Morning Star

Winter 2021

*** Club Info ***

Announcements

Associate Members interested in becoming full members make your interest known to one of the board members. To become a Full Member one has to actively participate in club functions and events and be active in some other aspects of astronomy (more details are in our by-laws).

Wanted - PR person
If interested in this position contact Jack St. Louis or Paul Walker.

Moving or Changing Email?
Please send changes to Paul Walker, 53 Valley View, Middlebury, VT 05753, paulwaav@together.net (info@vtastro.org will also work)

Hinesburg Observing Site

We have an observing site in Hinesburg, VT. (Located on town property). A locked gate (required by the town) limits access to the site.

Associate Members can request access to the gate lock. They have to a member for 3 months. This provides access to the Warming Hut, 115v AC power and port-a-potty.

Full Members can request access to the gate lock and the observatory locks.

Board approval is required in both cases. Some training is required. There is a training checklist and an access agreement that need to be filled out.

Contact the Secretary, Paul Walker or Jack St. Louis for more information at info@vtastro.org

Observing List for HOS

We have an email List for Member's interested in getting a heads-up when someone will be at the Hinesburg Observing Site (HOS).

If interested in getting on the list contact **info@vtastro.org**

Observing Certificates

Several certificates (beginner to advanced) are available to members as encouragement to get out under the stars and hone their observing skills. Follow the link on our web site.

Outreach Acknowledgment Letter

To help record our broad community involvement with public star gazing events, projects and classes, we have developed an Outreach Acknowledgment Letter with a Sample Form. It is posted on the website and can be found under **Members, VAS Club Materials for Members, Outreach Acknowledgement Letter**.
Direct Link: http://vtastro.org/wp-content/uploads/2018/03/VAS_Outreach_Ack_Letter_V3.pdf

Dues

Associate Members $15
Full Members $25

Send dues and any address or email updates to VAS, PO Box 782, Williston, VT 05495. Or bring to any monthly meeting or Contact Paul Walker, 802-388-4220, paulwaav@together.net.

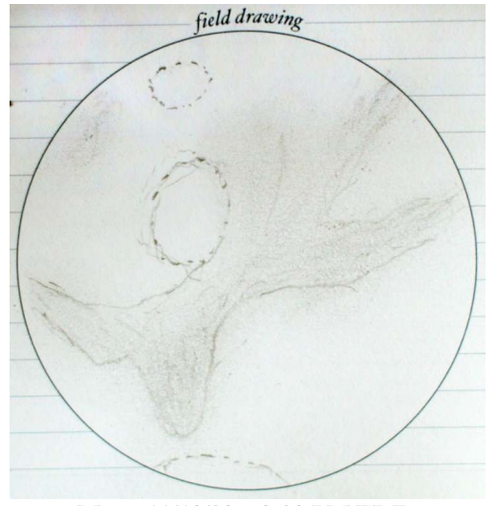
Connect On-line

www.vtastro.org
Twitter@VTAstroSociety
Facebook.com/Vermont-Astronomical-Society-113053818706458/
Email: info@vtastro.org (Goes to President and Secretary)
webmaster@vtatro.org
(Goes to Secretary and Webmaster)

Board Members

Jack St. Louis	Pres	857-5049
Joe Comeau	VP	238-1664
Doug Williamson	Treas	388-3482
Paul Walker	Sec'y	388-4220
Bob Horton		879-7802
Keith Lawrence		453-5496
Jim Bosek		879-1697
Terri Zittritsch		598-7226
Scott Turnbull	Webmaster	

Editor and Publisher - Paul Walker
Contributors: Joe Comeau, Peter Gillette, Maura Kelley, NASA Night Sky Network, Scott Turnbull, Duane Waller, Paul Walker, Richard Whitehead, Peter Williams, Terri Zittritsch. (My apologies if I missed anyone)



Mars, 11/10/20, ~9:20 PM EDT
by Paul Walker
10" f/5.6 Newtonian, 380x (Celestron 8-24mm zoom @10.5mm, 2x Barlow, Atmospheric Dispersion Corrector). Dashed lines delineate lighter areas, the top one being the South Polar Cap, next down is Hellas Basin, North Polar Hood at the bottom. Syrtis Major is "pointing" at the North Polar Hood.

Contents

Gary's Astronomical Events for the Month
can be viewed via WCAX at https://www.wcax.com/weather/astronomy

Stargazing and other Events

All observing events -are weather Permitting unless otherwise stated. Bring extra clothes. Even a summer evening can be chilly after standing still for a couple hours in damp air. We have an mail List for Member's interesting in getting a heads up on impromptu events at the Hinesburg Observing Site (HOS).

If interested in being on this list contact **info@vtastro.org**

Events are listed on our website (vtastro.org) and Google Calendar (https://calendar.google.com/calendar?cid=Nzc5dnQ1bnZrN2ljcDA2NG9vbXFnczI1M2NAZ3JvdXAuY2FsZW5kYXIuZ29vZ2xlLmNvbQ)

Member & Invited Guest Star Gazing at HOS & other events

Note: If you would like to be a host, greeter/orienteer or want some training on operating the scopes let Paul Walker know.

Corona Virus Note:
Members are welcome use the Hinesburg Observing Site. Please use precautions when more than 1 person is there. For those on the observing@vtastro.org email list, as always it is at your discretion as to whether or not to send a notice via that email list.

Remember to following appropriate social distancing and mask usage recommendations. Other restrictions for us is no sharing of eyepieces, so you will have to bring your own to look through the club's or other member's scopes and a recommendation of wearing gloves of some type when using someone's scope (could be light cotton or leather or the rubber kind)
Contact info@vtastro.org

Public Star Gazing at Schools, Libraries, and other groups.

If you know of a group or institution that would like to schedule a star gazing session have them contact: **info@vtastro.org**

Corona Virus Note: We will likely not have public events for the next few months.

Green Mountain Astronomers (GMA)

All events start about sunset. Check before going as some events are not cast in stone or written in the stars yet.

Contact Ron Lewis for info
802-779-5913 (cell)
802-247-5913 (home)
vtpoet@gmail.com

Done for the season

New Members

VAS welcomes the following new member who joined us since the last newsletter:

Jay Kaknes
Ollin Lang-Chimal
Charles (Chic) Mc?Arther
Rick Daniell

Meetings/Presentations

Normally meetings are held at Brownell Library, due to COVID-19 we are holding them remotely.
Meetings are held the first (non-holiday) Monday of the month, at 7:30 P.M. in the Kolvoord Community Room of the **Brownell Library**, 6 Lincoln St., Essex Jct (2nd building north of Essex 5 corners on the left on Rt. 2A). Extra parking is available in the Bank North parking lot across from the library. **For inclement weather call Jack St. Louis (802-658-0184) or Paul Walker (802-388-4220) to confirm.**

January 4

Medium Field Imaging - Eldorado Star Party, Texas

By Steve Grimsley

Plieades by Steve Grimsley

The Eldorado Star Party is a major observing and imaging event held at the X-Bar Ranch on the Edwards plateau in central Texas. It is always scheduled in October giving it five to six months separation from the much larger Texas Star Party that is held in the spring in the Davis Mountains of west Texas. With attendance limitations and strict Covid mitigation rules in place, the Eldorado event went on as scheduled. Those who attended were rewarded with mostly clear sky, mild night time temperatures, and only occasional light dewing. Seeing was mostly moderate which enabled crisp planet viewing and deep sky imaging when objects were high in the sky. I was grateful for the opportunity to have five imaging nights to try out a new Astro-Physics 92mm Stowaway refractor. This telescope was mounted on a heavy duty Takahashi NJP mount side by side with a FS-78 guiding telescope. In five nights of observing and imaging I was able to capture, using the new Canon Ra camera, twelve medium field, 3 to 4 degrees on the long axis, high resolution images of some of the more spectacular astronomical objects visible in the fall constellations.

Sh2-108 by Steve Grimsley

The first part of the talk will be an equipment discussion of the imaging telescope, accessory optics, guide scope, mount, and the Canon Ra camera. Second, we will look at some of the problems with artifacts from the Ra camera that had to be cleaned up in processing to produce the images that you will be seeing. Finally, there will be a review of the images acquired, their resolution quality, and the additional small objects that were also captured along with the primary targets. A total of about 129 square degrees of field were captured in these twelve images. The zoom enlargements on the small objects show surprisingly good detail so for the visual observers there is much to see.

February 1

Astronomical (Non-) Trivia Contest

By Mark Moyer

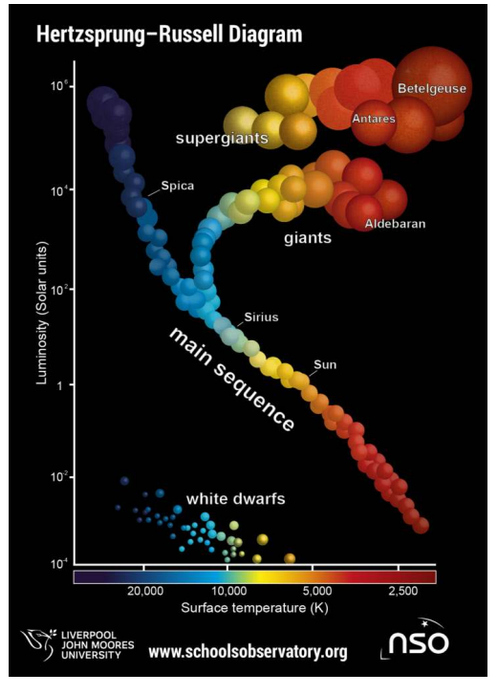
We'll explore a miscellaneous list of astronomical facts (about astronomical objects, amateur observing, astrophysics, the history of astronomy, and space flight). We'll pose them as questions for a self-scored trivia contest, you can test your knowledge of astronomy or just have fun guessing the answers. The answers are not merely trivial factoids. Each one is chosen because an understanding of the answer gives us a deeper knowledge of some aspect of astronomy. Each question and answer will be followed up by an explanation that describes something significant about the heavens or our study of the heavens that will be both interesting and enlightening. So even if you join us just to listen in, you should find it fun and thought-provoking!

March 1

The Hertzsprung-Russell Diagram and Stellar Evolution

By Steve Quigley

Astronomy is a unique science. With few exceptions, everything in Astronomy is based on light, and what information we can glean from it. The Hertzsprung-Russell diagram is an excellent example of this. This presentation will cover the techniques, events, and people who contributed to the development of the H-R diagram. You'll meet Germans, Italians, Danes, Indians, English, and American scientists whose work contributed to the "final" product. Much of the action will take place at Harvard, and there you'll be introduced to the "Harvard Computers." This is a very basic summary of the work that led to the H-R diagram, and the insight it gives us into the concept of Stellar Evolution—the life and death of stars…… and all from understanding the message of the photons.



Articles

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, stargazing info and more.

The International Space Station: 20 Continuously Crewed Years of Operation

David Prosper

Did you know that humans have been living in the International Space Station, uninterrupted, for twenty years? Ever since the first crew members docked with the International

Space Station (ISS) in November 2000, more than 240 people have visited this outpost, representing 19 countries working together. They have been busy building, upgrading, and maintaining the space station - while simultaneously engaging in cutting-edge scientific research.

The first modules that would later make up the ISS were launched into orbit in 1998: the Russian Zarya launched via a Proton-K rocket, and the US-built Unity module launched about a week and a half later by the Space Shuttle Endeavour. Subsequent missions added vital elements and modules to the Space Station before it was ready to be inhabited. And at last, on November 2, 2000, Expedition-1 brought the first three permanent crew members to the station in a Russian Soyuz capsule: NASA astronaut William M. Shepherd and Russian cosmonauts Sergei Krikalev and Yuri Gidzenk. Since then, an entire generation has been born into a world where humans continually live and work in space! The pressurized space inside this modern engineering marvel is roughly equal to the volume of a Boeing 747, and is sometimes briefly shared by up to 13 individuals, though the average number of crew members is 6. The unique microgravity environment of the ISS means that long-term studies can be performed on the space station that can't be performed anywhere on Earth in many fields including space medicine, fluid dynamics, biology, meteorology and environmental monitoring, particle physics, and astrophysics. Of course, one of the biggest and longest experiments on board is research into the effects of microgravity on the human body itself, absolutely vital knowledge for future crewed exploration into deep space.

Stargazers have also enjoyed the presence of the ISS as it graces our skies with bright passes overhead. This space station is the largest object humans have yet put into orbit at 357 feet long, almost the length of an American football field (if end zones are included). The large solar arrays – 240 feet wide - reflect quite a bit of sunlight, at times making the ISS brighter than Venus to observers on the ground! Its morning and evening passes can be a treat for stargazers and can even be observed from brightly-lit cities. People all over the world can spot the ISS, and with an orbit only 90 minutes long, sometimes you can spot the station multiple times a night. You can find the next ISS pass near you and receive alerts at sites like NASA's Spot the Station website (spotthestation.nasa.gov) and stargazing and satellite tracking apps. Hundreds of astronauts from all over the world have crewed the International Space Station over the last two decades, and their work has inspired countless people to look up and ponder humanity's presence and future in space. You can find out more about the International Space Station and how living and working on board this amazing outpost has helped prepare us to return to the Moon - and beyond! - at nasa.gov.

A complete view of the ISS as of October 4, 2018, taken from the Soyuz capsule of the departing crew of Expedition 56 from their Soyuz capsule. This structure was built by materials launched into orbit by 37 United States Space Shuttle missions and 5 Russian Proton and Soyuz rockets, and assembled and maintained by 230 spacewalks, with more to come!

Credit: NASA/Roscosmos More info: bit.ly/issbasics

The ISS photobombs the Sun in this amazing image taken during the eclipse of August 21, 2017 from Banner, Wyoming.

Photo credit: NASA/Joel Kowsky More info: bit.ly/eclipseiss

First Telescope Program
(Kept in as a reminder for all)

With the support of the VAS Board, I am developing a First Telescope Program for new members of the club. For now I am seeking a few old 4 ½" f/8 Newtonian telescopes that I can renovate, fit with 1 ¼" rack and pinions and eyepieces then outfit with Dobsonian mounts. My target is to sell these to club members for $100 or non-members for $125. For the first year the new owners can return it for full refund in case of non-use or to upgrade, etc. After a year the refund will depend on condition. Sales will depend on availability of telescopes and components, so if you have old telescopes, eyepieces or parts you want to sell or donate please contact me.

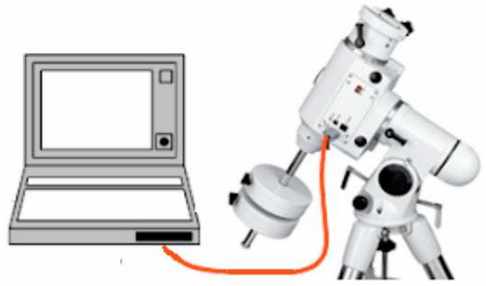
Keith Lawrence
sleepingbearwoodworking@yahoo.com
802-453-5496

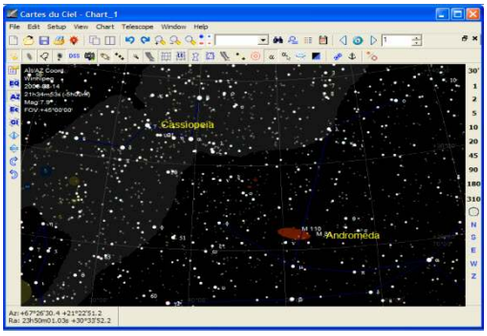
Another Arduino Astronomy Project
By Duane Waller

The Orion Sirius EQ-G is a very stable and accurate motorized telescope mount, which many Astronomy lovers utilize for Astrophotography and general observing.

There are a few different ways to control the EQ-G. It comes with a hand controller as standard equipment.

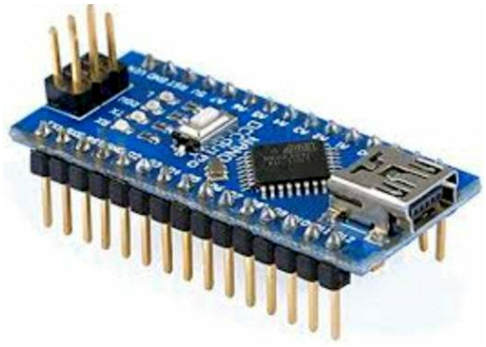
But it can also be controlled with a tablet or smart phone. And with the advent of the EQMOD project, it can be controlled with planetarium applications, such as Stellarium and Cartes du Ciel.





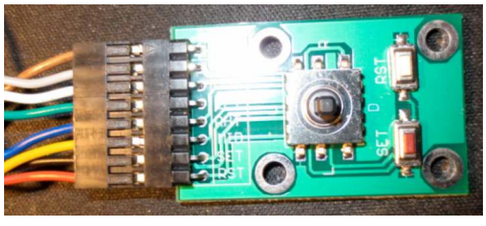
Curiously enough however, for anyone who wants to control the mount with a simple dual-axis hand-controller, there is no known commercial product available.

Enter the Arduino NANO micro controller!

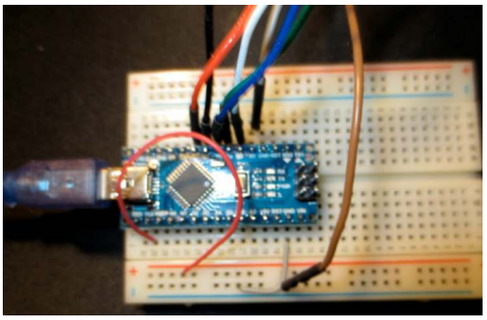


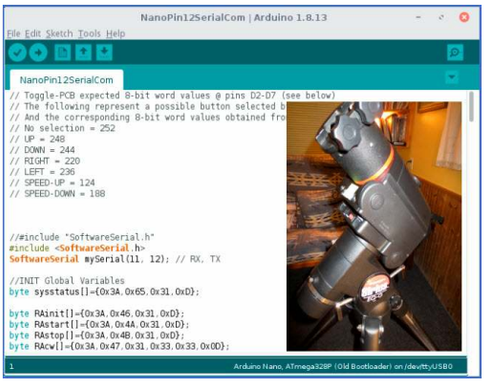
With a little help from the Skywatcher Serial Command Motor controller documentation, and a little help from a few online friends, the Arduino NANO can easily serve as a way to control the EQ-G.

We will need some kind of control switch device. And this little miniature toggle-switch will do nicely as our first control implementation and facilitate our proof of concept.



With a serial cable to connect to the mount, and a little Arduino code to tell the NANO what to do.





WELLA! - we are now controlling the Orion EQ-G!

Board & Committee Meetings

Board Meetings

October

Jack opened the meeting. Jack opened the meeting. No updates on the possible solar array on the landfill. The last update is that it will be completely on the capped landfill with nothing on the area we use for parking.

We received an offer from Caleb Ackerman, a junior at Calvin University, working with one of the film faculty members on the distribution of his upcoming documentary, scheduled for release next year. The film, Luminous, tells the story of the highly publicized prediction of a binary star merger in the constellation of Cygnus in 2022. Paul will contact Caleb to arrange to host screening of the movie at a monthly meeting.

Doug gave the financial update.

Bob has been working on his upcoming talk about his recent projects of building his own Push-To

and Go-To telescope computers.

Keith has been talking to Gary about People's Academy's interest in having an observing event at their refurbished Grout Observatory in Morrisville. On that note Kieth asked whether the board should make a statement about VAS members supporting school and library sponsored events to cover possible insurance issues. Since they are not VAS sponsored events, our insurance policy would apply.

Fletcher Library, Ludlow, VT, has their Loaner Scope Program telescope.

Paul received a request from Siddhesh Mukerji for gate access to the Hinesburg Observing Site (HOS). Paul and Terri recommend him. The board approved this request. Paul or Jack will train him.

The 2024 solar eclipse will be here before we know it. Jim Bosek brought up the question of what VAS is going to do, what kind of out reach we may do such as providing information to the Vermont hospitality industry and contacting state officials. Jim is willing to head a committee to work on this. Contact Jim if you are willing to help on this committee.

Since we said we would re-visit the question of having club sponsored events at the Hinesburg Observing Site (HOS), Doug asked whether we were willing to do this. The consensus is the situation with COVID-19 has not improved and therefore not comfortable holding club sponsored events yet. However, members are welcome to observe and image the site.

MOTIONS: None
ACTION ITEMS: None

November

Jack opened the meeting. No updates on the possible solar array on the landfill. He picked up a donation of astro-stuff from long time (Life) member Tom Yandow. Tom is retiring and moving out of state. If we do not have an in-person Annual Meeting in 2021 Jack suggests we have an on-line auction and/or put these and other items in the newsletter.

Joe- Ben McShane of the South Burlington Recreation & Parks contacted us with interest in doing something astronomical for the community. It will likely have to be something "remote". Jack will contact Ben.

Paul- Monthly meetings are set for the next few months. **Dec. 7**, Home-built Push To and GoTo controllers by Bob Horton. **Jan 4**, Eldorado Star Party & Astro Images by Steve Grimsley. **Feb. 1**,Trivia Contest by Mark Moyer, everyone gets to play at home and keep track of their own points**. Feb 1**, The H-R Diagram by Steve Quigley, a tool used extensively by astronomers. **Apr. 5**, Spacecraft Rendezvous and Orbital Maneuvers by Christopher Mauro (a member of the New Jersey Astronomical Group and referred to me by Mary Lou West). **May 3**, Annual Meeting. **June 7**, Astro-Imaging by Terri Zittritsch. **Date not set yet**- screening of "Luminous" an astronomy documentary in the works that tells the story of the highly publicized prediction of a binary star merger in the constellation of Cygnus in 2022. The film follows astronomer Larry Molnar's five-year journey to make and test his historic prediction, knowing that its success or failure will unfold squarely in the international spotlight.

Paul trained Siddhesh (Sid) Mukerji for gate access.

Doug- Gave the financial update.

Terri- Working on final preparations for the on-line Forum.

Keith- Burlington Library bought a scope similar to the Library Loaner Scope and asked if we could modify it so they could use it as a loaner scope.

Jim- 2024 Solar Eclipse Update- Briefly talked about who we should contact for possible people, such as Naturalist, to disseminate info to and who could organize public events in northern Vermont. The Eclipse committee will have a kick-off meeting soon.

MOTIONS: None
ACTION ITEMS:

Paul will send Keith contact info for the Springfield Telescope Makers (Stellafane folks) so Keith can contact them about the request from Springfield Library for a Library Loan Scope.

December

No meeting was held.

VAS Membership Committee

No meeting was held this quarter.

Observatory Site Committee

No meeting was held this quarter.

We did have 2 work parties to clear brush from around the perimeter with thanks going out to Bill Banke, Jim Bosek, Richard & Kate Whitehead, Maura Kelley, Leah Christopher, Joe Comeau, Peter Gillette, Scott Turnbull and Duane Waller.

Paul Walker and Jim Bosek installed the rain gutter on the Chmela Observatory.

Site Survey Analysis

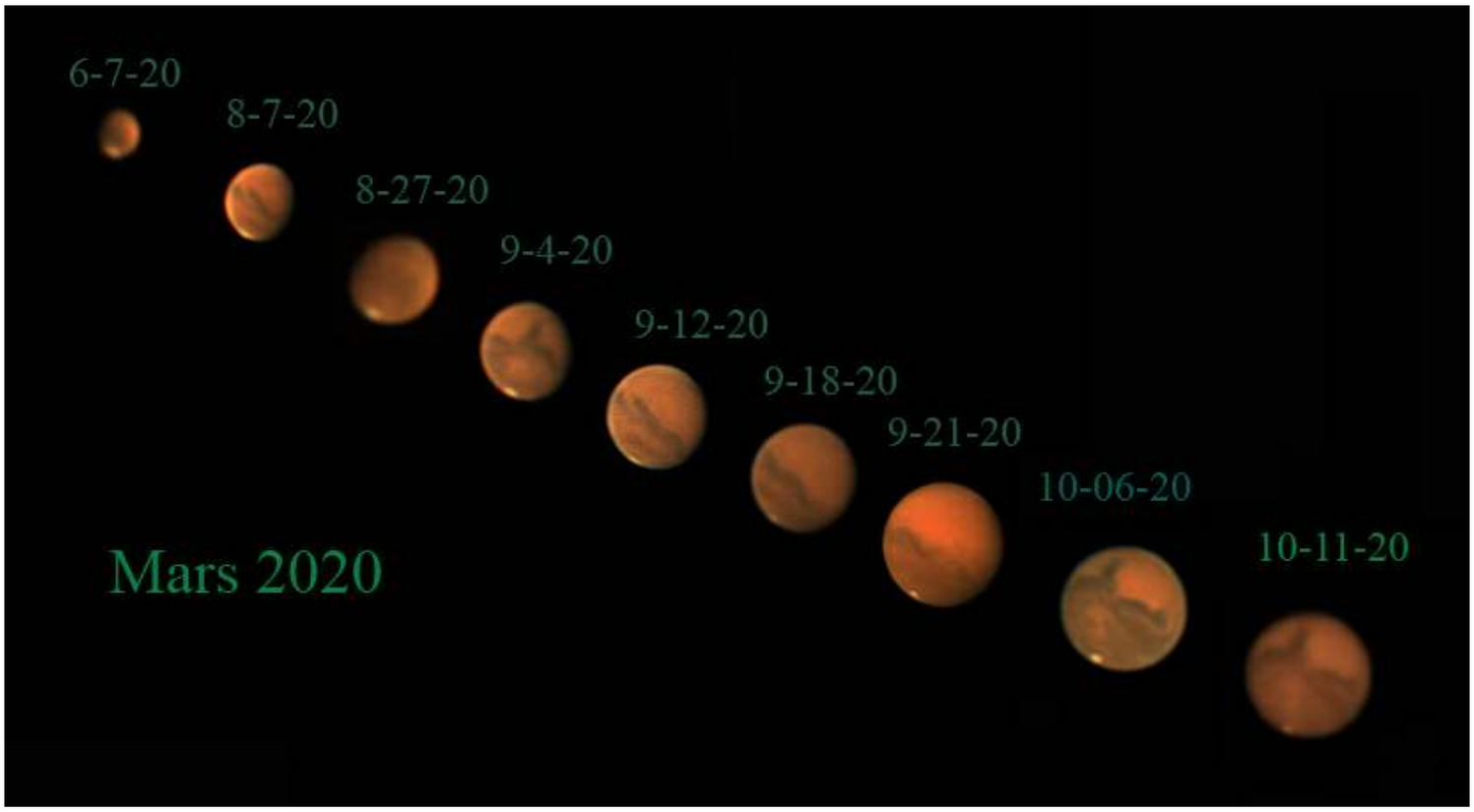
The results were reported in the Winter 2020 newsletter (available on our website, www.vtasto.org). The full 2018 Site Survey results are available as a PDF file on request (contact info@vtastro.org)

Under the Stars & Planets

Mars

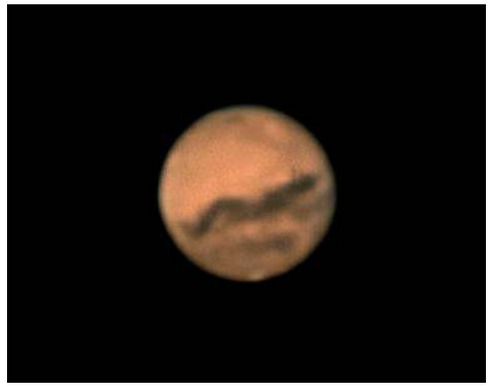
We had some nights of good viewing for Mars this Summer and Fall. Here are some imaging results.

At the top of the next page is a collection by Joe Comeau taken with his C14 (north is up and slightly to the right). Some days were better than others. You can see this in Joe's images.



Compare the ones taken on the nights of 8-7-20, 9-12-20, 9-18-20 and 9-21-20 which all show some of the same features. Of course some of the difference in resolution has to do with the apparent size of Mars (disks are to scale). The most obvious dark feature on those dates is Mare Erythraeum, the wide slightly wiggly feature in the middle of the disk. It is centered between 0 and -30 degree latitude. It is also well placed in Terri's images (center of the page). Her images is mirror reversed from Joe's. Mare Erythraeum is easy to make out in pretty much any telescope. An even easier feature to recognize is Sytis Major, seen it Joe's images taken on 9-04-20, 10-06-20 and 10-11-20. Sabaeus Sinus, a slightly less prominent dark feature, sits between Sytis Major and Mare Erythraeum. In Joe's 10-06-20 image Sabaeus Sinus can be seen to the right of Sytis Major.

Terri took her shots on 10/17/20, with an 11" Celestron Edge SCT with a 2" Televue Powermate and ASI224MC color camera at 2.1ms exposure time. Terri's comments sent with the top image – "Well, I thought I'd give the 11" one more try at Mars. I think I have more detail in this one and some smaller features… still not a great night and as soon as it gets over my house I get



lots of boiling. The TEC is going back on the scope and next image I take of Mars will be double-Barlowed as Joe has suggested on a smaller scope. In any case, I'm pretty pleased with this one. The whole wavelet processing things is a bit of an art, like most other things in imaging process. I'll have to play around with it to see how to best optimize".

Very good for a "not bad" night, but wait, there's mor.]

Terri's comments with the bottom, reprocessed version – "From my initial takes, this is pretty much what I can get.. Been playing around with various stacking and think that the only way to do better is to get more frames but weather has not been cooperating. I checked this against a high res shot on the same date in Italy, and all of my markings align with high res markings. So it is what it is".

This has got to be the most detailed image of Mars I've seen taken in Vermont. See page 19 for a collage Terri put together of images she took.

International Space Station Images from Terra Firma

By Paul Walker

I have taken images of the ISS a couple times before with my 10" f/5.6 Newtonian Telescope, in 2007 and 2009. I was pleased with them but the ones I took this Fall are better.

The ISS is very much a moving target! It obits the Earth at approximately 17,100 miles an hour. That's 4.75 miles per second, 25 feet in 1/1000 of a second. The size of the Space Station is approximately 240 x 360 feet. A difficult task unless you have a way to lock

onto the ISS and track it. At least one person does just that using a video camera, commercial GoTo mount and custom software that automatically detects the Space Station as it zips through the field, locks onto it and precisely drives the telescope to follow it. I used none of that.

The first time, I used my 10" f/5.6 (1407mm f.l.) Newtonian on a homemade "split-ring" mount (like on the Palomar 200", only *little* smaller) and a Canon XTi (10 Mp) camera at prime focus. I acquired and more or less, mostly less, locked onto the ISS using a 50mm finder scope with cross hairs and my eye. It's was not easy to keep the Space Station near the cross hairs by pushing the scope in RA and DEC simultaneously. The ISS tended to wander around in the field of view a lot.

This was one the best images. 8/19/07, 1/320 sec @ ISO 800, cropped. As a bonus, the Endeavor Space Shuttle was

either coming or going, I forget which, and not that you can tell it's a shuttle. 1/320 sec @ ISO 800.

The next time, I used the same scope and camera but with a 2x Barlow, which due to the location of the camera's sensor gives 2.65x magnification. Because of this I knew I would need to use a shorter exposure and/or higher ISO setting.

7/9/09, 1/160 sec @ ISO 1600, cropped. For size comparison, Jupiter on the right was taken with the same setup on the same evening and cropped the same.

This September 21st was my 3rd shot at imaging the ISS. I again used the same telescope but a new camera and I now use an 80mm finder scope.

Stack of 8 images. Approaching from the Southwest (~7:32:06 PM).

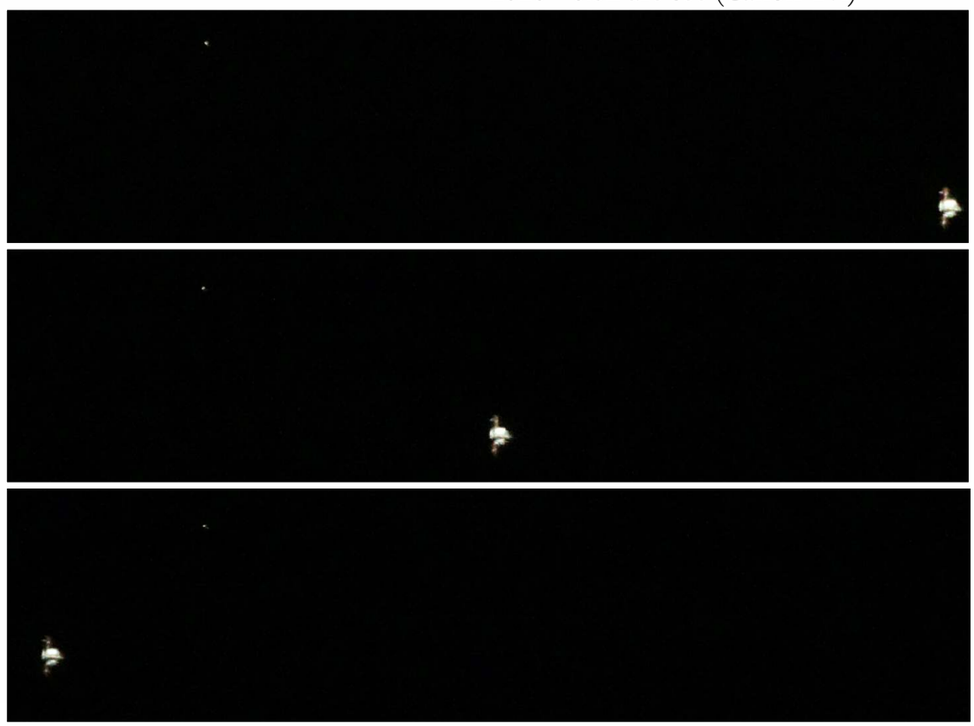
6 images. About midway through imaging (~7:32:50 PM). Main solar panels are brown.

Stack of 2 images. Near the zenith, ~300 miles away. ~7:33:16 PM, about 4 seconds before closest approach. The ISS was at the bottom of the frame where the camera's mirror vignettes the light, reducing the brightness. The lightest parts are heat radiator panels which in the other images are over exposed. There are 2 sets of these panels, one appears to be rotated away from us, the other face on or nearly face on. For reference they are ~35'x66'. Most of the various modules that make body of the station are 14' across.

Camera used-Canon T7i (modified), 1/2000 sec exposure at ISO 3200. At the closest approach (7:33:22 PM EDT) the theoretical resolution was 3.6 feet per pixel (7 ft for 2 pixels, 11 ft for 3 pixels). These are 6% crops, resized 200% than sharpened. Next time I may try 1/3200 or 1/4000 sec exposures.

Below is a sequence with the ISS zipping by Beta Draconis (upper left) at ~1/6 sec intervals. Who would have thought a 2.8 magnitude star could be recorded with 1/2000 sec. exposures!

Pixel sizes:
2007 - 0.81 arc sec (Canon XT)
2009 - 0.31 arc sec (Canon XTi + 2.65x Barlow)
2020 - 0.52 arc sec (Canon T7i)



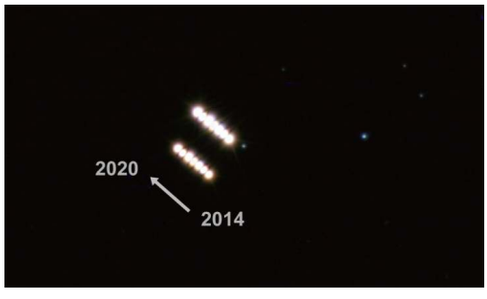
Here's an image of the ISS from space. Along with the 2 sets of primary heat radiator panels, there are 2 each on the solar panel booms, one for each set of solar panels. The viewing angle, which changes as the ISS crosses the sky, greatly affects it's appearance. How many of the parts can you identify in my images?

For more info about the ISS - https://www.nasa.gov/mission_pages/station/structure/elements/space-station-assembly
Downloadable reference guide - https://www.nasa.gov/sites/default/files/atoms/files/np-2015-05-022-jsc-iss-guide-2015-update-111015-508c.pdf

Proper Motion of 61 Cygnus- Update

By Paul Walker

7 years worth of images of this 6th mag., high proper motion double star. 10" f/5.6 Newt., Canon XTi camera, 5 sec., ISO1600, 2X Barlow (2.65x eff.)(75x eff. visual mag.), 30% crop , for a final effective visual magnification of ~250x.



Observing Notes from Peter Gillette

November 29th. First clear day and semi-clear night in a while. I had the pleasure of some day-time observing of the large sunspot group, and then swung over to catch Venus, and even Mercury before moving back over to weekend chores. A late-afternoon walk to "our" overlook to the west netted a fine sunset, but as I was about to head inside for an early dinner, a light on my easterly ridge caught my eye, and I knew right away that the Moon was coming, so I grabbed my camera, and this is one of my shots...

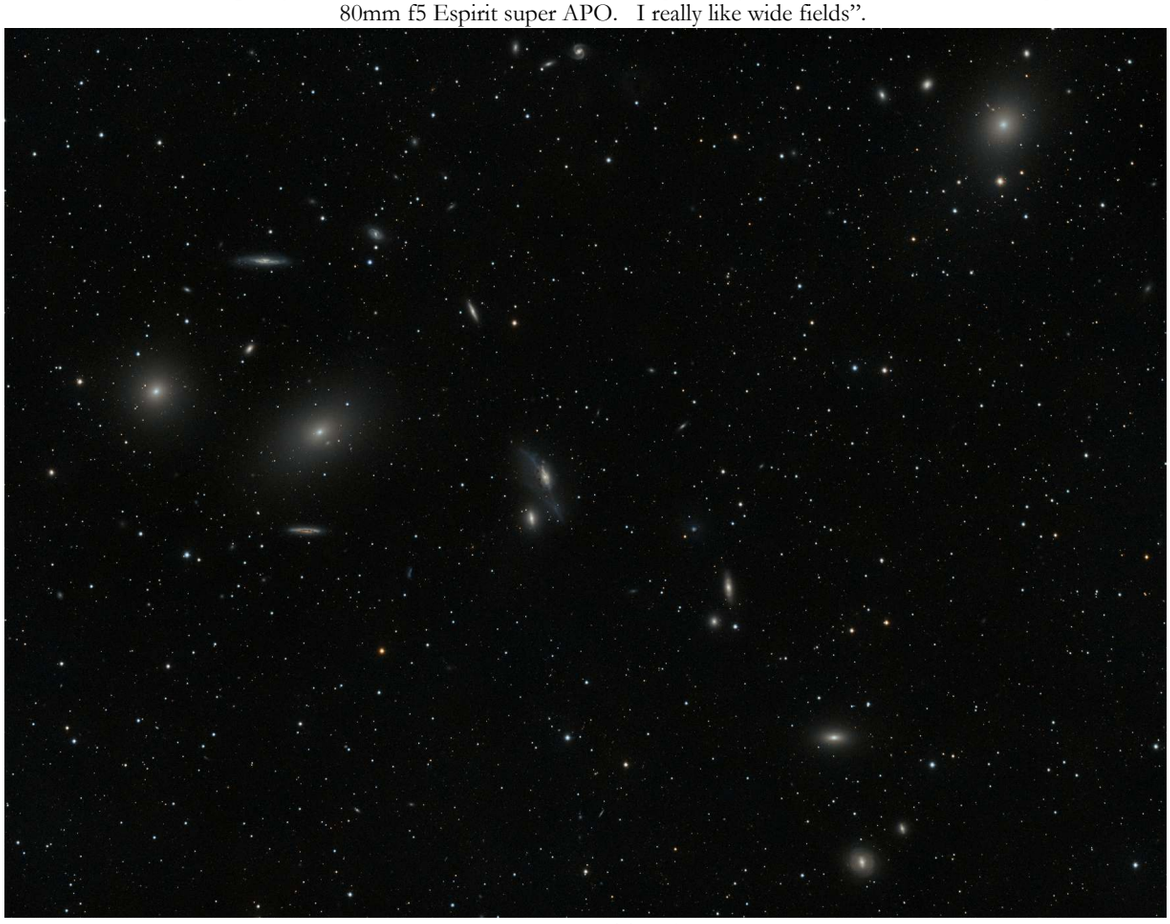
I knew the Moon would be taking up most of the sky, and planned to make the most of it. It didn't hurt that I'd recently been reading about the "Murs Enigmatiques" of Etienne Trouvelot in the British magazine, Astronomy Now (the best astro-mag out there, in my humble opinion!), wherein a strikingly straight wall or at least beam of light was seen cutting across the crater Eudoxus. I knew that it was seen only once, and at "sunrise" at that part of the Moon, so I had no hopes of seeing anything more than the crater itself, but I thought it would be fun to take a look, anyway.

I don't have anything like the knowledge of the lunar surface that some people have, like Lawrence Garrett, but I do have a GoTo scope and an installation of the Virtual Moon Atlas, and 'tho' I had hardly ever popped open the software, I was pretty sure I had noticed that it could, in theory, run a GoTo scope around the lunar features, so I gave it a shot. After some snags, I updated my version, and away I went. First was Eudoxus, but the light was so flat that I really didn't see much, and was unsure that I was in the right area, so I decided to head for familiar ground, and see how things went from there. Proclus is a favorite, with it's angled sprays, and the VMA got it into the field of view. After centering it, I was able to "Sync" the scope to the software, and I moved to a 10mm eyepiece. The thin clouds overhead made contrast even tougher than just the full moon, but the higher magnification helped a bit. From there I selected another favorite, Posidonius, and VMA nailed it, even at high power. I could see another favorite, Daniell, up in the corner of the view, and headed there. I'm partial to it for its name, which, if I drop one "L", is the name of one of my sons. In that view, I saw in interesting crater at the top of the field, with a center peak? or was it a smaller crater? It turned out to be named Hercules, and was a fine sight, but again, I got distracted by an odd feature of a neighboring crater. On the southern rim was a -very- dark patch. Quite distinctive, there was nothing else like it that I could see. VMA to the rescue, it told me that it is a pyrochlastic feature called "Atlas South".

I'd had so much fun, cruising the Moon with the help of VMA, that I just wanted to share it. Are others using this tool and just keeping quiet about it?

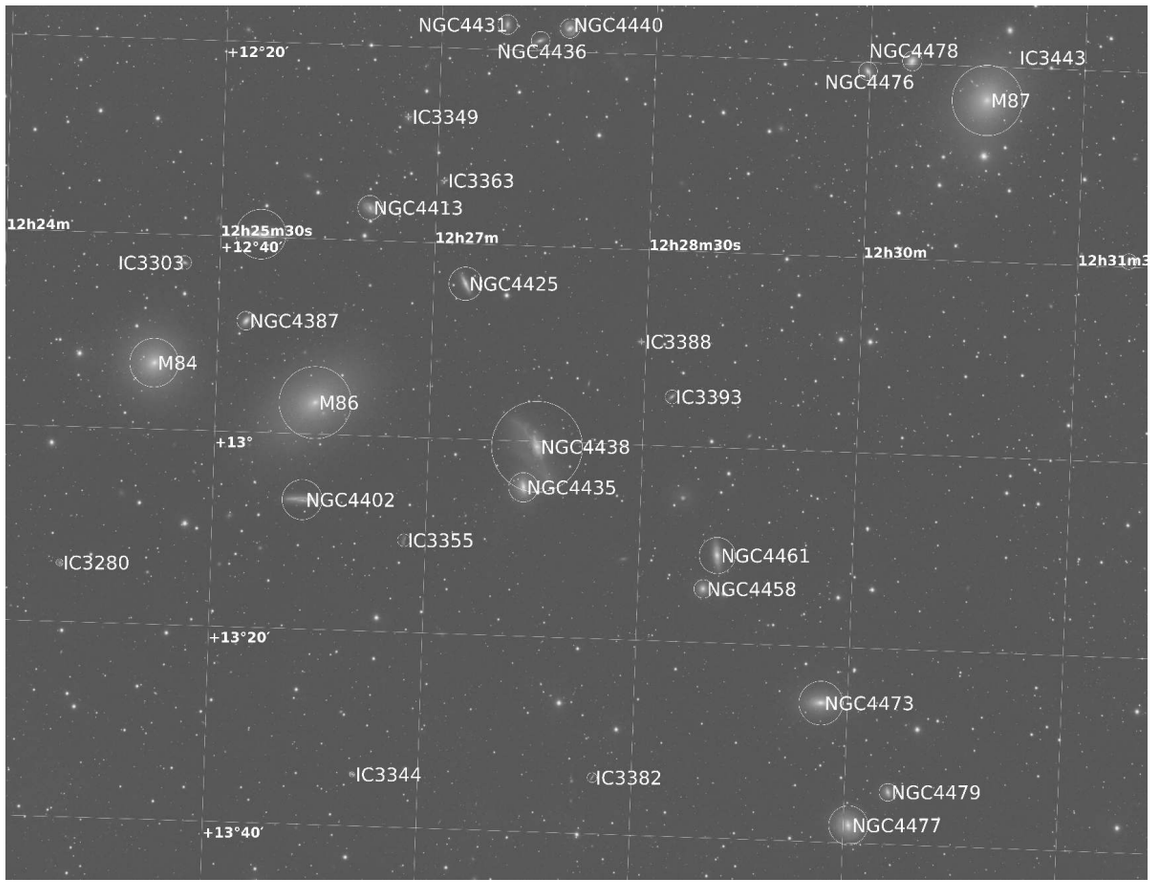
Lobster Nebula (sh2-157) by Terri Zittritsch

Along with a few other named objects in the scene. "I also have an SHO version [Sulfur II, H-alpha, Oxygen III wavelengths used for the RGB channels], but really like the HOO presentations [H-alpha, Oxygen III, Oxygen III wavelengths used for the RGB channels where Green is synthesized by combining the H and O data] because of the simplicity of star color [shown here]. SHO images really mess with star color and fixing it is a chore. Taken with my 80mm f5 Espirit super APO. I really like wide fields".



Markarian Chain by Terri Zittritsch

"I remember the first time I saw the chain through my 8" scope, I was with Russ Chmela and he was pointing out interesting things to look at with my size scope. Up until then I was focused on planets, star clusters and planetary nebula.. Russ really opened my eyes to what I could see even with a modest instrument in dark skies." (see annotated version on next page for designations of brighter objects)



Markarian Chain annotated version with designations of brighter objects

Lagoon Nebula (M8), left and Trifid Nebula (M20), upper right
By Richard Whitehead
This was 1 min X 60 plus 3 min X 10.
Celestron RASA 11" f2.2 , 620mm focal length, CGX Mount, ZWO ASI 6200MC Pro (one shot color camera)

Horsehead (center) and Flame (left of and below center) Nebulae
By Richard Whitehead
This is an HaRGB (Hydrogen-alpha, red, green, blue) image processed in PixInsight with a little touching up in PhotoShop 2021. Celestron RASA 11" f2.2 , 620mm focal length, CGX Mount, ZWO ASI 6200MM Pro (monochrome camera) with noted filters.

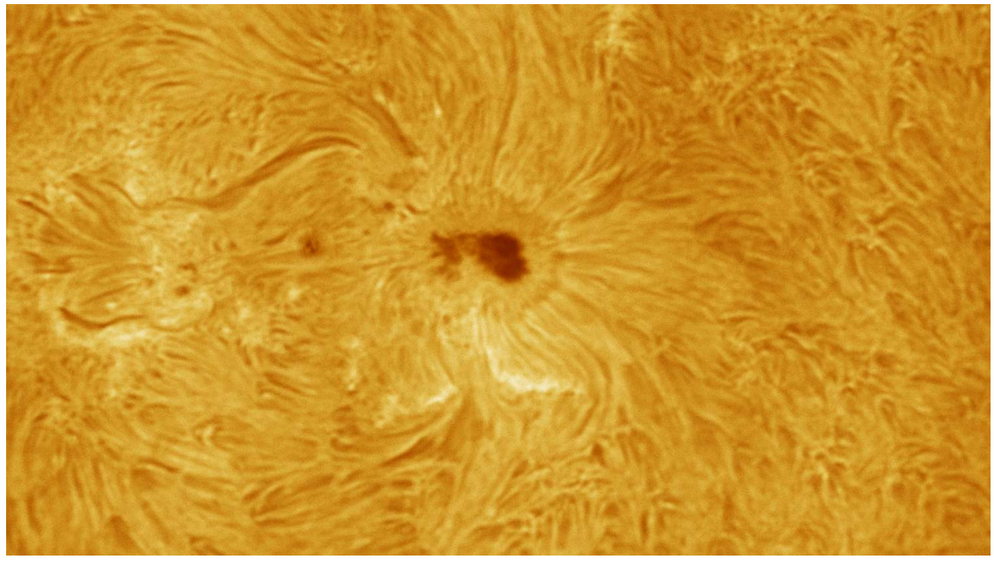
The Eastern Veil Nebula (NGC 6992)
By Maura Kelley
"This is my first image using autoguiding. I found the sub exposures were highly improved [compared to 20 sec. subs] using PHD2 autoguiding. This image consists of 125, 60-sec. subs for 2 hours 5 minutes integrated exposure time, using modified an Olympus DSLR and Explore Scientific ED80CF refractor".

The Great Red Spot on Jupiter
By Peter Williams

Peter was a member of the club back in the late 70's and early 80's and has recently rejoined. He has made a living as an artist. Here is one of his astronomical paintings of the Great Red Spot. He used Hubble images for inspiration.

Original VAS Logo

A few of the "old timers" know this, that Peter created the original VAS logo. This is a photograph of his original artwork taken in the mid 80's by Paul Walker. He drew the center art which depicts Mount Mansfield in the background and UVM's 9" f/12 Alan Clark refractor in the foreground. The club was allowed to use of this telescope for several years. First in large observatory they built in Underhill in 1974 and in the 80's in another large observatory they built in Williston.



A Sunspot!

Terri Zittritsch took advantage of a short reprieve from clouds November 29th, during the day, to see what was happening on the Sun. "I've noticed that there are some sunspots recently, and a fairly big one at that."

Astro-physics Stowaway telescope, quark solar filter, ASI290 monochrome camera, Astrophysics Mach2 equatorial mount.

Taking Surprisingly Good Deep Sky Images with DSLR's and Short Exposure Times

By Paul Walker

Unless otherwise noted images are by Paul using a 10" f/4 Newt., Canon T7i camera (APS-C sensor), 20 sec @ ISO 6400.

DSLR;s are digital single lens reflex cameras, cameras with removable lens.

One of the keys to taking good short exposure deep sky images is using a modern, low noise, camera. The lowest noise DSLR cameras are the so called "Full Frame" cameras because mega pixel for mega pixel they have the largest surface area per pixel and therefore the lowest amount of noise. The lower the noise the better the image looks. The next best are those with APS-C sized sensors and the worst are ones with Micro 4/3 sensors. Even the worst in this case is good! *(see "Basics of How Digital Cameras Work" on our web site under "Articles and Presentations" for more info)*

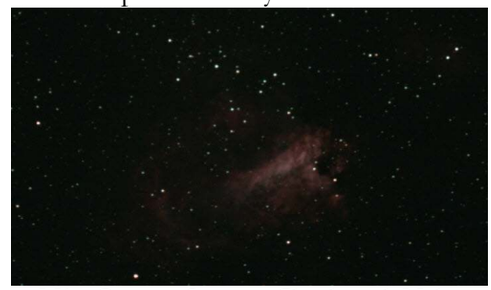
The Great Orion Nebula (M4)
by Maura Kelley

20 sec. @ ISO 16,000. 80mm f/6 apochromatic refractor OM-D E-M1 Mark II Micro 4/3 camera. Other than slight cropping this is as-is out of the camera.

If you have a telescope on a sturdy motorized equatorial mount and a DLSR camera give it a try. You can try an Alt-Az mount but you will definitely be limited in exposure time due to "field rotation" even if it tracks very well. *Use the equipment you have and see what you get.*

Normally for deep sky images the camera would be set to low to moderate ISO setting, 200 to 800 and dozens of images taken and stacked. Since we are talking about single images you will want to crank up the ISO to 3200, 6400 maybe even 12800 or higher depending on what it takes to see the object reasonably well. I would recommend checking you manual to see what is the highest setting. Try staying at least one notch below the highest setting.

You will need to get a T-adapter specific for your camera and a T to 2" adapter. This pair replaces the camera lens and allows camera to be inserted into a 2" focuser. Your telescope will of course need to have a 2" focuser. Most scopes these days do.



M17, Omega, Swan or Checkmark Neb.
Almost as-is out of the camera. Resized 20% (reduces the graininess), cropped 55%.

Color balanced, brightened a little, increased contrast, boosted the color saturation a little.

I recommend you turn the brightness down on the rear display of the camera. The default setting is for viewing during the day which at night will make the image look brighter and better on the camera than on your computer and you may be surprised how dim the image is when you get back inside.

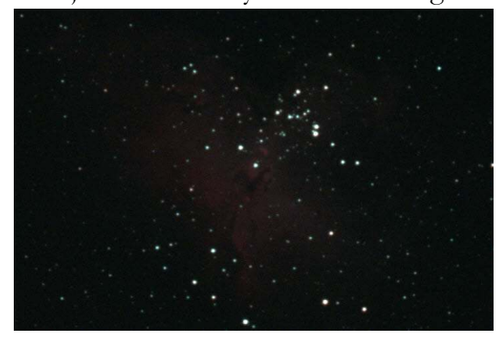
Most DSLR's have a live view that can be magnified. You will need to use this feature to focus on the stars. Use a fairly bright star for focusing.

Before I forget. Pick your target from the brighter of the deep sky objects such as the Messier list. When verifying and centering your target object set the ISO to the highest or next to highest setting. This will allow you to spot your target using very short exposure times of 5 to 10 seconds and allow you to center the object within a minute or two.

Example - M16, 5 sec @ ISO 12,800

Once centered, experiment with the ISO setting and exposure time. With most camera/scope setups you can get reasonable results using 20-40 second exposures and ISO settings of 3200-6400 on the brighter objects.

Magnify the image on the camera's display and see if the stars are trailed. A little trailing will not be noticeable when viewed on a computer. If little or no trailing is visible, take a few shots and examine them to see how consistent the tracking is. Some may have trailing and some may not. You can just throw away the trailed images.



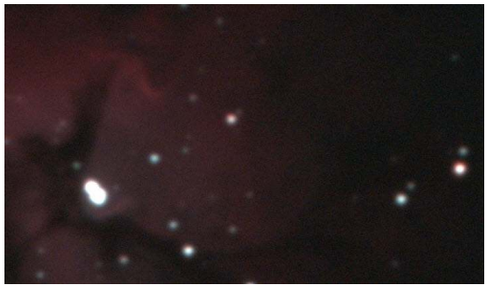
M16 (Eagle Neb.) 20 sec @ ISO 6400
Cropped 40%, resized 30%

Same image - Applied histogram curve (brightened), resized 30% than applied noise reduction.

You will want to use the longest exposure you can so push the exposure time. Since you are looking to do single images it's quite OK if with 1 minute exposures you only get 1 good shot out of 5 to 10.

If you want improve the images, stacking even a few is a relatively easy way to do so. I won't go into details here but I show an example below. Joe used to stack 30 second exposures and Maura, until recently, was stacking 20 second exposures with nice results.

M20 (Trifid Neb) single image, unprocessed, cropped to show the graininess.



Stack of 5 images, unprocessed, note how much smoother it is.

Single image, unprocessed, not cropped

Single image, processed, cropped

Stack of 5 images, processed, cropped

If you don't have equipment yet. General recommendations are- Telescopes with faster f/ratios will produce brighter images. f/4 is faster than f/6. An f/6 image is 2.25 times dimmer than an f/4 image. Most Newtonians used for imaging are f/4 but need a "coma corrector" for good images to the edge of the field. Most small APO refractors are f/6 to f/7 and benefit from "focal reducers/flatteners", typically 0.8x that will bring them down to f/4.8 to f/5.6 respectively and improve the focus across the field. Get a mount that is rated for at least the weight of your telescope + camera. In general the beefier the mount the longer your exposures can be. The shorter the focal length of the telescope the longer the exposure can be except for small objects for which you will likely want to crop the image.
(see "Basics of How Digital Cameras Work" for f/ratio info and "Astro-Imaging Equipment Overview" for equipment options info, on our web site under "Articles and Presentations")

Jupiter and Saturn Conjunction

Jupiter & Saturn One Day After Conjunction (12/22/2020)
By Paul Walker
Started with an 1/8 sec @ ISO3200 image than cloned Jupiter from a 1/320 sec, ISO3200 image. 10" f/5.6 Newt. Barlowed (2.65x), Canon T7i camera. Cropped 65%, field of view: ~0.60 x 0.40 deg. Moons L-R, Europa, Callisto, Io, Ganymede.

Space Science Roundup

Rise and Fall of the Arecibo Observatory –

By Scott Turnbull, VAS Member and Solar System Ambassador volunteering for JPL/NASA

Sometimes a grand plan for big science brings forth capabilities far beyond anything previously achieved. The Arecibo Observatory is one such example.

Also known as National Astronomy and Ionosphere Center (NAIC), the observatory is located near the city of Arecibo on the island of Puerto Rico. The observatory has been in operation since 1963. The operation literally came to a crashing halt on December 1st 2020, thus ending 57 years of continuous data collection provided to scientists in search of new discoveries. This article provides a brief history of the facility.

Construction of Arecibo Dish and Sensor Platform

The Arecibo Observatory began with an idea of Professor William E. Gordon, from Cornell University. Gordon's research in the study of the Ionosphere during the fifties led him to the idea of using radar back scatter to collect data. Gordon's persistence culminated in the construction of the Arecibo Observatory. The 305m

(1000ft) diameter dish was completed in November 1963 and has continuously provided valuable data for the scientific community.

The spherical dish was constructed within a natural limestone sinkhole on the island of Puerto Rico. It is formed from 38,778 perforated aluminum panels suspended on a cable mesh above shade tolerant vegetation.

A 900 ton instrument platform is suspended 450 feet above the reflector. Constructed of steel girders, it hangs from eighteen cables strung from three concrete towers. Each tower is tethered to ground anchors with seven 3.25 inch diameter steel cables. Another set of three pairs of cables runs from each corner of the platform to concrete blocks under the reflector. They are attached to jacks which allow adjustment of the height of each corner with millimeter precision.

Below the frame of the upper platform is a circular track on which the azimuth arm rotates. The azimuth arm is a 328 feet long bow shaped structure. The curved part of the arm forms another track, on which a carriage house on one side and the dome (installed in 1996) on the other side can be positioned anywhere up to twenty degrees from the vertical. Inside the dome two subreflectors focus radiation to a point in space where a set of horn antennae can be positioned to gather it. Hanging below the carriage house are an array of linear antennas each tuned to a narrow band of frequencies. The antennas point downward and are tuned for the Arecibo spherical reflector. By aiming a feed antenna at a certain point on the reflector, radio emissions originating from a very small area of the sky in line with the feed antenna will be focused on the feed antenna.

Attached to the antennas are highly complex radio receivers. These operate immersed in a bath of liquid helium, to maintain a very low receiver temperature. At such cold temperatures the electron noise in the receivers is very small, and only the incoming radio signals, which are very weak, are amplified. The Arecibo system operates at frequencies from 50 megahertz (6 m wavelength) up to 10,000 megahertz (3 cm wavelength). A total of 26 electric motors control the platform. The motors drive the azimuth and the dome and carriage house to any position with millimeter precision. The tertiary reflector can be moved to improve focusing. The 1 megawatt planetary radar transmitter located in a special room inside the dome, directs radar waves to objects in our solar system. Analyzing the radar echoes provides information about surface properties and object dynamics.

The Scientific Legacy of Arecibo Observatory Discoveries

In 1967 data collected by the Arecibo Observatory was used to determine that the rotation rate of Mercury is 59 days, not the previously estimated value of 88 days. The rotation is not tidally locked, but rather, the rate is an orbital resonance with 2 orbits for every 3 rotations.

In 1968 Arecibo measured the 33-ms period of the Crab pulsar. Only sporadic radio pulses from the Crab nebula supernova remnant were know before Arecibo.

In 1974 Arecibo discovered the first ever binary pulsar. Changes in periastron confirmed the predictions of General Relativity. The 1993 Nobel Prize in Physics was awarded to Hulse and Taylor for this discovery.

In 1981 Arecibo produced the first radar maps of the surface of Venus. Optical images show only the top of the thick cloud layer.

In 1992 Arecibo discovered ice at the North and South poles of Mercury. The ice persists in shadowed craters despite the high temperatures, 800°F, at the surface; this discovery was confirmed in 2014 by NASA's MESSENGER spacecraft.

Also, in 1992 Arecibo discovered the first ever exoplanet. In subsequent observations, an entire planetary system was found around the pulsar PSR 1257+12.

In 2015 NANOGrav (North American Nanohertz Obs for Gravitational Waves) uses an array of high precision millisec pulsars to search for gravitational waves from supermassive black hole binaries. Upper limits are already constraining models of spacetime strain.

In 2016 Arecibo discovered the first ever repeating Fast Radio Burst. FRBs are millisec-duration, radio pulses that appear to be extragalactic. The repeater demonstrates that its source survives the bursts and rules out a class of models requiring catastrophic explosions.

The Popular Media Legacy of Arecibo Observatory

In 1974 the observatory director, Frank Drake, celebrated an upgrade to the antenna by transmitting a 3 minute-long, friendly message to the globular star cluster, M13. This is the most powerful message ever sent from Earth. The message should arrive in the vicinity of the cluster in approximately 22,000 years.

In 1992 the NASA SETI Program began a study of 1,000 star systems using Arecibo. Some of these stars were several hundred light-years away, so Arecibo's unrivaled sensitivity was a major selling point.

After the cancellation of the NASA program, private- and university-funded projects kept Arecibo in the SETI game. The SETI Institute used Arecibo for three years beginning in 1998 as part of its Project Phoenix, a scrutiny of about 800 nearby star systems.

The Arecibo Dish is featured prominently in the 1977 movie "Contact", based on Cark Sagan's novel describing discovery of an extra-terrestrial signal.

The observatory is also famously depicted in the 1995 James Bond movie "GoldenEye". The movie's climax involves a fight to the death above the huge dish, with the multi-ton instrument package crashing into the dish, finishing off the villain.

End Game

As the fates would have it, GoldenEye was perhaps a bit too accurate in predicting the way the Arecibo Observatory would meet its end.

The observatory had been amassing deferred maintenance over recent years. Repairs were made as necessary to recover from hurricane and earthquake damage. A lack of proactive maintenance left the observatory in a

precarious condition as the infrastructure aged.

On August 10, 2020 one of the 18 cables that support the 900-ton instrument package slipped loose from its connection point to the instrument platform. An engineering analysis was done, and plans were developed to stabilize the platform and repair the damaged cable.

On November 6th a second cable failed. It broke apart in the middle of its length and caused significant damage to the dish surface and to other cables. The NSF stated on November 19, 2020 that it was decommissioning the telescope due to safety concerns.

On December 1st a third cable failed at its connection point to the instrument platform. A cascade failure commenced immediately, with all cables on one side of the platform giving way. The platform swung down on the remaining cables and plowed into the side of the dish.

An ignominious end to an amazing facility. Its 57 years of service provided scientists worldwide with insight into many atmospheric and cosmological phenomena. Other instruments have been developed that surpass specific capabilities of the Arecibo Observatory, but the loss of observing capacity will be felt for some time to come.

Resources

Information presented in this article was provided by the NSF and SETI from their online resources.

For more information, please refer to
The Arecibo Observatory Website:
https://www.naic.edu/ao/
SETI Institute:
https://www.seti.org/goodbye-arecibo

MARS 2020 Mission – Perseverance Rover – Countdown to Touchdown in February

By Scott Turnbull, VAS Member and Solar System Ambassador volunteering for JPL/NASA

When it comes to scratching the surface looking for new discoveries, sometimes the best way to proceed is to literally scratch the surface. That's what the Perseverance Mars Rover will be attempting to do when it executes its descent and landing maneuvers on February 18th, 2021. Much like its older sibling, Curiosity, the Perseverance Rover must survive "7 minutes of terror" to position itself gently upon the surface of Mars. This is not simply a repeat performance. NASA and JPL have some new tools at their disposal to get the job done (again).

Mission Overview and Status

The NASA Mars 2020 Mission is the follow up mission to the currently active Curiosity Rover and Insight Lander missions. The primary objective of the Mars 2020 Mission is to deliver the Perseverance Rover to the surface of Mars, where it will search for signs of ancient microbial life. The goal is to advance NASA's quest to explore the past habitability of Mars. *See Figure 1.*

The Perseverance Rover is built on the same chassis design as the Curiosity Rover. That makes the mission cost a fraction of what it would have if a design had been done from the ground up. That's not to say that Perseverance is a copy of Curiosity. Far from it.

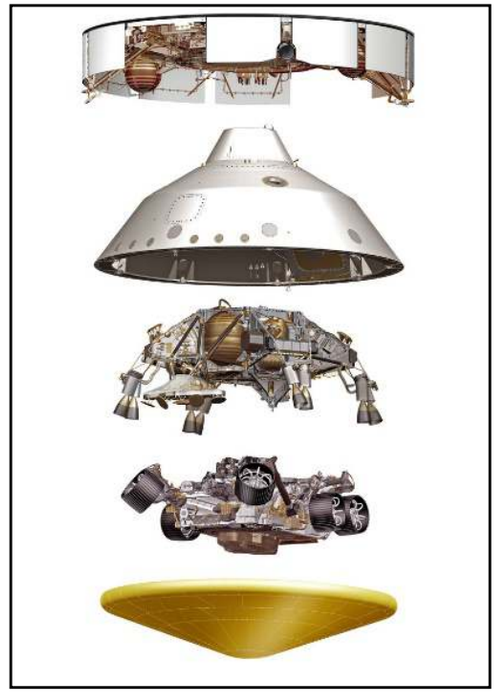


Figure 1

The lessons learned during eight years of Curiosity operation have been applied to upgrade Perseverance. Upgrades have been made to the wheels, cameras, robotic arm, and sampling instruments. Most notable is the ability of Perseverance to secure samples in canisters and deposit them in a cache location where a subsequent sample return mission can collect them for launch back to Earth.

The spacecraft was launched on July 20, 2020, taking advantage of the favorable orbital positions of Earth and Mars. At the time of this writing the spacecraft has been executing its cruise phase for five months, with approximately two months remaining to cruise. The spacecraft has traveled over 221 million miles and has approximately 71 million miles left to reach Mars. *See Figure 2.*

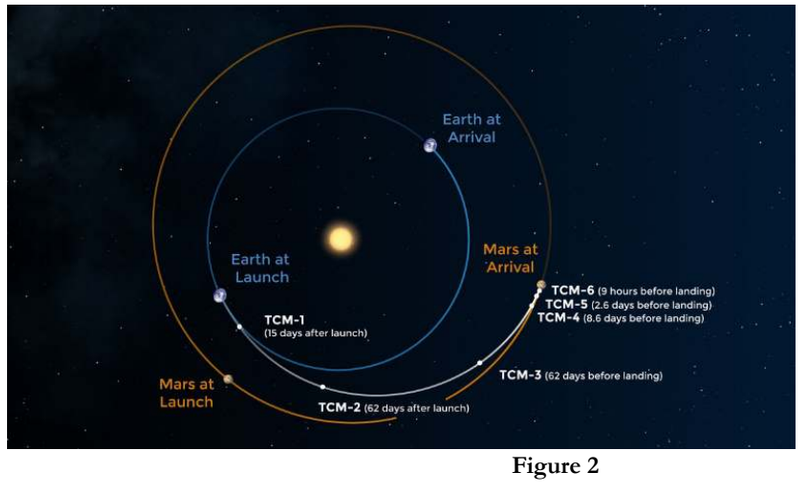


Figure 2

7 Minutes of Terror

On February 18th the spacecraft will execute its Entry, Descent, and Landing (EDL) Maneuvers. The elapsed time for this most perilous portion of the mission is 410 seconds. The engineers at NASA/JPL have previously referred to this phase as "7 Minutes of Terror". It involves aerobraking, ablative heating, hypersonic maneuvering, parachutes, descent rockets, and a sky crane. *See Figure 3*. In the broad picture this is a sequence very similar to that which successfully put the Curiosity Rover on the surface of Mars in 2012. The team at JPL have upgraded the EDL process to increase the probability of success for landing at Jezero Crater. The site was chosen for its features. Features that suggest the area was once covered in flowing water.

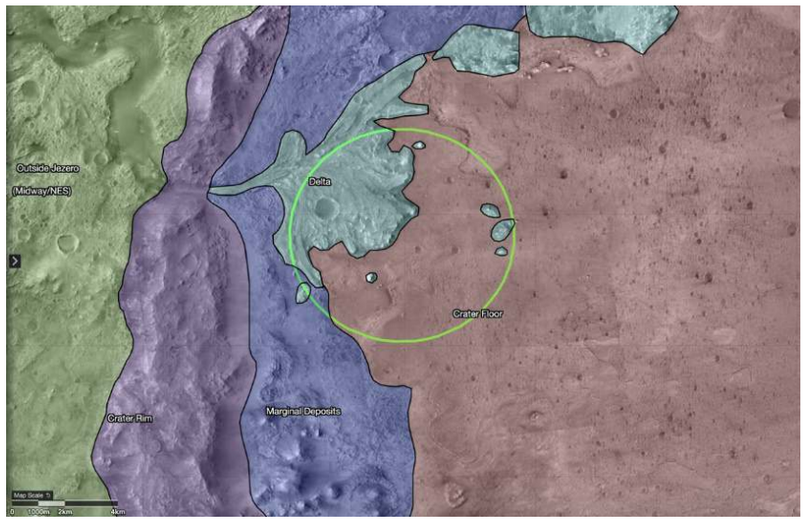


Figure 4

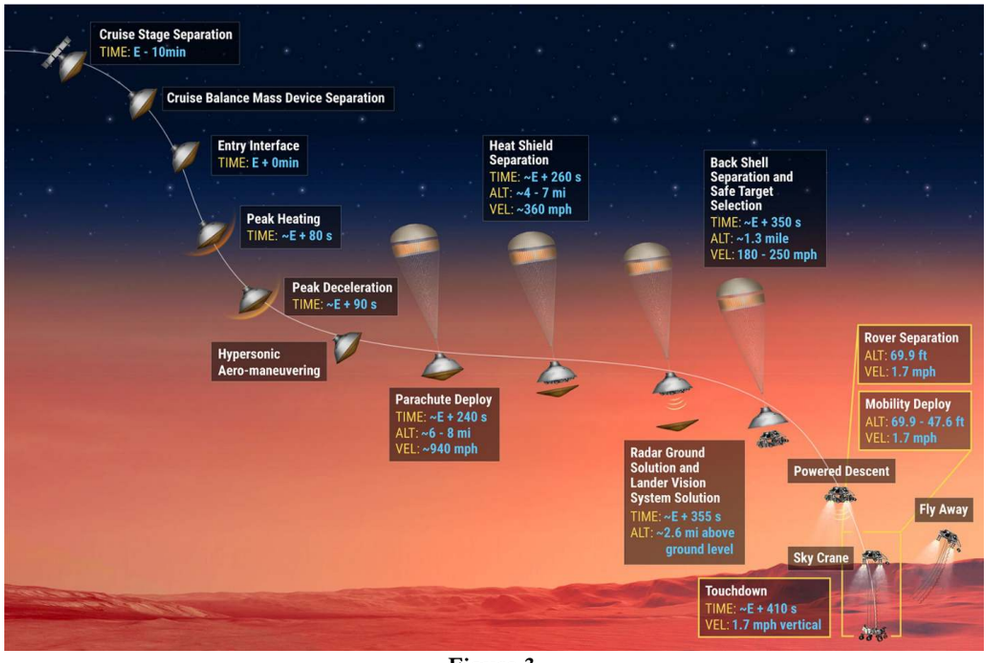


Figure 3

This mission marks the first time that the descending spacecraft will sense the terrain it is rushing towards, match it to internal maps, and adjust its trajectory to center itself in the targeted landing zone. Much as Neil Armstrong needed to adjust the trajectory and pause the descent of the Lunar Module for Apollo 11, the Mars 2020 spacecraft is equipped and prepared to adjust its trajectory and navigate over obstacles as it approaches the landing zone. Radar mapping and vision system terrain recognition will be used to guide the last stages of descent. This must all be done autonomously onboard the spacecraft. The signal lag time to Earth is such that the entire descent and landing sequence will be over with by the time we on Earth see the signal that it has begun.

The Road Forward

Once the Perseverance Rover is successfully delivered to the surface of Mars the primary science of the mission begins. The plan is to operate on the surface for at least one Martian year, which is 687 Earth days. Perseverance is 10 feet long, 9 feet wide, and 7 feet tall. At 2260 pounds it is the size of, but weighs less than a typical compact car. Its six independently driven wheels mounted on a double bogey suspension are designed to navigate the rough Martian terrain without being cut up like the wheels of the Curiosity Rover have been.

The Jezero Crater landing site has many features similar to areas on Earth known to have been affected by ancient flow of water. *See Figure 4*. The goal is to explore those features in pursuit of obtaining the following objectives.

While exploring Mars during surface operations, Perseverance:

- finds rocks that formed in, or were altered by, environments that could have supported microbial life in Mars' ancient past (Objective A)
- finds rocks capable of preserving chemical traces of ancient life (biosignatures), if any existed (Objective B)

- drills core samples from about 30 promising rock and "soil" (regolith) targets and caches them on the Martian surface (Objective C)
- tests the ability to produce oxygen from the carbon-dioxide Martian atmosphere, in support of future human missions (Objective D)

Imagination Takes Flight

In addition to the primary mission objectives outlined above, the Mars 2020 Mission includes one additional technology demonstration never before attempted. Namely the operation of aircraft on a non-terrestrial body. A multi-rotor aircraft, named Ingenuity, is carried aboard the Perseverance Rover. Ingenuity will be offloaded from the undercarriage of the rover, and instructed to fly between one and six short aerial hops over 30 days.

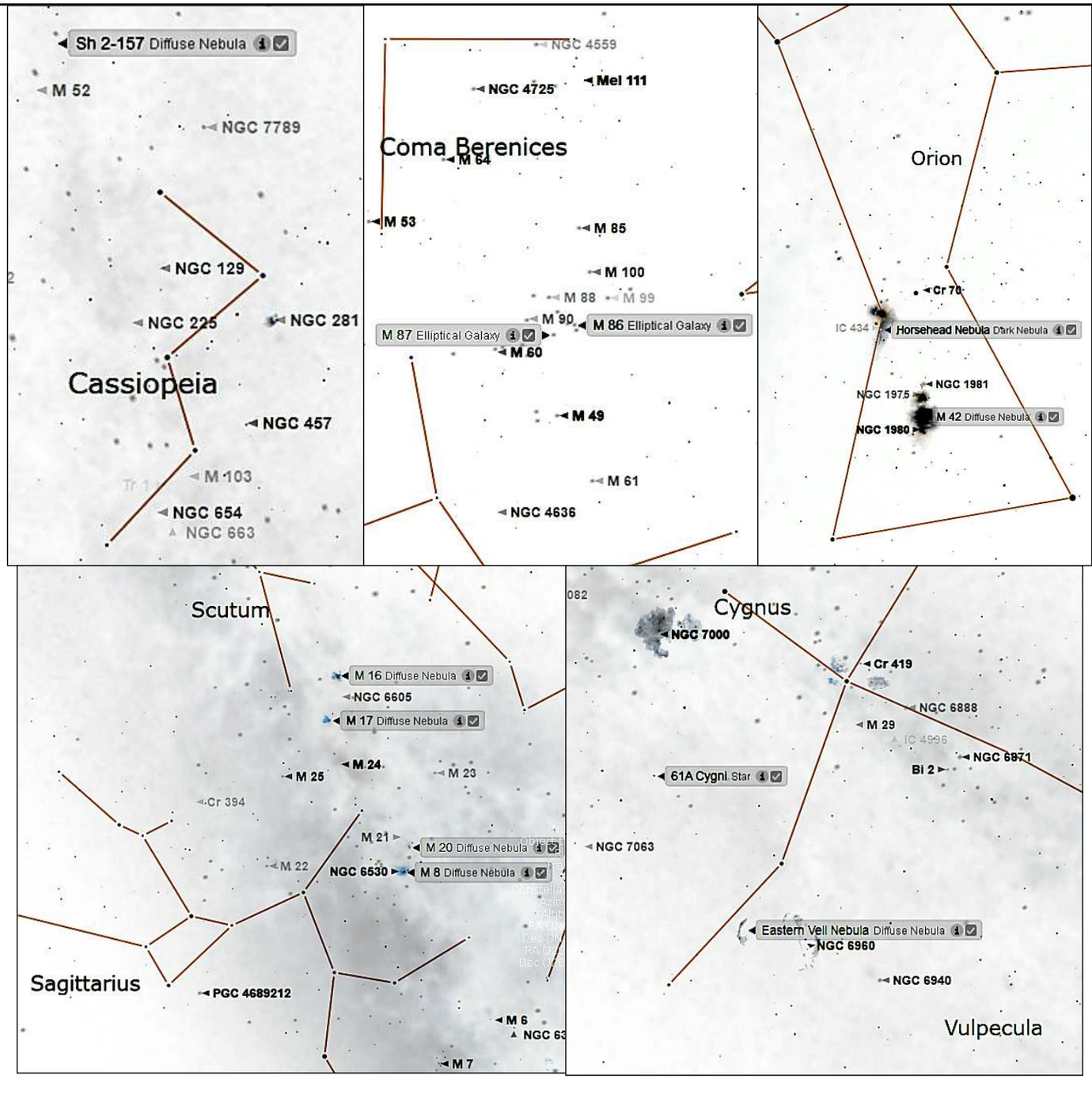
Resources

Information presented in this article was provided by the NASA/JPL mission web sites. For more information, please refer to NASA Mars 2020 Mission Perseverance Rover: https://mars.nasa.gov/mars2020/

NASA Mars Ingenuity Helicopter: https://mars.nasa.gov/technology/helicopter/

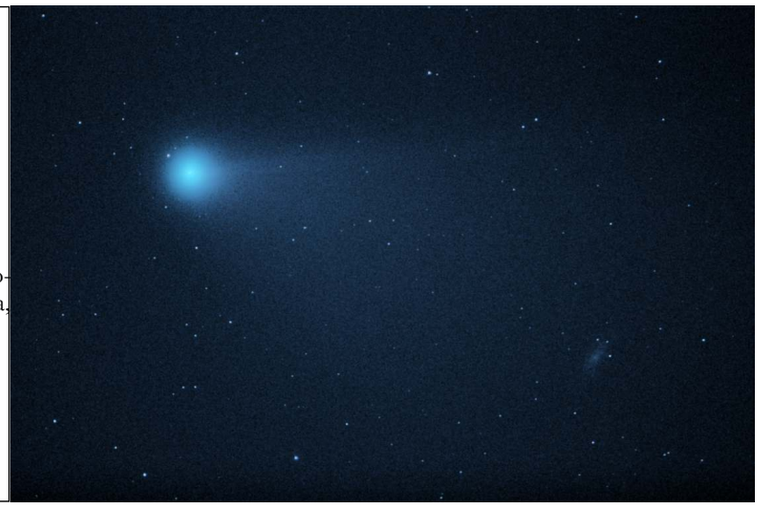
Location Charts for the deep sky object images in this issue.

Created using Starry Night Pro 8 & Picture Window Pro 7.



Comet NEOWISE C-2020 F3 & NGC4559
By Paul Walker

2020/07/31
Field of view 1.2 x 0.8 degrees. 10" f/4 Newtonian, Canon T7i camera, Single image, 1 min @ ISO400.
NGC 4559 is a 10th magnitude spiral galaxy in Com Berenices.



I took all of these with the 11" Celestron Edge SCT with 2X Powermate and ASI224MC color camera. I shot the images all around 2.4ms frame rate, shooting sometimes 1000's of frames. This was my first real foray into planetary imaging, so I didn't really know what I was doing, but it was a fun learning experience. Seeing was terrible most days, but October 31 was excellent at times but I over exposed so not as good a result as I could have had. I processed and stacked the frames in Autostakkert, then used Registax to perform some levels of sharpening by wavelets. Wavelets aren't magic, but if you have good seeing they seem like it. With poor seeing, they really can't fix the issues of seeing.

Wanted

Wanted - First telescope program - I am working to recycle old 4.5" reflectors to construct starter Dobsonian telescopes for first time users. I am looking for donations of old telescopes, 1 ¼" rack and pinion focusers, Plossl eyepieces and other parts..

Contact Keith Lawrence, 802-453-5496, sleepingbearwoodworking @yahoo.com

Wanted- Old medium duty tripods and/or legs that I can use to manufacture binocular parallelogram mounts.

Contact Keith Lawrence, 802-453-5496, sleepingbearwoodworking @yahoo.com

For Sale

4 inch, 550mm f.l. brass Televue Renaissance scope with carrying case
Equatorial mount with oak tripod

2", 20mm Nagler type 2
2" 45deg. righting prism
2" Big Barlow
2", 4.8mm Nagler
1-1/4", 26mm Plossl
2", 45deg. Prism camera adapter

New Price $1700 - will negotiate.

Contact Richard Cummings at Rick@vsbmetal.com

Copies of "Mirror Mirror" - A History of the Human Love Affair with Reflection by Mark Pendergrast of Colchester, Vt. available for **$25.** Mark will split the profits with VAS. Contact Mark at markp508@gmail.com or see Jack St. Louis at any monthly meeting.

Telescopes for sale:
1) Takahashi FC-100DC - this optical tube assembly is in near-mint condition and includes the upgraded Takahashi MEF3 fine focuser and Takahashi clamshell holder: **$1900**.
2) Edmund Scientific Astroscan - a nice, collimated made-in-Japan specimen of this classic telescope with clean and surprisingly good optics. Includes the original mount, strap, and dust caps - **$160**

Mount & tripods for sale:
1) Scopetech Zero alt-az mount - excellent condition. Includes ADM slow-motion knobs: **$315**.
2) Manfrotto 475B geared tripod - good condition: **$275**.
3) Berlebach Report 212 tripod - like-new condition: **$275**.

Combination:
The FC-100DC + Scopetech Zero + either of the tripods that I listed makes for an outstanding alt-az refractor setup. I'll **reduce the total price by $50** if you would like to purchase these together.

Eyepieces for sale:
1) Tele Vue 3-6mm Nagler Zoom - like-new condition: **$300**.
2) Tele Vue 27mm Panoptic - like-new condition: **$250**.
3) Meade 12.4mm "Research Grade" wide-angle (70°) - excellent condition: **$60**.

Binoculars for sale:
Zeiss Jenoptem 10x50 wide-angle (73°) - beautiful, clean, collimated pair that includes dust caps, strap, and the original leather case: **$225**

Contact Siddhesh (Sid) Mukerji at siddmukerji@gmail.com if you're interested. I'm happy to answer questions.

Observing Aids for sale

Observing chairs - Enjoy longer observing sessions. Adjustable seat height for comfort and better viewing. **Starting at $90**.

Binocular parallelogram mounts- - Raise and lower your binoculars while maintaining an object in the field of view. Work well for use with lounge chair for observing at higher elevation or for multiple observers of different height. I will fit your binoculars to the mount for optimum performance. **Starting at $195.**

Binocular mount for your tripod - replace the bracket with a system that keeps the binoculars in balance. Find an object, release the binoculars and they stay where their pointed. **$50**

Clip on red book lights with variable brightness - I am working on modifying these for use on clip boards etc. If you have an interest please email or call me to discuss your need.

Contact Keith Lawrence, 802-453-5496, sleepingbearwoodworking @yahoo.com

ETX-125 OTA only--This one has the USA made optics. Just too heavy for my needs. Needs some TLC but gives the images you expect out of this model. Contact me for more details if interested. **$50**
Orion Tri-mag 3x Barlow in very good condition - **$30**
Celtstron Omni 2x Barlow in excellent condition - **$25**
Contact Paul Marino, paulmarino@gmavt.net or call (802) 482-5128

Celestron NexGuide Autoguider

I purchased used at the Stellafane Swap Tables as a backup to the one I am using, however, I forgot had already purchased a backup at the Swap Tables the previous year. I don't really need 2 spares.
$140 OBO. ($300 new)

Paul Walker 802-388-4220 or paulwaav@together.net

6" f.4 Apertura Newtonian telescope Model 6F4N, 16 months old, in original box, purchased from Highpoint Scientific, current list price is $299. Crayford 2 inch dual speed focuser, 2" to 1.25" Adapter, 8 x 50 mm finder, cradle rings, Vixen-style Dovetail plate, 35 mm 2" extension tube, dust cover.
Package includes: Bahtinov focusing mask - $22 value, Meade 1.25" laser collimator (608001) - $45 value, Baader solar filter (home-made) - $90 value
Package Price = $160

Contact: Gerry Davis, mac319@aol.com or 802-878-2109

Light duty machining and custom hardware for astronomy. Simple adapter plates and other custom made or custom modified hardware for VAS members.

For a nominal fee (~$10 - $50 depending on size and complexity) I will consider making custom mounting brackets and adapters. I can also do some custom modifications to existing brackets and hardware. Dependant on availability of material and my time.

I have a have mini milling machine and a mini lathe.

Paul Walker 802-388-4220 or paulwaav@together.net

Explore 6" apochromatic telescope for sale $2,999.00 list price $5,400. The scope purchased new 5/14. The scope has had light use over the years.

152mm aperture Air-Spaced Triplet Optics with HOYA FCD1 ED Glass and EMD Coatings; Carbon Fiber Tube Assembly and Removeable Dew Shield; Two-Speed 3" Feathertouch Focuser; Cradle Ring with Handle and Losmandy Style Dovetail Plate; 99% Reflective 3-inch Diagonal (with 2-inch and 1.25" Adapter); Deluxe Carry Case.

Contact Ron Anstey 802-233-0726 or rgaranstey7115@gmail.com.

First Telescope Program
With the support of the VAS Board, I am developing a First Telescope Program for new members of the club. For now I am seeking a few of the old 4 ½" f/8 Newtonian telescopes that I can renovate, fit with 1 ¼" rack and pinions and eyepieces then outfit with Dobsonian mounts. **My target is to sell these to club members for $100 or non-members for $125**. For the first year the new owners can return it for full refund in case of non-use or to upgrade, etc. After a year the refund will depend on condition. Sales will depend on availability of telescopes and components, so if you have old telescopes, eyepieces or parts you want to sell or donate or if you know of someone who would like an inexpensive telescope that really works, please contact me.

Contact Keith Lawrence, 802-453-5496, sleepingbearwoodworking @yahoo.com

Orion EQ-1 equatorial mount and tripod with Orion AstroTrack Drive. Small portable mount good for a small telescope and/or as a camera platform for wide field astro-imaging. Also has Orion 1/4"-20 Adapter for quickly attaching cameras.

The drive runs off a 9v battery, uses a dc servo motor and has variable speed control.
All together the combination goes for $192 new, **asking $50**.

Tom Clevland at ClevelandT@biotek.com

Meade 6" LXD55 telescope with the following: 26mm eyepiece, Finder Scope, Anniversary eyepiece kit with 15mm; 6.4mm; 9.7mm; 12.4mm; 40mm; 32mm; and 20mm. Solar filter, Dew cap, Autostar Instruction Manual, Martin Preston users guide
Asking $350 with the accessories listed.
Contact Bruce Harmon, 802-876-7535 or bdhinvt@yahoo.com.