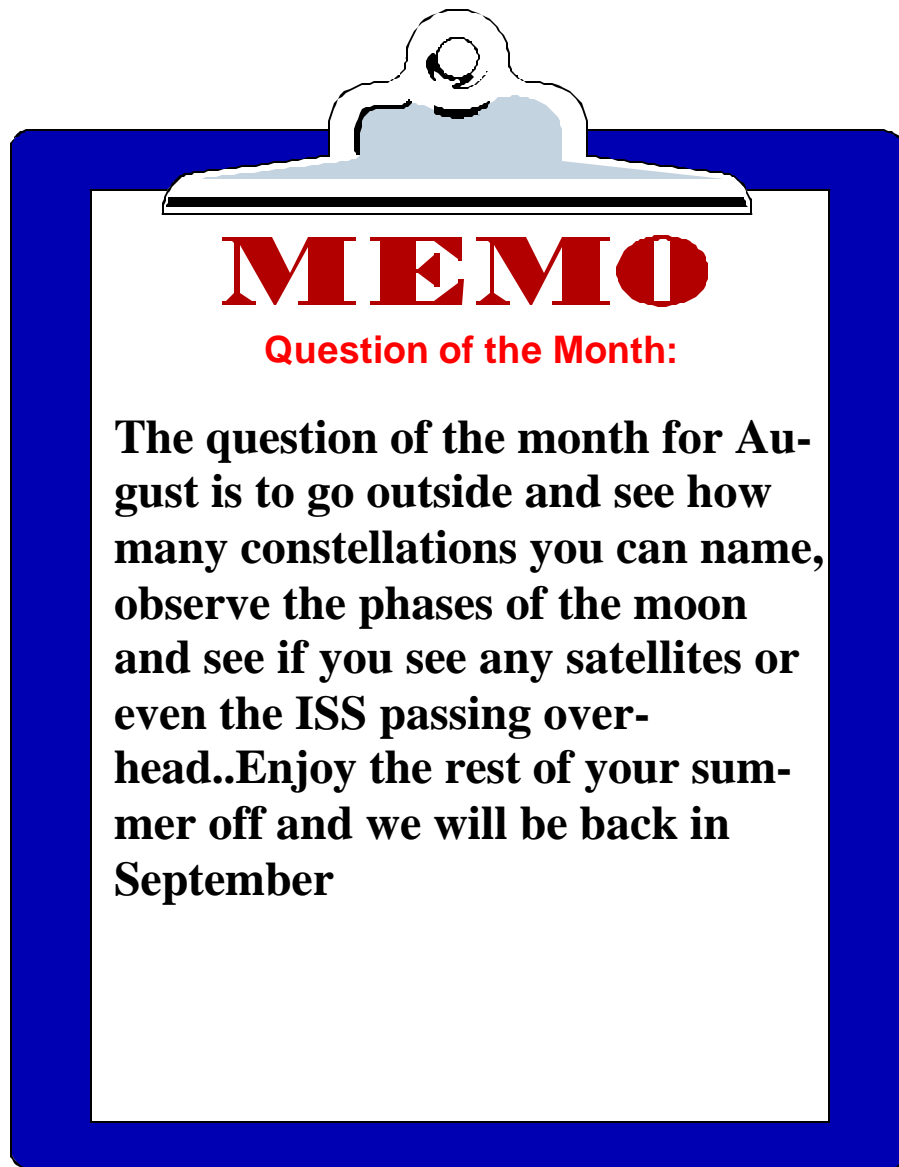
Observing Awards – Triple Nickel
Astronomy 101 – Triple Nickel
CCD Imaging – Al Kelly
Binocular Observing – “OPEN”
Telescope Making – Bob Taylor
Deep Sky Observing – Hernan Contreras


































**Do you think we will be able to see the flag on the moon
at the George Observatory tonight?**

Astronomy and Kids

This is the section strictly for kids (or kids at heart). We will be including information, stories, ideas, puzzles or anything that has to do with astronomy. The only difference here is, it will be directed for children. We don't discourage parents or any other adult to get involved. In fact, we encourage it strongly. So we hope you enjoy this section and if it touches a child's interest in astronomy, our goal has been achieved. Enjoy!!



PHASES OF THE MOON FOR AUGUST

August 2009						
««	Sun	Mon	Tue	Wed	Thu	Fri
»»	Sat					
						1 
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9 	10 	11 	12 	13 	14 	15 
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23 	24 	25 	26 	27 	28 	29 
30 	31 					

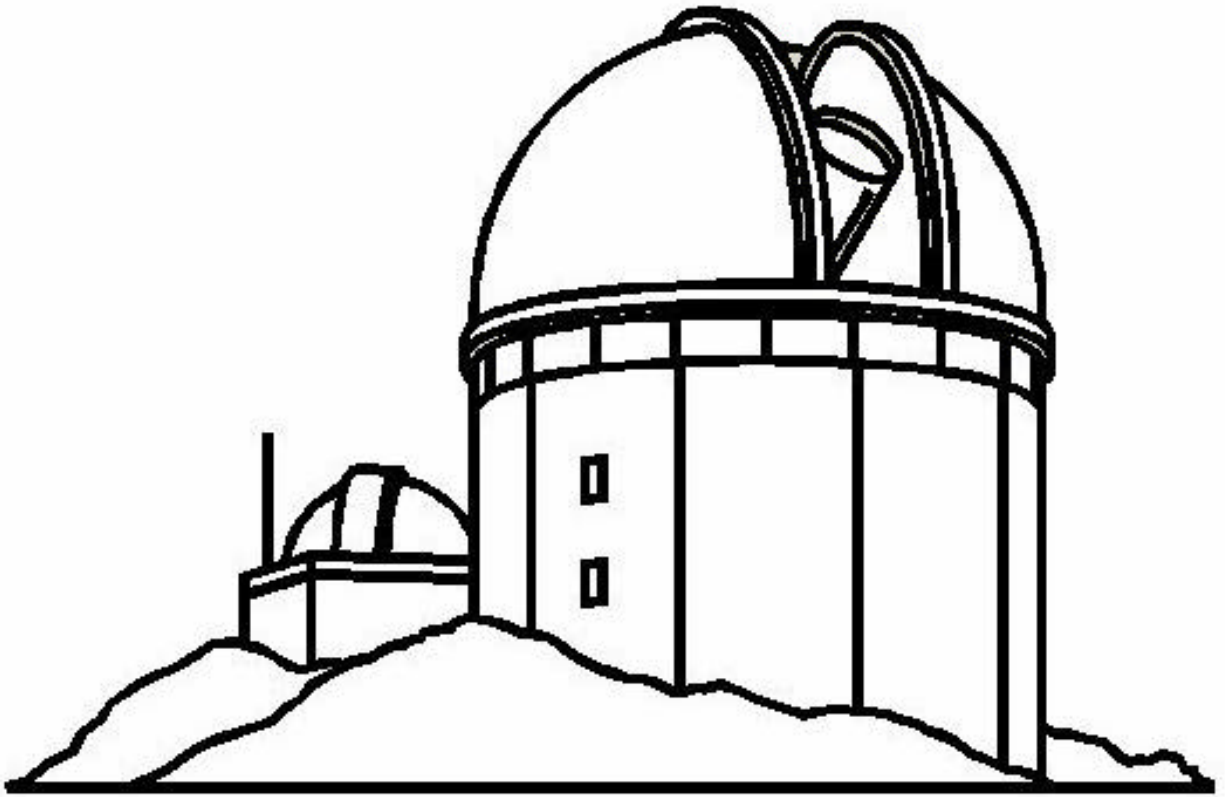
Moon calculations are based on your time zone. Check your computer time to ensure accuracy.
 (c) 2009 MoonConnection.com. All Rights Reserved. Please report unauthorized use.

SUNRISE AND SUNSET FOR HOUSTON

82009 Lat: 29.8012 Lon: -95.3883 Timezone: GMT-5						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1 Rise 6:41 Set 20:14
2 Rise 6:41 Set 20:13	3 Rise 6:42 Set 20:13	4 Rise 6:42 Set 20:12	5 Rise 6:43 Set 20:11	6 Rise 6:44 Set 20:10	7 Rise 6:44 Set 20:09	8 Rise 6:45 Set 20:08
9 Rise 6:45 Set 20:08	10 Rise 6:46 Set 20:07	11 Rise 6:47 Set 20:06	12 Rise 6:47 Set 20:05	13 Rise 6:48 Set 20:04	14 Rise 6:48 Set 20:03	15 Rise 6:49 Set 20:02
16 Rise 6:50 Set 20:01	17 Rise 6:50 Set 20:00	18 Rise 6:51 Set 19:59	19 Rise 6:51 Set 19:58	20 Rise 6:52 Set 19:57	21 Rise 6:52 Set 19:56	22 Rise 6:53 Set 19:55
23 Rise 6:53 Set 19:54	24 Rise 6:54 Set 19:53	25 Rise 6:55 Set 19:51	26 Rise 6:55 Set 19:50	27 Rise 6:56 Set 19:49	28 Rise 6:56 Set 19:48	29 Rise 6:57 Set 19:47
30 Rise 6:57 Set 19:46	31 Rise 6:58 Set 19:45					

AN OBSERVATORY

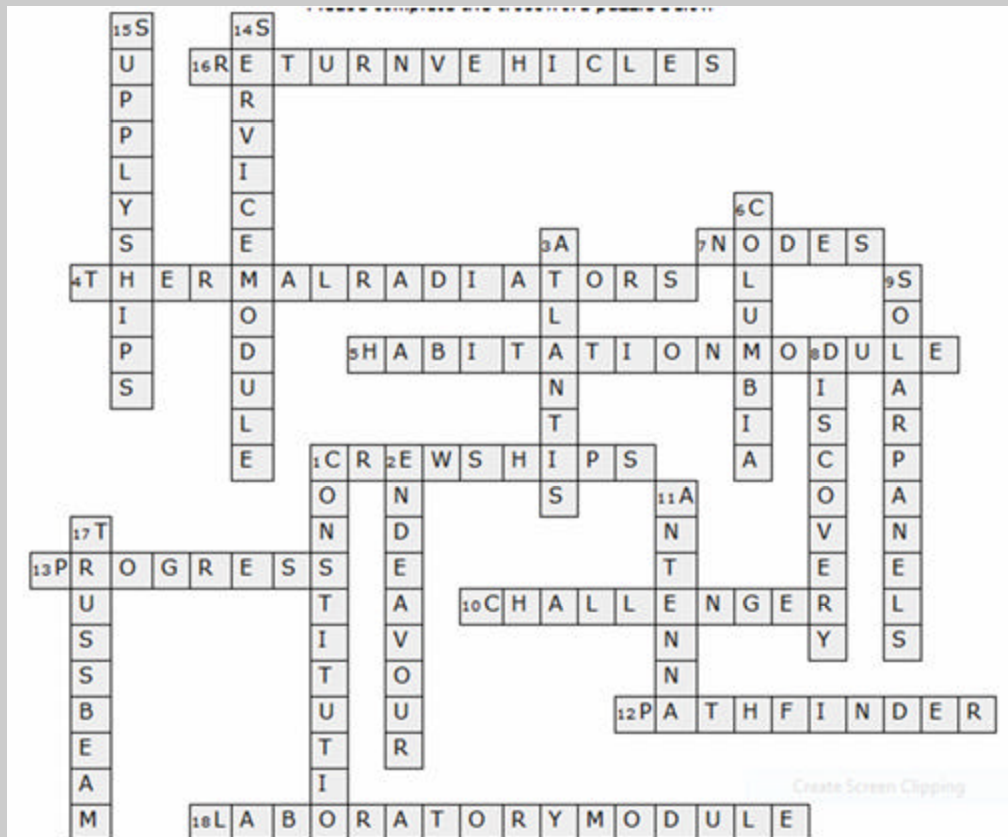
COLOR ME



Where could this observatory be?

SOLUTIONS TO JULY'S PUZZLES

Z O C L Y U P M T M E V A B Y G L W Q H D X R Z B F L K V R
J R A M U D Y W N B I U E L C F D R B K I D A H I F K P Q O
B T G S D S R Y V V B U F H N K D E A V A X K F G V B M V N A
Q C B N V J D Y G K D L N S P H L F E T E F U J R D P T S
S G B V X L **S U P P L Y S H I P S** T D L W Z V N Z L G Q E V
M L C V S Q F Y K W S F **C O L U M B I A** R R E U N B O Z **T** A W
O H Z U R Y J C C X K R F D P U A F C H A X C Z Z M R **H** W C
Q X X I O E Y R G V J R Z U I **E** T A V X R S G G V A J **E** V L
K **S L E N A P R A L O S** J P L H E C K A Z X M Z L W X R **M** I M
Y R O N N H A J P Y M Z D **U** L E I L L E Y P E V U I R **A** I J
M R L V F V W J J F E R **D** Y J B G **R E G N E L L A H C** A I J
D E C D M K I Q N G W **O** T Q H Q B C I Y O L I Z S T N L A S
D N X D R E X H Z Z **M** K S T S V M H G **S** S A U P I B J R K P
V K F T Z U F K W N P U H H W I S I **E** R V G X X S Q V A W E
V **S** X W O X F Y **O L A B O R A T O R Y M O D U L E** E N D S S
A Z **E** G B P C **I** P K X S H J R A V S N S X A R A X S H I W U
N H M **D** R C **T** H C H C W J V T **I** M S P I H S W E R C V A Y N
N U B W O A P P V O K W M W **C** A H I M D P Y B A R V I T O X Z
E V **S** I T N A L T A N M C E E O T U Y M N I O X V L C O R M T
T E B I G C S I D I N S **M** B Q G F N I J K L G Z **E** U G S E N
N N B D R B J Q A E Q **O** S L O R G P Q Z J O X U N A G S
A A X I E J Y D P O **D** S I T P L Y H Y S V Z Z D T X U P G Q
H Y E S D B F Y A **U** U Q R E T U R N V E H I C L E S U X A B
T I D C N B L K **L** R U O V A E D N E T V X B H X R J P B P V
K N V O I E F **E** T Q C M Q W I N K F W M V L W T P B F B P
Z S Q V F F I A R R A P U S E T V S F G R C U Y R Q F C N U
E C S E H B L Y R D Z M C H F U H X H F J O Z P I W V Z O B
E X Q R T U L G P V C E P T G A N D C I T H T J S N L O O T
J E F Y A W Q L N Q B P U R J O R W P L C S D H E C T I W T
G G H X P N X J E L N Z V X W J T X J W J R J T B R W C B O

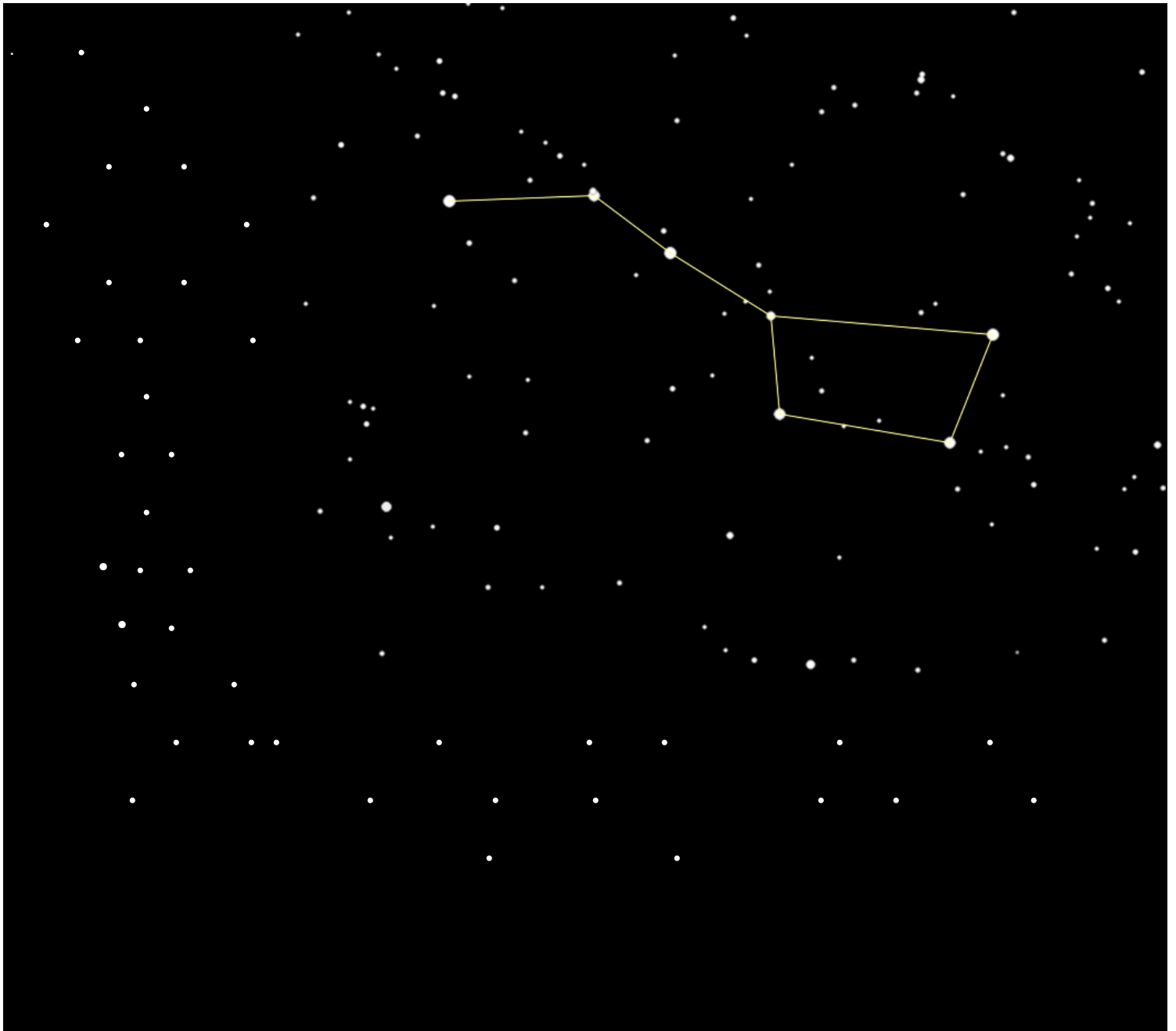


SOLUTIONS cont'd

QUESTION OF THE MONTH:

Question; Name all of the shuttles that were built. (Hint: there have been 7 shuttles built)

Columbia +
Challenger +
Discovery
Endeavour
Atlantis
Enterprise (former Constitution), built for tests, is in museum
Pathfinder, built for tests



*Snoopy says, never stop looking
up..reach for the stars and may you al-
ways have clear skies!!!!*

