Gemini

a publication of the Minnesota Astronomical Society

Minnesota Astronomical Society

December 2015

Volume 40 Number 6

In the pages of the Gemini

Stories Wanted: *Gemini* is written entirely by our members, for our members! *Gemini* needs your stories… how you first became interested in astronomy, how your interest has evolved over the years, equipment you use, star parties and events you've attended here and elsewhere, how you've encouraged others — especially young people — to get involved in this fascinating hobby. Submit your stories to: brownreveugene66@gmail.com

E-mail Update: If your e-mail address has recently changed, chances are your address used for MAS email distribution lists is not current. Please inform Bob Brose of your new e-mail address at bob@qbjnet.com

Equatorial Platform for a Flatscope

By Dick Jacobson

In this article I'll describe an equatorial platform that I built recently. The platform performs very well and is, I think, easier to build than many other designs that I've seen.

Background

Equatorial platforms are one way to make an altazimuth or Dobsonian mount follow the stars automatically. The simple altazimuth mount popularized by John Dobson was a great advance for portable Newtonian telescopes, but its major drawback is that you have to frequently nudge the scope around both axes to follow an object. This isn't too bad at low magnifications, but when using a high power I really hate the frequent nudge-nudge that I have to perform when using a Dob.

In the 1970s Adrian Poncet invented a wonderful device that could make any Dob follow the stars. In January 1977, *Sky & Telescope* published his design for a platform that would cancel the Earth's rotation for any device placed on top of it. The platform has a lower part that rests on the ground, an upper part that can hold a telescope, and some cleverly designed bearings in between; together with a motor and drive mechanism, they make the upper part rotate around the Earth's axis.

To understand how the platform works, picture a fat, solid cone, shaped something like a funnel with the lower part removed. Imagine that the cone is resting on its side, with the axis of the cone pointed towards Polaris. (In this article I'll indulge in hemisphere-ism, writing from the perspective of folks in the Northern Hemisphere. Of course, platforms can be used just as well down under, rotating in the opposite direction.) If the cone is mounted on rollers that are turning very slowly, it can rotate in unison with the sky so that anything attached to the cone will see the sky as a fixed object. Make a horizontal slice through the solid cone to remove the highest part, and you're left with a table that tracks the stars.

This may seem like a perfect solution for the nudge-nudge problem, but there are a few complications. Most platforms can run for only about an hour

Side view of the equatorial platform. South pivot is at the left. At the right are the north arc, drive mechanism, and bar for counterweights.

before they need to be reset to the starting position. A platform that works well for one telescope may not work as well for another because of balance problems. Ideally, the center of mass of the telescope plus the upper platform should coincide with the imaginary polar axis of the platform, or tracking might not be accurate. On most equatorial mounts, the angle of the polar axis can be adjusted so it tracks accurately almost anywhere on Earth. On the other hand, most equatorial platforms have little or no angle adjustment and have to be built for a specific latitude. The platform usually adds four to six inches to the height of the telescope, which may be good or bad depending on the situation.

Close-up of the drive motor and gears. The drive roller is hidden behind the large gear. The motor is mounted on the spring assembly at left.

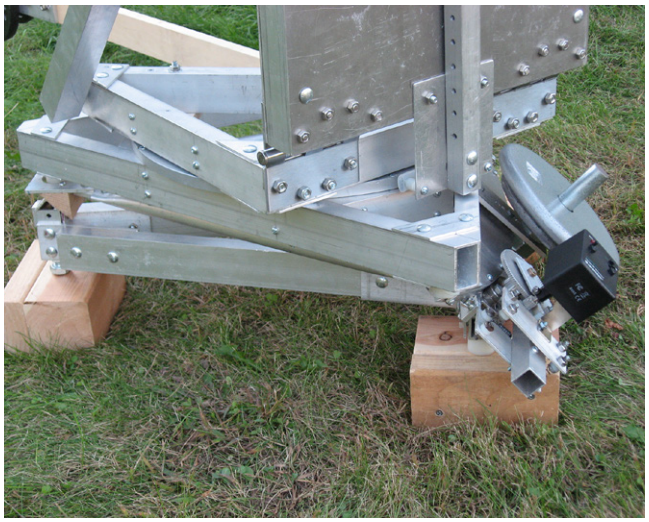
If you're interested in an in-depth discussion of platforms, I recommend going to the superb web site created by Reiner Vogel (reinervogel.net).

My Platform Project

For many years I've been building equatorial mounts for my telescopes, so I had no need for an equatorial platform. Then about two years ago I built an unusual 10" Newtonian that folds flat. (I described this in an article in *Gemini*, June 2014.) Because of the flatscope's unusual lopsided structure, I couldn't think of a way to build a compact and lightweight equatorial mount for it, so I built an altazimuth mount. Although the mount worked well, I missed the convenience of automatic star tracking. A platform seemed like a worthwhile improvement. Since I enjoy designing and building astronomical equipment, it was an easy decision to build my own platform rather than look for a commercially made one. I wanted to try out some ideas that I believed would make the platform perform well with the flatscope.

Before starting the project, I did some thinking about performance goals. I was not planning to do any imaging but simply wanted the platform to eliminate most of the nudging when following objects at high magnification. Specifically, I hoped that it would keep the object in the central one-third of an 82-degree field at 400x for several minutes. This works out to a tolerance of about two arc minutes either way from the desired path. The platform's bearings should be smooth to about 1/1000 of their radius, or about 1/50 inch. And of course the drive should be reliable, the platform should not contribute any significant vibration, and it should be compact and lightweight.

There are three principal sources of inaccuracy in a platform. If the motor and drive components don't run at an accurate speed, the object will drift out of view in right ascension (east-west). If the bearings are bumpy or irregular, there will be drift in declination (north-south). Finally, if the mount is not accurately polar aligned, the object can drift in any direction.



The triangular base of the Newtonian resting atop the equatorial platform.

GEMINI INFO

Editors
Brian Litecky and Eugene Brown

Webmaster
MAS Web Committee,
chair Merle Hiltner,
webteam@lists.mnastro.org

Forums Administrator
Russ Durkee

E-mail List Administrator
Bob Brose

Monthly Meeting Presenter Coordinator
Lauren Nelson

Gemini is published 6 times annually by the Minnesota Astronomical Society.

Electronic submissions for Gemini may be sent to:
blitecky@gmail.com
brownreveugene66@gmail.com

Hardcopy items should be sent to:
Minnesota Astronomical Society
Attn: Gemini
P.O. Box 14931
Minneapolis, MN 55414

Send MAS membership dues, changes of address and S&T subscriptions to the MAS Membership Coordinator. *Astronomy* magazine subscriptions are available by contacting the MAS Treasurer.

MAS Board Members

10" flatscope Newtonian mounted on the equatorial platform, viewed from the north.

Construction Details

Since I knew the exact dimensions of the existing mount, I could tailor the platform to fit the base of the mount perfectly. This enabled me to make the upper part of the platform very light, with strength needed only at the three points that supported the mount's footpads. In many equatorial platforms, the upper part rests on four curved plates that move on rollers. These plates represent small parts of the imaginary cone that I described above. In Poncet's article, the design was simplified by replacing the two plates at the south with a simple pivot. This simplified design works best at higher latitudes like our local 45 degrees, so I decided to adopt it.

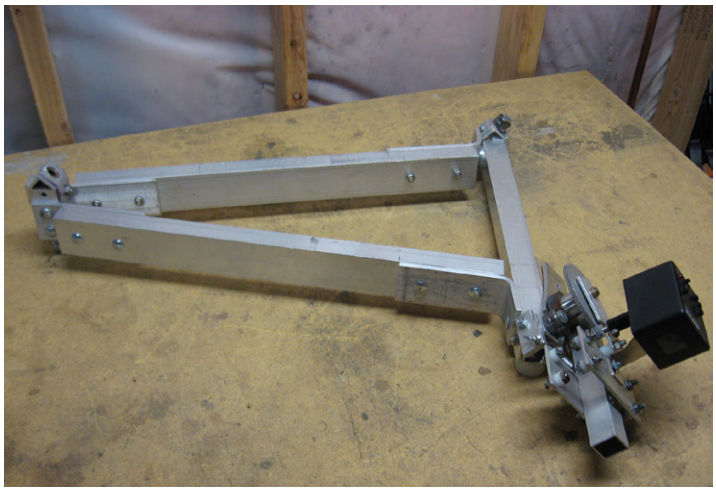
Another simplification that I made was to replace the two curved north plates with a single continuous arc. The arc is a piece of ½" square aluminum bar. I own a metal bending device that makes it easy to bend bars or tubes into very accurate circles. Using this tool, I felt that I could easily make a strong and accurate north bearing supported by two rollers. I attached a 1/8" thick aluminum plate to the arc to stiffen it. The upper part of the platform consists simply of the south pivot, the north arc, and a lightweight aluminum structure holding the two together. One of the telescope's footpads rests directly above the south pivot, and the other two rest on the ends of the north arc.

The tubing roller that I used to make the arc is sold by Harbor Freight Tools. You probably don't own such a tool. I believe that you could achieve equally good results by cutting an arc from plywood and bending a 1/8" thick metal bar around it. With my design, or any platform design, it's important to calculate the radius of curvature of the bearing plates, or else the platform won't track accurately. In my case I had to know the size of the circle around the imaginary cone where the support bearings at the north end are positioned.

Math alert! Stephen Hawking says that every equation that you put in a book cuts its sales in half, so I suppose I am risking losing my readers by putting a little math in the next two paragraphs. Rest assured, you can skip them without losing anything important unless you are designing your own platform.

I knew the size of the equilateral triangle formed by the telescope's footpads. Calculating the radius of the north bearing arc required three steps, each one easy if you remember your high school math. First, calculate the altitude of the equilateral triangle. This gives the length of the top of the platform in the north-south direction. It is simply the length of the triangle's side times one-half the square root of three, or .866. Second, calculate the distance from the polar axis to the center of the north end of the platform. This number depends on the latitude for which you are designing the platform. The ratio equals the sine of the latitude. At 45 degrees this equals one-half the square root of 2, or .707. Multiplying this number by the number from the first step gives the distance from the polar axis to the center of the north end of the platform, perpendicular to the polar axis.

Imagine that you are looking south down the polar axis. You know the distance from the axis to the north end of the platform. You also know the distance from the center to the corner at the north end, which is simply one-half of the side of the equilateral triangle. The number you need is the radius of the circle, which equals the hypotenuse of the right triangle whose sides equal these two numbers. Pythagoras taught us how to calculate this, using the square root of the sum of the squares, remember? So putting it all together, in the case of a design for 45 degrees latitude, the formula becomes ((.866 * .707) ^ 2 + .5 ^ 2) ^ .5. This is the number which, multiplied by the length of the sides of the equilateral triangle, gives the radius of the north bearing. For 45 degrees, the number comes out to .790. For other latitudes you'll have to figure it out yourself, substituting the sine of your latitude for .707 in the formula.



The base of the platform with the upper part removed.

There is a problem with Poncet's simplified design—it tends to be unbalanced. The imaginary polar axis passing through the south pivot is typically quite far below the telescope's center of mass. This causes the upper assembly to be top-heavy and tending to tip to the east or west. To address this problem, I attached a one-inch diameter steel bar (a cut-off hex bolt) at the bottom center of the arc. I can slip barbell plates onto this bar to precisely balance the platform. Since my flatscope is very top-heavy, I need about 25 pounds of weight. The lower part of the platform is a strong frame that supports the south pivot and the two rollers at the north end. The rollers are simply pairs of roller skate ball bearings and are angled 45 degrees to match the angle of the north arc of the upper assembly.

The mount is driven by a urethane roller that presses against the north arc. The roller is driven, through a pair of gears, by a simple DC motor assembly (Celestron Astro-Master single axis drive). Many amateur platform makers use this motor. The motor shaft turns at about 1/8 RPM. A pair of spur gears, along with the

roller, reduce this to the required 1/1436 RPM needed to track the stars. A spring holds the drive assembly against the north arc. It takes only a few seconds to reset the platform by pushing the urethane roller away from the arc and swinging the platform back to its start position.

The upper (moving) part of the platform.

In order for the roller friction drive to work reliably, the platform should be well balanced and its support bearings should have little friction. I've had a lot of trouble with friction drives in previous telescope projects. With this project I had some trouble at first because the spring holding the roller against the arc wasn't strong enough and the platform wasn't carefully balanced. Some roller drives eliminate the gearing and simply use a motor shaft pressing against the north bearing. With a 1/8 RPM motor, I would have needed to use a shaft about ¼" diameter. I believe that my geared roller drive may be more accurate and reliable, though I have no way of proving it.

Many other platforms are driven by a nut on a turning threaded rod. These platforms should not be affected as much by balance problems. I chose to use a roller drive because I felt it would be more compact and would be easier to reset. Having built equatorial mounts driven by both threaded rods and rollers, I've come to prefer the roller method. The only significant problem that I ran into was vibration from the motor. Even this small motor produced enough vibration to cause star images to turn into little bars. I fixed the problem by mounting the motor on springs.

Performance

I'm very pleased with the platform's performance. The accuracy of the bearings seems to be excellent. I cannot see any wobble in declination as the platform moves; at most there might be one or two arc seconds of variation. There is a very slight variation in the drive speed. Following an object at the edge of the field, I can see a slight amount of wandering, about 10 arc seconds or ¼ the diameter of Jupiter. I'm not sure whether this is caused by variations in motor speed or by irregularities or slippage in the drive roller. At any rate, the variation is barely noticeable and the object stays near the center of the field for many minutes at a time.

Without the platform, the flatscope is fairly solid, with vibrations from a thump dying out in one to two seconds. The platform doesn't add any more vibration as far as I can tell. Though it weighs only 12 pounds, it easily carries the scope and counterweights totaling 120 pounds. At first I had some problems with a loose set screw on the motor shaft, and the spring holding the drive roller against the arc was too weak, but once these were fixed the drive has been highly reliable. It runs for 105 minutes and then stops when a screw head at the end of the arc bumps into the northwest support bearing. It takes just a few seconds to reset the drive by pushing the roller away from the arc and rotating the platform back to the starting position.

According to the advertising, the motor runs for 40 hours on a 9-volt battery. I probably don't get that much run time, since the platform barely keeps up with the stars when the battery's voltage drops to 7.8 volts. A different gear ratio might improve the run time. As the battery discharges, the motor slows down; it is occasionally necessary to tweak the speed control to maintain accuracy. This is no problem for visual observing, but it might make the platform unsuitable for imaging exposures lasting several minutes. I haven't tried any imaging. To do so successfully might require a voltage controller circuit or a motor with more precise control, such as a stepper or synchronous motor.

Imaging would also require more precise polar alignment. Usually I just use a compass to get the platform pointed within a degree or two of north and make sure the platform is roughly level. This is good enough for visual observing. The south bearing rests on a bolt which could be turned for precise leveling. There is no mechanism for precisely adjusting the platform in azimuth, but I usually set the footpads on wooden blocks, so it would be easy to adjust the south end to the east or west by tapping with a hammer. I think it would be easy to build a more precise azimuth adjustment device.

Since the platform is designed for a latitude of 45 degrees, tracking won't be accurate far north or south of here. When I used it in Cedar Key, Florida, latitude 29 degrees, I propped the south end up on a block of wood to partially compensate for the latitude difference. Although the tracking was not very accurate, it was still much better than no tracking at all. The platform adds five inches to the height of the telescope, bringing the eyepiece to a more comfortable position for me.

Conclusion

If you're tired of dancing the nudge-nudge with your Dob, I'd strongly recommend buying or building an equatorial platform. Commercially available platforms that I could find in a brief search range in price from $1,300 to $4,200. The materials for my platform cost about $200, so there is an opportunity to save a significant amount of money. Since the platform contains parts that move, I'd call it a fairly advanced project. I enjoy working with aluminum and used it for most of the construction, but I believe that a wooden platform would work equally well except for being a bit heavier.

I'm currently building a 29" Newtonian. A portable equatorial mount seems impractical for such a large telescope, so I've built an altazimuth mount and am planning to put it on an equatorial platform based on the design described here. I'm eager to see how well the finished combination performs.

Besides equatorial platforms and equatorial mounts, a popular alternative for providing tracking is an electronic two-axis drive such as Servo Cat. Several MAS-owned scopes are equipped with Servo Cat, including the 25" and 30" Obsessions at Long Lake Conservation Center, the 24" Starmaster at Cherry Grove, and the 20" Obsession at Eagle Lake. I have little experience with electronic drives. I think the choice between an electronic drive, platform, or equatorial mount is largely dictated

by your style of observing. Electronic drives add little to the size and weight of the telescope and can provide GoTo capability. On the other hand, they may be expensive and difficult to install, require an alignment procedure during setup, and are vulnerable to failures of the electronics or power supply. My feeling is that electronic drives are best suited to very large telescopes, especially if they are used by a lot of people where the GoTo capability is valuable. For Newtonians 10 inches and smaller, an equatorial mount with a rotating tube is the best and is not unreasonably large or expensive.

Platforms are a good option for Dobs larger than 10 inches, especially if you already own the scope and want to add tracking with a minimum of complication.

Fall Astronomy Day • 2015

By Dave Falkner, ELO program director

Astronomy Day is an event sponsored by the Astronomical League in the spring and fall each year. Local astronomy clubs open their doors and invite speakers to introduce the public to the wonderful hobby of astronomy.

Fall Astronomy Day for MAS was held on September 19 at Eagle Lake Observatory. The event began around noon with the opening of Onan and Sylvia Casby observatories and turning our solar telescopes to view the Sun. Venus, although a morning object seen before sunrise, could easily be seen during the day as a bright crescent shape in the telescopes. There were high cirrus clouds, which made seeing Jupiter and Saturn really tough.

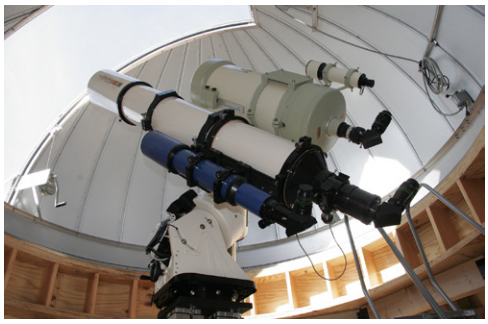
The presentations began around 1:00 p.m. with Dave Falkner talking about the historical flyby of Pluto by the New Horizons spacecraft. Dave talked about the history of Pluto observations and our continued fascination with this dwarf planet. He talked about the instruments on the spacecraft and its record-setting trip using Jupiter for a gravity assist. Using imagery from New Horizons, Dave described some of the features on Pluto and some of the amazing things found, like a rather large atmosphere and ice mountains 11,000 feet high. One of the latest images showed mountainous features and layering in the atmosphere.

September 19 was also designated International Observe the Moon day. Fellow MAS member and high school teacher Jake Hairrell honored the day by doing a presentation on the Moon. Jake not only talked about some of the scientific facts about our nearest celestial neighbor, but he also talked about the cultural and physiological effects the Moon has had on the Earth and its inhabitants.

Observing in the late afternoon.

Because one of the speakers canceled at the last-minute, Dave moved his presentation scheduled for after dinner to before. Dave's presentation, "Stars in the Universe," discussed relative sizes of stars with respect to the Sun and planets of our solar system. The largest of these, VY Canis Majoris, if placed where the Sun is, would have a radius stretching somewhere between the orbits of Jupiter and Saturn. He went on to talk about the vast distances between the stars, the huge number of stars in the Milky Way, the size of our galaxy, and the vastness of the universe along with the billions of galaxies it contains.

After Dave's presentation we took a supper break. Most of the MAS volunteers for A-Day made to the trip into Norwood-Young America to Thirsty's Tavern. We enjoyed the food at Thirsty's and the good conversation and friendly bantering. We returned to ELO and Dave gave an encore presentation of his New Horizons talk. Nancy Rauschenberg followed with a presentation on "What's Up: Fall 2015." Nancy began by talking about what is required to be a stargazer. She then talked about what is in the



The 8" refractor in the Sylvia Casby Observatory is focused on Venus.

Dave giving his talk on New Horizons.

Victor Yang, winner of the grand prize

MAS members enjoying dinner at Thirsty's Bar.

MAS members talking about the day. From left to right: Mark Job, Dave Olmstead, Parke Kunkle and Jackie LaVaque.

night sky by breaking it down to Earth-orbiting objects, solar-system objects, and deep-sky objects. Her presentation included information about the Moon, planets, meteor showers, artificial satellites, constellations, asterisms, and deep-sky objects like M13 (Hercules Cluster), M11 (Wild Duck Cluster), Double stars Albireo and Mizar/Alcor, and asterisms like the Big Dipper, the Keystone and the Great Square of Pegasus.

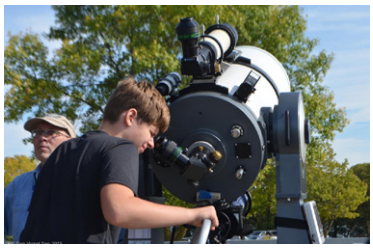
Following Nancy's presentation we held a drawing for a number of nice door prizes, including an image taken by noted astro-imager Adam Block, some books and MAS merchandise. The grand prize was a pair of Celestron 15x80 binoculars won by Victor Yang.

The skies had been deteriorating slowly throughout the day and evening, but we were able to look at the brighter objects and some items that appeared through sucker holes. By ten o'clock the clouds had settled in for good and we closed up the observatories.

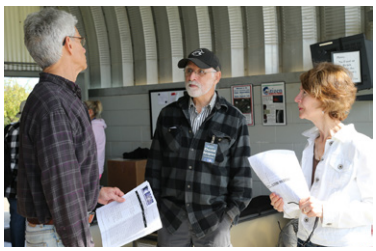
It wasn't the best Astronomy Day we've ever held, nor was it the worst. We ended up with a respectable attendance of about 320 people. Thanks to all the MAS volunteers who came out to help. It was good to see some members who hadn't been to the observatory in a while. I also want to thank the speakers, some of whom had given a presentation just a month earlier at Camping with the Stars.

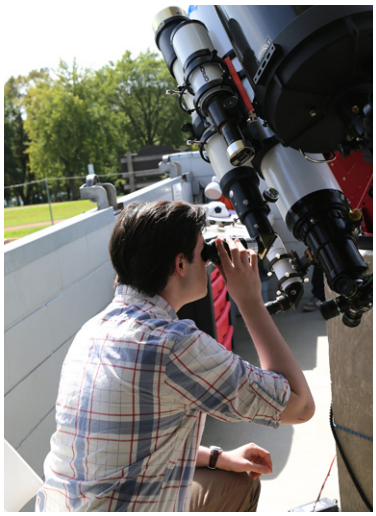
More Fall Astronomy Day 2015 photos on page 11.















Photographs by Dave Falkner, Ben Huset and Father Brown

Super Lunar Eclipse

By Dave Falkner

The September 27 lunar eclipse was highly publicized and anticipated to be a great event with a Super Moon passing through the Earth's shadow. We were fortunate to have good weather and the eclipse didn't disappoint.

When we opened the observatories at 7:00 p.m. we had people waiting. The weather was clear and the temperature was warm, making nearly ideal observing conditions. Clouds could be seen far on the western horizon; we hoped they would stay there. Cars kept streaming in. Families spread out blankets and set up lawn chairs. Private telescopes were set up in the grassy area around the plaza. Photographers set up tripods and attached their cameras. Before long photographers and observers were spilling out onto the grassy areas beyond the observatories. Soon the parking lot was full and cars were parking on the road.

At 8:07 p.m. the Moon started getting eaten away by the Earth's shadow. Cars continued showing up, parking in the grass alongside the road. Stars were appearing in the sky and the telescopes took in views of the Moon, Saturn and the brighter stars. Lines for looking through the three Onan telescopes, the 20" Dob and the Sylvia telescopes were long.

At about 8:50 p.m. we were able to direct everyone's attention high in the sky to witness one of the brightest iridium flares I have ever seen, at magnitude -8.1. The bright flare wowed the crowd and was a nice extra to an already extraordinary night.

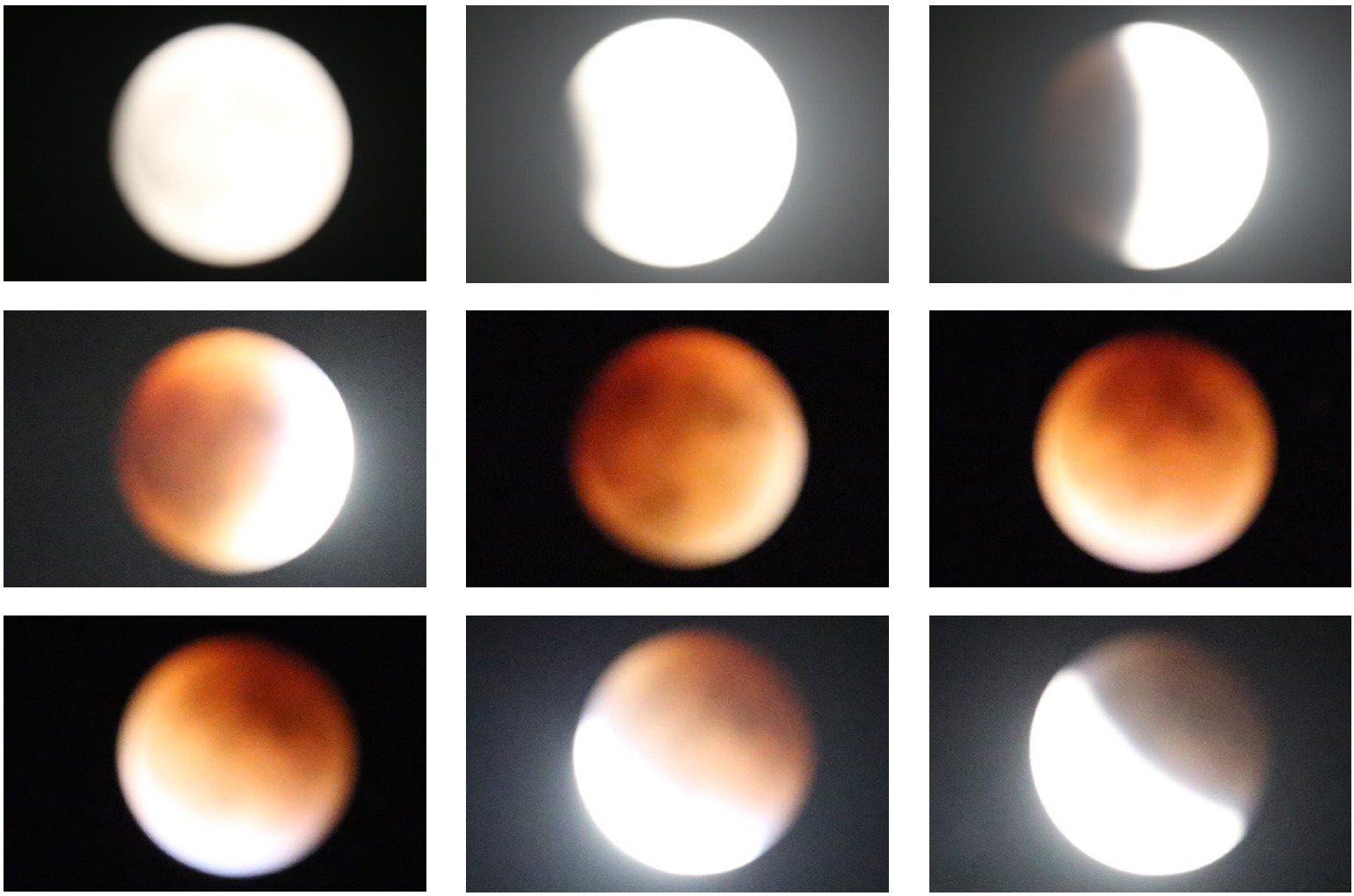
By the time we reached totality at 9:11 p.m., the entire area around the observatory was full of people. We estimated 550 people had come to Eagle Lake Observatory to witness this amazing event. I was able to speak to a number of them and was surprised that for most this was their first visit to our fine observatories. We hope it won't be their last.

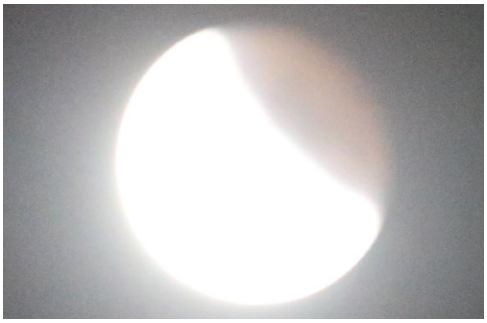
As totality set in, the cloud bank that had been in the west began to break off in pieces that drifted toward the east. Occasionally they would obscure the Moon, but for the most part we had some great views of the Blood Moon. I was amazed that some of our visitors left almost as soon as totality began, since it would continue for over an hour.

Totality also afforded us a nice dark sky no longer illuminated by the full Moon. We treated ourselves to the bright, deep-space objects of late summer. After over an hour of totality, beginning at 10:23 p.m., the shadow began receding, revealing the bright Moon. The clouds had been coming with increasing frequency and the Moon was now covered frequently. The crowd was drifting off and there was a steady flow of cars heading out of the park. By the time the eclipse ended at 11:23 p.m., only the die-hards remained. Since there were just a few sucker holes visible through the cloud cover, we closed up shop.

This event drew a large number of members and a huge public crowd. It was one of the largest crowds that MAS has ever had at an event. The night was warm and, of course, this was a perfect event for the public since you didn't need any equipment to enjoy it. It was a Super Moon, a super eclipse and a super event. Thanks to everyone who came to help out and make it successful.

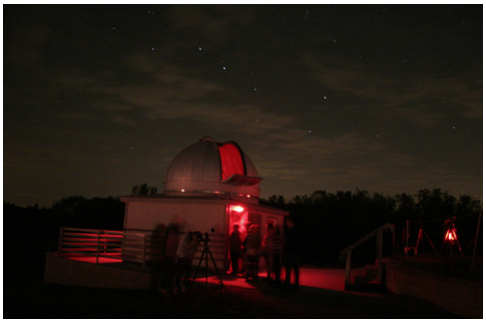
Photographs by Dave Falkner and Father Brown







Candidate for Board Member at Large

Dave Venne

The sky has always been a source of wonder and fascination for me. I got my first telescope when I was 10 and the views it gave me will never be equaled. There have been lapses in my attention to the sky between then and now; years of college working toward a doctorate and a new career commanded my time. I spent about 15 years working on research grants from the National Science Foundation, NASA, and the Air Force. That was followed by another 20 years teaching physics courses (mainly astronomy and meteorology) at Augsburg College. There was a small educational software business that I co-owned during that time as well. I'm now retired and the business has been closed.

In the last decade I've rediscovered the joy of visual observing by working on multiple Astronomical League observing programs. My current passion is astrophotography. It's a source of fun, frustration and continual learning. Retirement has given me the opportunity to travel to nearby dark-sky star parties where I image and enjoy mooching views off other people's scopes.

I've been a member of MAS since around 2000. In that time I've seen an organization gifted with talented members who are amazingly generous with their time. A spirit of positivity and can-do pervades the organization, and that's a rare and wondrous thing. I look forward to contributing to this endeavor by serving as an at-large board member.

Candidate for Board Member at Large

Scott Anderson

I currently live in Lakeland, which is in the far eastern suburbs of the Twin Cities near the Wisconsin boarder, about a ten-minute drive from the Belwin/Metcalf/Casby observing sites in Afton. I am a senior chemist at 3M Company in the Health Care Business Sector (Infection Prevention Division) and have been working there for over 34 years. I have been a MAS member for about eight years and have attended most meetings throughout that time. When time permits I also try to attend several star parties during the year. I enjoy the star parties that MAS regularly organizes at several observing sites, such as Cherry Grove for the mini and full Messier Marathons as well as LLCC up near McGregor. Although I have never attended a star party at Eagle Lake, I am excited for this opportunity to visit there and become more involved with the organization.

My interest in astronomy has been a life-long one, beginning in my pre-teen years in the late 60s and early 70s when I observed the Perseids meteor shower with my father. Back then, in an open field near Stillwater, this event ignited my interest in the stars and planets. Shortly thereafter I received my first telescope, a rather inexpensive 2" refracting scope from Sears with several eyepieces and solar attachments. After two decades of observing inactivity since that time, I finally got started again when I heard from a friend about the Minnesota Astronomical Society. I then purchased a used Celestron 5" GoTo Schmidt-Cassegrain, which I currently use for observing, and joined this fine organization.

Astronomy is one of the few sciences where ordinary citizens can actively take part. Equipment quality and sophistication has improved greatly over the years. Anyone at just about any age can get actively involved in astronomy. But what inspires me about astronomy is its ability to get anyone young or old to ask questions about what's out there and about nature surrounding us.

Thank you for this opportunity and the chance to become a MAS board member.

Candidate for Board Member at Large

Valts Treibergs

My interest in astronomy is primarily imaging and research. I am active on the imaging forum. Imaging brings together some of my most keen personal interests: photography, computers, robotics, astronomy and just plain tinkering. I find it fascinating what imagers can do these days. Even with modest equipment, through organizations such as MAS and through Internet groups, the technical quality and sheer beauty of images taken can rival if not exceed images taken only 10 years ago by professionals. I can only imagine what the next 10 years will bring! It is very satisfying being able to share the beauty of the sky with everyone in the world.

Even though I am a techno-geek, I always enjoy setting up a scope and binoculars in my driveway and letting the neighbors enjoy the show in the night sky. I have occasionally set up mini-outreach activities for local scout groups and the public at Tamarack Nature Center in White Bear Lake.

My day job is as an R&D engineering manager for a semiconductor equipment manufacturer. I occasionally get to travel the world, and I try to stop by and see nearby observatories—current and historic, as well as participate in other astronomy club events when I can. I have been to observatories as varied as Kitt Peak in Arizona and the 17th century Rundetarn in Copenhagen, Denmark. My most memorable experience was seeing Mars at opposition through the 24" Alvan Clark refractor at Lowell Observatory in Flagstaff—the same instrument Percival Lowell used to study Mars.

I have been a lurking member of MAS for close to 10 years. I have seen all of the great projects initiated by the MAS board come to life: Eagle Lake Observatory and Hotspot classroom, the Belwin partnership and J.J. Casby Observatory, the partnership with Long Lake Conservation Center and our great dark-sky site. Over the last few years I have stepped up and am a member of the LLCC committee. I had a great time helping plan this year's Northern Nights Star Fest. I feel that it is my turn to take a greater role and responsibility in MAS. I plan to contribute my efforts to the duties of the board as needed.

Candidate for Board Member at Large

Alan Noot

I've been an active member of MAS for the past three years and am seeking the position of board member at large. We all have the opportunity to exercise our passion for astronomy and the untold wonders of our universe right here in Minnesota because of MAS, and I want to better support this great organization. I'm a key holder at both the Eagle Lake and Joseph J. Casby facilities and have completed my training at Long Lake. I've enjoyed helping with public events at the Eagle Lake Observatory as well as star parties at Long Lake.

I was born in Minneapolis in 1951 and graduated from Patrick Henry High in 1969. After high school I went to Loyola Marymount University in Los Angeles and graduated with a degree in Administration of Justice. I joined the police force in Culver City, California, and planned to make criminal justice a career, but an injury during an arrest stopped me from continuing to chase the bad guys.

After being honorably retired from the police department, I returned to Minnesota, married, and started a company called Research Service International. For the past thirty-five years, my wife and I have worked closely with the probate courts to locate missing or unknown heirs to estates and trusts. This involved extensive knowledge of genealogy and detective work to first identify an unknown family member of the deceased and then to locate these entitled relatives living anywhere in the world. After finding unclaimed money for heirs for over 35 years, we officially retired last year. This will now offer me the opportunity to devote my time to furthering the mission of MAS.

Since joining MAS I've been rapidly trying to educate myself in quantum mechanics, particle physics and relativity. There's a lot to learn in trying to understand our universe!

Last November I went to Kitt Peak in Tucson to attend an all-night observation and photography session. That was my first taste of astrophotography and I got hooked. I also toured the Mirror Lab in Tucson and had the opportunity to watch finishing touches being made on a giant mirror before it shipped to Chile. In February of this year my wife and I traveled to Alaska to learn more about the northern lights with a Bob Berman led astronomy

tour. Just a few of weeks ago I attended the Astrophotography Advanced Imaging Conference in San Jose, CA, and had the opportunity to partner with fellow MAS member Mark Job. Mark and I felt right at home with the many newly minted astrophotographers at the conference, and we even got to sit with Adam Block, the renowned astrophotographer, at the final dinner.

If elected to the position of board member at large, I will carry out my duties with vigor and do my best to help MAS fulfill its mission for the benefit of both our membership and the general community. Thank you for your consideration.

Candidate for Vice President

Jim Harstad

I have been interested in astronomy since I was a kid. I got my first telescope when I was twelve years old and quickly learned how to use it, observing the planets and several deep sky objects from my family's suburban back yard. My interest waned for several years but was renewed when my wife and I moved under the dark skies of northern Minnesota. I joined the Arrowhead Astronomical Society and learned the joy of sharing my interests with others. I have been a member of the Minnesota Astronomical Society for four years since moving back to the Twin Cities. I enjoy the monthly meetings, especially the speakers and presentations. I don't get out to the observing sites very often (I don't like to drive late at night), but I enjoy sidewalk astronomy, outreach events in the city and suburbs, and observing from my back yard. I feel that MAS does important work by inspiring people, especially kids, to appreciate science and by encouraging them to consider learning more about it. I think MAS is also a wonderful place to continue to learn about astronomy and observing and to enjoy our shared interests. I will relish the opportunity to do my part to help MAS continue to grow and succeed in these important ways.

Candidate for Treasurer

Heather Birch

I have been a member of MAS for two years. I've been interested in astronomy my entire life, thanks to my Dad. I have an 8" Celestron that I am just learning to use, and I'm getting ready to start on an Astronomical League program. By day I am an accountant at a manufacturing company.

MAS Board Minutes for September/October

By Jerry Jones, secretary

September

Membership Services: We're attempting to determine how best to put many of the member opportunities in video format and put them on the website for easier access. One way we are considering is to video new member information as well as observatory operation/key holder training. If you are interested in helping with video recording, please contact Jerry Jones, MAS secretary. **Student Member of the MAS Board**: According to our charter, the involvement of a student member on the MAS board is not only suggested but considered a valuable addition. We are happy to announce that Daniel Trieff is our student board member. Exact member duties will be forthcoming. **Site Reports**: MAS purchased new laptops for ELO. They should be in operation within the month. The door lock at CGO has been replaced. Kudos to Vic and Steve for their work on rebuilding the east wall of the building and installing the air conditioner. **AL Coordinator Replacement**: Jerry Jones has agreed to take over the responsibilities of the Astronomical League Awards coordinator. Tremendous kudos to Greg Haubrich for his past 13 years of service to MAS as the past AL coordinator. Look for an upcoming article about Greg in *Gemini*. **Phone Message System Changover**: Jerry Jones is working on changing the antiquated MAS phone messaging system. The future is difficult to predict about this one. **Legal/Risk Discussions**: It has been brought to our attention that we need to set in place policies regarding the issues of risk and liability. Wayne B. has put together some documents regarding this; we will be spending some substantial amount of time looking into them over the next few meetings. We want to make certain that we protect our assets, both people and equipment, appropriately. **Upcoming Elections**: Steve Baranski is heading up the election process for the positions which will need to be filled during the December meeting. Positions open are vice-president, treasurer and member-at-large. **Key Holder Privilege Guidance**: Along with the risk-management documents, we are continuing to look into how our facilities managers and key holders can best be served to reduce the potential of risk and increase the usage of our facilities. This will be an ongoing topic for many meetings. **Web Broadcasting MAS Meetings**: This topic has been tabled for the moment, partly due to the technological difficulties and lack of capable, available people.

October

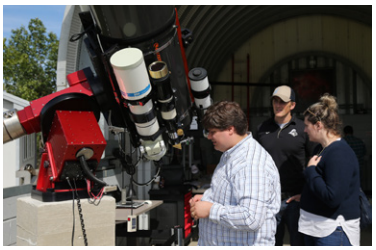
Laptops for ELO: The laptops have been purchased and Clayton delivered them to ELO on October 17. **Loaner Scopes**: The LX200 is having pointing/software issues. Steve B. is not certain what to do with it; it is not clear if it will be a good loaner scope. **Third Quarter Budget**: The board will be working on this online in the next few weeks. **Site Reports**: We are looking at upgrading the locks for the doors at ELO and J.J. Casby. We received a donation of shingles at Metcalf; now we need a work crew to put them on. There is talk of LLCC reducing the height of the trees to the south, which would be greatly appreciated by all who use that facility. **B-SIG Co-Coordinator**: We are having some difficulty filling this position. If you are interested in helping in this capacity, please contact Clayton Lindsay or Jerry Jones. **Dave Falkner and the MSO**: The board approved the purchase of stereoscopic viewers to be given to children who attend the Mesabi Symphony Orchestra performance of Holst's "The Planets." Dave and a crew of helpers will be presenting information about our solar system as well as Hubble images of the planets while the MSO performs. **Key Holder Responsibility Document/Risk Management**: Much time was spent on creating a key holder responsibility document which outlines some of the challenges that can be faced when dealing with the vast amount of wonderful equipment that MAS owns. Much more discussion will be necessary.

More Astronomy Day Photos










MAS Patron Members

Patron memberships are available to those who wish to contribute a little extra to support MAS activities. Patron memberships are established by constitution at 2-1/2 times the Regular membership rate—currently $65 annually for a patron membership. The $39 additional contribution is tax deductible. Patron memberships help fund equipment acquisitions, facility improvements, outreach activities and more. We would like to thank the following patron members as of October 26, 2015.

Hytham Abu-Safieh
Tom and Arlene Alm
Scott Anderson
William Arden
Jack Atkins
Steve Baranski
Greg Baril
William Beauchemin
Bradley Beisel
Wayne Boline
Ken Bolvin
Rev. Eugene Brown
Jonathan Burkhardt
Jeff Burrows
William Bynum
Ken Carlson
Kurt Casby
Stuart Chastain
Deane Clark, Jr.
Mark Connolly
Kelda Cutler
Mike Daniels
Paul and Jolie Davis
Mary Beth Smith &
Ted DeMatties
John Donoghue
Brogan Duffy
Russell Durkee
Scott Dutcher
Jim Elmquist
Steve Emert
Jamey Erickson
Dennis Faith
David Falkner
Joseph Fisher
Patricia Flugaur
Robert Foucault
Andrew Fraser
Paul Gade
Paul Garvie
Erik Gisselquist
William Glass
Steve Grabarkiewicz
Lawrence Gray
Matt Gross
Jere Gwin-Lenth
Dale Hagert
Brandon Hamil
Kevin Harris
Greg Haubrich
Michael Haydock
Jonathan Hayman
John Healey
Victor Heiner
Ric Heins Family
John Hill
Merle Hiltner
Lauren Hoen
Michael Hopfenspirger
George Hulme
Dick Jacobson
Gale Jallen
Ben Jarvis
Mark Job
Chelen Johnson
Julie A. Y. Johnson
Kurt Johnson
Jerry Jones
Deepak Kamath
Michael Kauper
Colin Kilbane
Jim Knudsen
Parke Kunkle
Mary Lahr
Jonathan Larson
Thomas Larson
Christine Laughlin
Louis Leichter
Rodney Liebeg
Clayton Lindsey
Brad Linzie
Walid Maalouli
Bruce McDonald
Brian McEnaney
Ron McLaughlin
Javier Medrano
Rebecca & Gary
Messer
Matt & Jessica Meyer
Beverly Miller
Scott Morgan
Brian Nelson
Alan Noot
Douglas Oines
Thor Olson
Christopher Paola
Ken Pederson
Joseph Reithmeyer
Brian Rembish
Kirby Richter
Stephen Riendl
Eric & Rebecca
Robinson
Jack Sandberg
Roy Cameron Sarver
Paul Schaleger
Dean Schantzen
James Schenz
Ronald Schmit
David Schultz
Lilah Schurstein-
Hanner
Dan Siers, Sr.
David Siskind
Cindy and Al Smith
Gerald Smyser
Jim Talbott
Valts Treibergs
David Truchot
Earl Truss
Steve Ulrich
Steven Vander Louw
Bob Vangen
David Venne
Paul Walker
Fred Wall
John Zimitsch
Neal Zimmerman

Gemini
a publication of the Minnesota Astronomical Society

MN ASTRONOMICAL SOCIETY
P.O. Box 14931
Minneapolis, MN 55414

ADDRESS SERVICE REQUESTED

NON-PROFIT
U.S. POSTAGE
PAID
Twin Cities, MN
PERMIT NO. 1407

How to pay your dues

December 2015 Volume 40 Number 6

Your MAS membership expires at the beginning of the month shown on your Gemini mailing label. Send your payment to the MAS Membership Coordinator at: Minnesota Astronomical Society, Attn: Membership Coordinator, P.O. Box 14931, Minneapolis, MN 55414. Make checks payable to MAS, or you can pay by PayPal on the MAS Web page. The current annual membership dues and subscription fees are: $26 for regular membership, $13 for student membership, and $65 for patron membership. For a printed copy of Gemini, add $9 to the above memberships. For a subscription to Sky and Telescope, add $32.95. For a subscription to Astronomy magazine, add $34 for one year or $60 for two years.

Membership rates changed as of February 1, 2014. The new rates are posted on the membership application form at *http://www.mnastro.org/membership/MembershipForm.pdf*

Fees for each of the membership levels were reduced and the option of receiving a printed copy of Gemini and/or Astronomy magazine as well as a place for an additional tax-deductible donation was added.

To Renew Your *Sky and Telescope* Subscription

New subscriptions to Sky and Telescope at the MAS member discount must be sent to the MAS for group membership subscription processing. Send new subscriptions with your MAS membership to the attention of the Membership Coordinator at the MAS at the Post Office box address shown on the back cover of the Gemini newsletter.

You may mail your subsequent subscription renewal with payment directly to S&T or renew via phone with Sky Publishing at 1-800-253-0245. This method is especially beneficial to those who wait until your subscription is about to expire before renewing S&T. If you wish, you may still submit your S&T subscription renewal to the MAS when you renew your membership in the MAS and we will enter your renewal on your behalf just as we always have done.

You will still need to send in your MAS membership renewal to the MAS Membership Coordinator at the MAS Post Office box address or renew your membership via PayPal.

How to Subscribe to MAS e-mail Distribution Lists

The MAS uses web Discussion Forums and e-mail distribution lists for timely communications. We highly recommend you subscribe to the MAS general distribution email list.

To subscribe to the MAS e-mail list visit: *http://lists.mnastro.org/mnastro/listinfo/* and follow the subscription instructions.

There is a general list (MAS), several Special Interest Group (SIG) lists and other lists for special purposes. Archives of the lists are also available by visiting the listinfo page for a specific list.