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April 2024

Club Website:
http://vlgastroclub.org/
Facebook:
https://www.facebook.com/groups/vlgastroclub/

Club Officers & Directors

President	Mark Graybill
Vice President	Ken Katta
Secretary	Randy Gilbert
Treasurer	Linda Meng

Newsletter Contact
saundby@gmail.com
(please include TVAstro in subject line)

UPCOMING EVENTS

Exec Directors' Meeting, May 3rd, 11am

All members are welcome, join us at Fishhawk Recreation Center, 2318 Buttonwood Run, from 11a to 12p as we plan 2024 and 2025 events and meetings. This meeting will largely focus on our summer educational activities such as Camp Villages, local summer school programs, and a volunteer event at Camp Geneva on May 16th.

Space Academy, May 6th, 6:30pm

This month's Space Academy meeting looks at "**Stellar Cores, Atom Factories**." Recent discoveries about Super Massive Black Holes at the centers of galaxies will also be discussed.

The meeting will be held at Truman Recreation Center, 2705 Canal St. and is open to all Villages residents and guests with ID.

Telescope Workshop, May 6th, 8pm

Learn about how to choose and use a telescope, binoculars, or smart scope. Learn about techniques and accessories for your equipment to make astronomical observation easier.

The Telescope Workshop is held at the Truman Recreation Center pavilion, behind the pool as viewed from the parking lot. Follow the sidewalk around the left side of the pool.

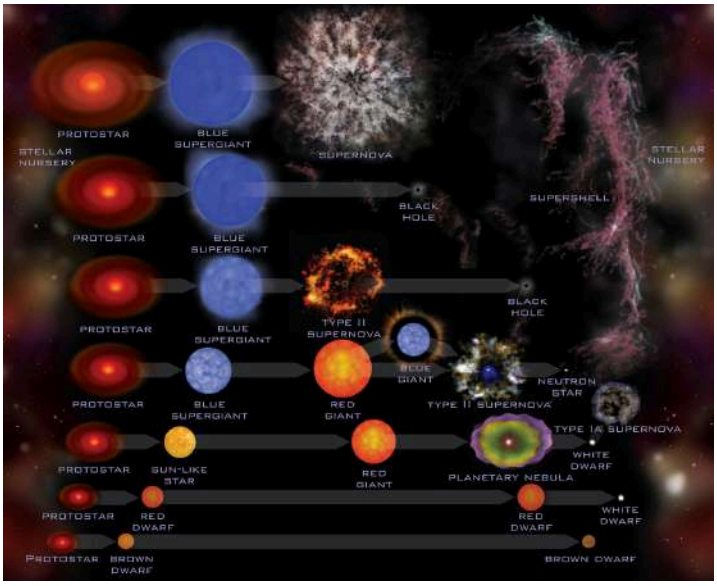
Sombrero Galaxy, M104, April 28, 2024
by member John Keller, 64 minutes, SeeStar S50

May 18th, 5pm:
Fruitland Park Astronomy Group

The Fruitland Park Astronomy Group meets for an evening of observing and talk on the third Saturday of the month every month, conditions allowing. The meeting is at the Cales Soccer Field in Fruitland Park at 300 Shiloh Road (at the corner of Shiloh Road and Dixie Avenue, north of the Fruitland Park water tower.) The Villages Astronomy Club members and the public are welcome. Gate opens at 5pm, solar observers can catch the sun while it's up, and astro observers can set up in daylight.

Scopes can be set up directly off of tailgates onto pavement, or taken further into the park to avoid lights. Bring power if needed.

General Meeting, May 21st, 6:30pm:
The Life and Death of Stars by Mike Peterson



Join us at Laurel Manor Recreation Center, 1985 Laurel Manor Drive, to learn about how stars form, change over time, and the many paths they may follow as their composition changes and as their nuclear fires fail, in many cases cataclysmicly, turning them into stellar remnants.

Space Academy and Telescope Workshop Combined Session, June 3rd, 6:30pm

For June, we will combine the Telescope Workshop and Space Academy meetings! Both meetings will be held inside the Truman Recreation Center at 2705 Canal St. in the Studebaker Room.

After an opening discussion of current research findings by Toni Graybill, we will have a presentation "**Astrophotography Processing Basics**" by Mark Graybill.

This presentation is for both beginning and aspirational astrophotographers, as well a general public members with an interest in how the astrophotos they see are made.

It will begin with the basics of how astrophotos are captured, the "calibration frames" that are captured with them, and how they are used to create a stacked image.

The stacked image will then be post-processed to bring out the contrast and colors of the final image. All processing will be done live as you watch, using free software.

You can start as simply as with a tripod and a digital camera, or take your EAA astrophotos to the next level by doing your own processing of your device's images.

Globular Cluster M3
A cluster of ~500,000 stars orbiting our galaxy. It is the farthest known globular in our galaxy.
Image by Mark Graybill from Homestead Astronomy Park

Calendar: https://vlgastroclub.org/calendar/

Recent Events

Solar Eclipse at Homestead, April 8th, 2024

The day of The Great American Eclipse did not pass The Villages by! While millions of people were able to enjoy this unique astronomical event from the path of totality, stretching from Mexico to Maine across several densely populated metropolitan areas, we were still able to see a partial eclipse from here in Florida.

While the experience of a partial eclipse doesn't hold a candle to that of a total eclipse--a 90% eclipse does NOT give 90% of the experience of a total eclipse--even a partial solar eclipse gave people an occasion to join The Villages Astronomy Club and The Villages Recreation at the Homestead Recreation Center for our eclipse event.

Several months in advance of the event, club leadership had to decide how many solar

glasses to purchase. We knew they'd be in short supply near the event itself, especially in areas outside the path of totality. What we didn't know was how much interest the eclipse would draw in The Villages.

Volunteers Jeff Kahler and Toni Graybill Provide Solar Glasses and Information at Our Booth

We had just had a very similar partial eclipse on October 14th, 2023. 60% of the Sun had been obscured by the Moon as viewers in the southwest enjoyed an annular eclipse--an eclipse where the Moon passes directly in front of the Sun, but is too far from Earth in its orbit (near its perigee, the farthest point from Earth) to block the complete face of the Sun.

At that eclipse event, we had prepared with 300 pairs of solar glasses. We had about 800 attendees at the event, and most shared their glasses so the number of solar glasses had been about right. Having the event on a Saturday meant that more people had been able to attend the event, whereas the April eclipse would be on a Monday. How many people would interrupt their usual Monday routine for another ~60% eclipse?

The club's executive board had to decide how best to use the club's funds. After all, the glasses cost us money from our donations and dues, and we had to be able to cover our other expenses.

In the end, we decided to increase the numbers of glasses we'd have to 400 pairs. Then, when we went to order the glasses the Astronomical League offered us 500 pairs for about the same price as we'd expected to pay for 400 pairs, and Treasurer Linda Meng jumped at the deal. Thank goodness!

On top of that, Secretary Randy Gilbert, our NASA Night Sky Network representative, secured an additional 70 pairs of glasses for us from Night Sky Network. We also had some glasses left over from October, though they ended up being misplaced, so we didn't have them at the eclipse event.

In the end, we had 570 pairs of solar glasses.

Where Are All the Astronomers?

Our next challenge was making sure that we had enough astronomers and volunteers for the event. Club members have an interest in total eclipses, being more aware than the average person of how special it is to experience a total eclipse. So many of them were traveling to the path of totality.

Astronomers Randy Gilbert, John Keller, Jeff Morse, Glenn MacKinnon, and Ken Katta Show the Eclipse

How many were we going to have with us in The Villages, to staff an event that promised to be even larger than the one in October?

Fortunately, we had enough astronomers with solar viewing equipment let us know that they'd be here that we knew we'd at least be able to cover showing the eclipse through telescopes for attendees. But making sure we had enough

volunteers for everything else--staffing our booth, directing people, leading tours of the Solar Walk, and people to make sure the other volunteers were able to take breaks, get water, and so on. Plus, we had a new task to perform that we hadn't had in October.

Volunteers Ken Katta and Frank Bridge Align Equipment on the Sun

The Virtual Experience

In addition to our normal daytime astronomy event activities, we decided to secure an inside room of the Homestead Recreation Center, where we would project video livestreams from along the path of totality. There, attendees to the event would be able to see video of totality as it occured at various places along the route it travelled through North America, and see the reactions of the people there.

Volunteer Pauline Schwartz Operates the Livesteam Projection inside Homestead Rec Ctr

Of course we thought it would be a good idea to add something new right when we knew we'd be shorthanded!

Fortunately, the club's volunteer coordinators were able to make sure that we'd have someone there to do the job, and an alternate to assist or cover the post in case something came up.

Solar Glasses Madness

Things were coming together as the date drew closer. We still weren't sure what sort of turnout to expect. Then, in late March, the phone calls, emails, and texts started coming in.

We started receiving several contacts every day from people looking for solar glasses. Apparently, some local stores had advertised that they had solar glasses (or it had been included in national ad copy for stores with local outlets.) And when people went to get some, they didn't have any. So they called us, wanting to know if we had any.

The Kahler Family Enjoys the Eclipse with Solar Glasses

We had some, but we'd secured them for attendees at our eclipse event. The Astronomy

Club is not a store. We don't stock and sell astronomy equipment. And if we sold our solar glasses, we'd be disappointing a lot of people at our event. Because we could easily have sold out all the solar glasses we had before the end of March, if we'd been willing to sell.

People wanted some for themselves, or for a block party they were planning. Or for their institution. We got calls from people inside and outside The Villages. And as the eclipse drew nearer, the numbers of calls, texts, and email grew greater, and the urgency of the callers grew greater as well.

Media Misnomers

Some people thought that even being outside during the eclipse without solar glasses would damage their eyes. They seemed to have the idea from news reports that solar viewing glasses were a special kind of sunglasses that were needed to protect your eyes during an eclipse, because somehow the Sun's rays would be more damaging during that time.

When we told callers that we would have solar glasses at our event, some complained that they didn't know how they could get there if they couldn't go out without a pair of solar glasses on. We'd explain that the solar glasses were only needed for looking directly at the Sun, and sometimes the message would come home.

Hopefully there wasn't anybody out driving on the roads with a pair of solar glasses on during the eclipse!

The Day Arrives

By the time the eclipse came, it was clear that we were likely to have a huge turnout for our event. Among all the calls about solar glasses, we had also received many contacts wanting further details about our eclipse viewing event. The Villages Recreation shifted schedules and changed plans to accommodate the large numbers we anticipated, set up traffic controls at Homestead, and bolstered their staff on hand. We prepared ourselves as well, making sure that we did everything we could to provide a good experience for those attending the event.

Before long, we had ourselves set up, and we brought out the much-desired solar glasses. By this time, a line had already formed at the booth.

The Line for Solar Glasses Stretched Up to the Front of Homestead Recreation Center...and Beyond...

From 11am to 2pm, when we ran out of solar glasses, there was a consistent line of about 100-120 people waiting to get solar glasses. We restricted the numbers of solar glasses per person and asked people to share glasses among their group so that as many people as possible would have the opportunity to get glasses and see the eclipse directly.

Volunteers Ron, Annette, and Jeff Cheerfully Distribute Solar Glasses

As the number of glasses dwindled, our volunteers went out to the line, letting people

know at what point in the line the glasses were going to run out, so that they wouldn't have to wait in line fruitlessly, and could go enjoy views of the eclipse through solar scopes or from the livestream rather than standing in line.

Finally, the solar glasses ran out. Shortly after, we noticed that somebody had snitched the glasses off of our Snoopy doll. Those glasses were old, out of date glasses, and had been a keepsake of one of our members from the 2017 total solar eclipse. We didn't hear of anyone being blinded, but those glasses were not intended for anyone to use.

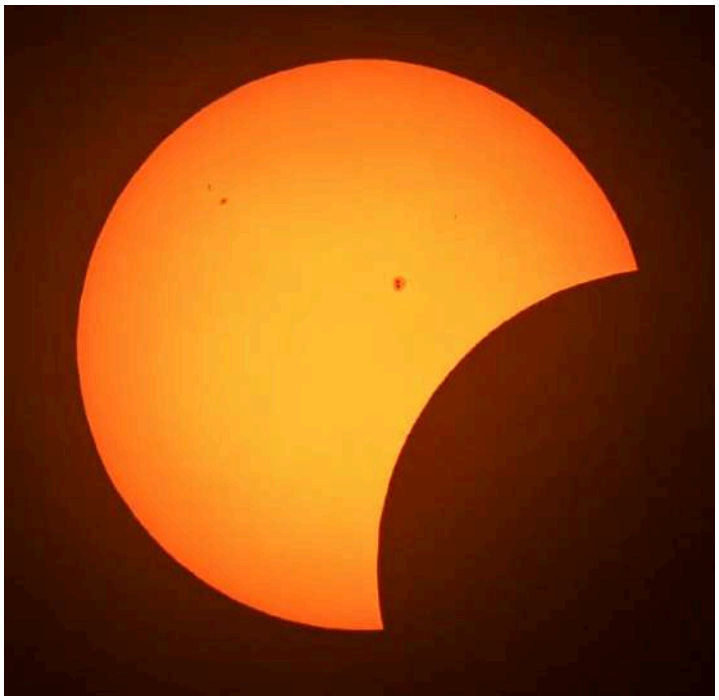
Somebody Took Snoopy's Glasses, Which Were Out of Date and Not Intended for Use!

The Eclipse

While totality only lasts minutes or seconds along its path, the partial phases of an eclipse last for a long time before and after. Off the path of totality, like here in Florida, we don't get totality, only the long, slow progress of the partial eclipse.

For us, First Contact, the time at which the Moon's disk first superimposes itself on the Sun's disk was at 1:50pm. Actually seeing this is very difficult, especially without a solar scope, but it marks the time to start watching closely to see when you can actually see a "bite" taken out of the Sun's disk.

By 1:57, 5% of the Sun was covered by the Moon, so the eclipse had visibly started, even to those watching without any magnification through solar glasses.



The Moon Approaches the Center of the Sun, with Multiple Sunspots and Active Regions Visible Image by John Keller

From that time on, the Moon would cover more and more of the Sun's disk. Due to the geometry of our location relative to the Sun and Moon, the Moon appeared to follow a curved path across the face of the Sun, where it appeared to dip inward from the southwest side of the Sun, approach toward its center, then curve back outward to the northwest side of the Sun.

The peak of the eclipse from The Villages was at 3:07pm, with about 65% of the Sun's surface covered by the Moon. This is not enough to visibly affect the perceived sunlight of the day. If you didn't know there was an eclipse, you wouldn't notice it being dark. Only when an eclipse is over 80% do you begin to notice that

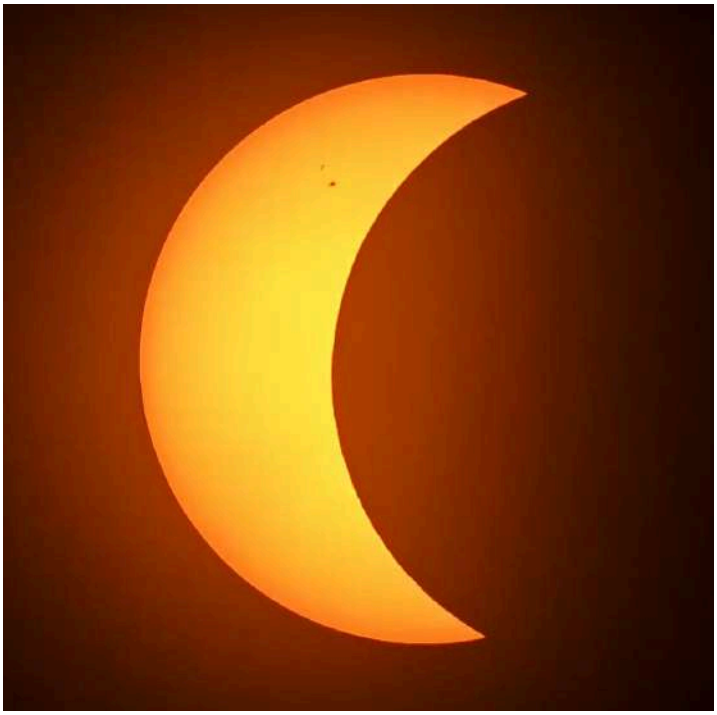
the day seems darker, and over 90% the air and sky begin to take on a strange color and feel.

Peak Eclipse

At peak, we had roughly 1000 people at Homestead Recreation Center. They were distributed all across the area, sharing solar glasses, looking through our telescopes, or using pinhole cameras. From the Astronomy Park and Nature Walk areas to the far side of the pool and pickleball courts, people were seeing the Moon blocking out 2/3 of the Sun.

From that time on, the Moon was working its way away from the Sun's center. There was still an eclipse to view, and would be until 4:18, when Final Contact, the separation of the Sun and Moon occurred.

Over the course of the eclipse event, we had about 1400 people attend. Some came only briefly to obtain solar glasses, others left before peak, and some wisely came after to avoid the crowds and see the eclipse with a bit less of the Sun hidden by the Moon. Seeing a 60% eclipse really is 90% of the experience of seeing a 65% eclipse!



The Eclipse Near Peak
Image by John Keller

Thank You to Our Hardworking Volunteers:

With a team of 15 volunteers, and the able assistance of The Villages Recreation Department, we were able to run a great event for about 1400 attendees. Thank you to members George Dubrasky, Frank Bridge, Ron Dienhart, Pauline Schwartz, Ken Katta, Jeff Kahler, Annette Bushfield, John Prudente, Glenn MacKinnon, Marilyn Awkerman, Jeff Morse, Randy Gilbert, John Keller, Toni Graybill, and Mark Graybill for your work!

Also a huge thank you to Amanda Brooks, director of the Homestead Recreation Center, and her hardworking staff, as well as all the Recreation personnel who were part of making this event safe and fun for everyone.

Volunteer George Dubrovsky Leads a Tour of the Solar System on our Solar Walk

Future Eclipses

To highlight how special this eclipse, and last October's was to us here, the next eclipse that will be visible from The Villages will not be until January, 2028. And it will be only 11%

coverage of the Sun by the Moon, with an annular eclipse visible in South America, the Atlantic, and Spain.

January of 2029 will bring another partial eclipse, with 31% of the Sun's disk covered. We will have other solar eclipses over the years, but none that will cover more of the Sun than April's did.

Club President Mark Graybill Speaks to The Villages Media About the Eclipse and Our Club

Until August 12, 2045, when our area will experience a total eclipse! Middleton will experience over 6 minutes of totality, an exceptionally long period, thanks to especially good geometry between the Sun, Moon, and our location here in The Villages! Here's hoping at least some of our current members will be there to enjoy it!

[Editor's note to the Astronomy Club of 2045: My advice to the club is to not try to hold a single event for totality, but work with The Villages Recreation to hold multiple events at Regional Recreation Centers and squares across The Villages! Coordinate with astronomers in your other clubs coming in from outside The Villages to bring in enough solar scopes for all the different sites.]

Uncredited images in this article were provided by Jeff Kahler, Sr., and were taken by Jeff Kahler, Sr, Kathy Kahler, and Jeff Kahler, Jr.

NEWS

Delta IV Final Launch

United Launch Alliance brought the Delta Launch Vehicle Program to a conclusion with their launch of a Delta IV Heavy rocket on April 9th.

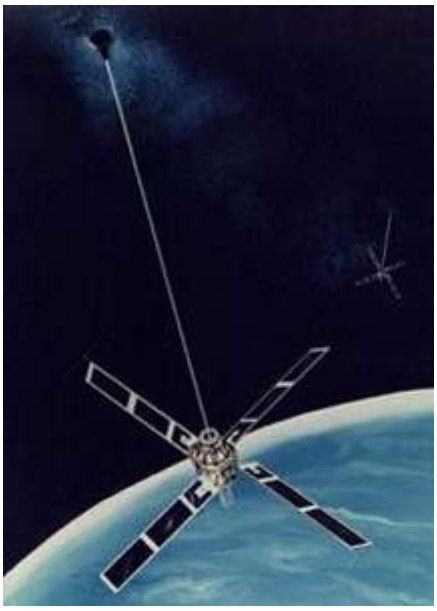
Delta IV Heavy at Ignition on Final Launch of a Delta Launch Vehicle on April 9, 2024.

Originally based on the Thor missile, Delta launch vehicles have been in use since 1958. This launch ends the 65 year career of Delta.

Thor-Able Carrying Pioneer I, October 11, 1958. NASA Image (NASA was 11 days old on this date)

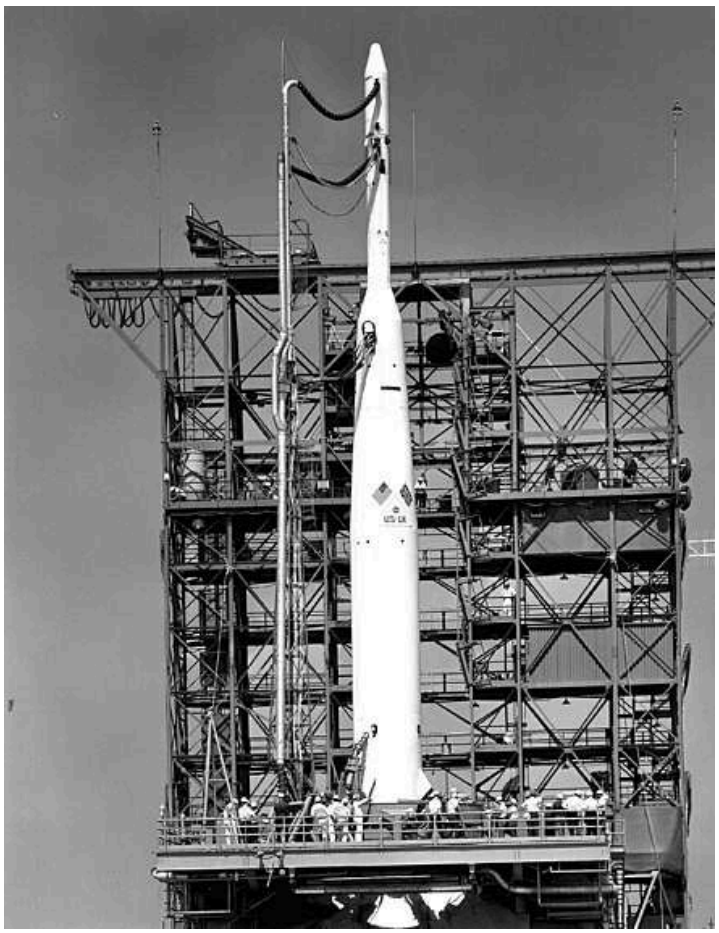
As surplus Thor missiles were demobilized in Europe and returned to the United States, they were seen as candidates for inexpensive launch vehicles for scientific space missions. The Thor booster was combined with the Able upper stage of the Vanguard launch vehicle to create the Thor-Able launch vehicle. The new National Aeronautics and Space Administration would inherit several science missions to be launched on this vehicle when they came into existence from NACA and other space science organizations on October 1st, 1958.

In 1959, the Able upper stage received upgrades to its propellant tanks to increase the capability of its Aerojet AJ-10 rocket engine, and the stage was redubbed as Ablestar. In the Thor-Ablestar configuration, many space probes and early communication satellites were sent to orbit safely and inexpensively compared to the more expensive Atlas and Titan rockets.



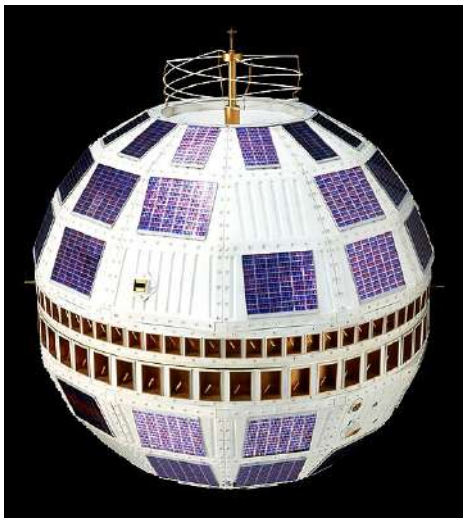
Transit Communication Satellite, Artist's Concept. Thor-Ablestar Launched Early Transit Satellites Beginning in 1960. NASA Image.

The next upgrade to the upper stage saw it renamed as Delta. This differentiated it from the military version of the Thor launch vehicle, renamed SLV-2 (Standard Launch Vehicle-2). Thor-Delta launched the Echo satellites, the Tiros satellites, Explorer 10 and 12, the U.K.'s first orbital satellite, Ariel-1, and perhaps most famously, the Telstar 1 TV communications satellite.



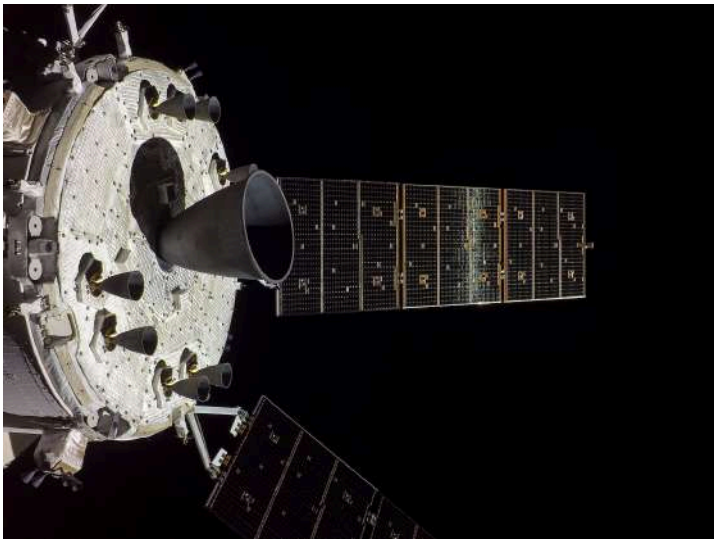
Thor-Delta 9 Prepares to Launch Ariel-1, the First Orbital Satellite of the UK. NASA image.

It was with the launch of the Telstar satellite that the name came to be shortened to the more familiar Delta name that continued to the present day.



Telstar 1, NASA image.

The root of the Delta name was the second stage, powered by the same AJ-10 engine as had been used on Vanguard, Able, and Ablestar, now known as the Delta engine. The AJ-10 was also used in Apollo as the Space Propulsion System on the Apollo Service Module, the rocket that had to work to bring the astronauts home from lunar orbit. This engine was also used on the Space Shuttle, as the Orbital Maneuvering Engine, mounted in pods above and behind the cargo bay by the tail of the Orbiter. These engines have been re-used for the Artemis program's Orion capsule's European Service Module as its main engine.



AJ-10 Delta Engine, Former Shuttle OMS Engine, on board Artemis I as it returns toward Earth from The Moon. NASA image.

Delta Grows

After the many successful uses of the Delta, users wanted a more capable version to launch larger satellites and probes deeper into space without the high costs of other, larger rockets. The first stage's propellant tanks were enlarged, with the fuel tank losing its distinctive taper, and the propellant tanks for the Delta upper stage were enlarged as well, giving the Delta launch vehicle a straight-sided new look. The new Delta 1000 series received the moniker of "The Straight Eight." Some versions replaced the Aerojet AJ-10 engine with the TRW-201 engine, as used on the Apollo lunar lander descent stage.

A Delta "Straight Eight" Launches NASA's Orbiting Solar Observatory 8, June 21, 1975. NASA image.

Delta continued to be developed in this form. To reduce costs, its first stage was outfitted with left-over H-1 engines from the Saturn I program that were not going to be used after Saturn was upgraded to the Saturn IB, then excess Saturn IB first stage engines were used in Delta after all Saturn production was cancelled during the Apollo program.

Shuttle and Challenger

With the development of The Space Shuttle, Delta launch vehicle production was slated to end. Congress had prescribed that Shuttle would be the sole launch vehicle used for orbital flight by the United States, replacing all of the Delta, Titan, and Atlas rockets. Optimistic estimates for the Shuttle were used to predict that Shuttle could replace all other launchers, with predictions of 40 or more Shuttle launches per year (10 flights per year per Shuttle.) The early 1980s would see all other launchers replaced.

As Shuttle's first flight was delayed, and more reasonable estimates of its abilities began to emerge, planners extended the production of the legacy launch vehicles to cover the early 1980s.

Then came the Challenger Disaster.

In the wake of the disaster, it became apparent that the estimates of 20 flights per year were overly optimistic. 1985 had seen the Shuttle perform 9 flights in one year, and after the changes to Shuttle's operations to improve safety, it never flew more than 5 times in a single year afterward.

Yet the United States, and its space partners, had many plans that required more launches.

Multiple programs were started to provide that extra launch capability. One was the conversion of deactivated Titan ICBMs into space launch vehicles. Another was the development of a new heavy-lift Titan launch vehicle called Titan IV. Likewise, Atlas got a new lease on life as the Atlas II--newly manufactured versions of the Atlas similar to the original, but with many upgrades for safety and cost reduction, as well as a more capable upper stage.

One program left out in the cold by the reduction of Shuttle flights was originally developed as a new version of the Milstar navigation satellites. To defray costs, and to extend the benefits of navigation satellites to non-military users, the new system was renamed the Global Positioning System (GPS), and it would have several modes available for civilian use.

At first, the new GPS program faced a lot of resistance from politicians fearful of such information placed in the hands of the public. Then a demonstration was performed, showing the use of open Milstar navigation, which required a large complex setup of antennas, receivers, portable field computers, and display units. Operators described each action in detail as they worked the complex arrays of knobs, switches, and buttons on the various boxes connected by series of cables. After roughly a quarter of an hour, the final box in the chain displayed a precise latitide and longitude on a pair of NIXIE displays, which was referenced to a paper map to show their location.

After seeing the size, cost, and complexity of the setup required to use it, the recalcitrant politicians agreed to support the program's use by civilians. Little did they know how rapidly all that equipment would be reduced to fit inside a device the size of a walkie-talkie. Never mind today's wristwatch GPS units!

But all these satellites for the new GPS constellation would need a ride to space. A ride they could afford, especially at a time when space spending was ballooning to cover the costs of other new launch vehicles for better-funded programs.

Enter the Delta II.

A Delta II Carries the Dawn Spacecraft to its meetings with the asteroids Vesta and Ceres. NASA image.

While there were no recycled engines to use in Delta II, a version of the older Delta could be manufactured at low cost by incorporating new manufacturing technology to reduce costs, and with system requirements specifically tailored to the needs of GPS launches, eliminating costs associated with different types of launches. In the end, Delta II continued Delta's heritage of being a low cost ride to orbit, and as such it attracted many other missions beside GPS that were able to live within the constraints of the Delta II vehicle.

Delta II started out a low cost vehicle, but in the course of the program, several cost-cutting programs were run to reduce its costs even more. Improvements in processes alone resulted in cost savings of over 20%, drawing even more users to the Delta II and extending its life into the 21st century. At a time when a Titan IV launch cost $380-450 million dollars, a Delta II could take a smaller payload to orbit for only $50 million.

But could low costs be brought to even larger payloads? Enter the Delta III.

Delta III. Boeing image.

Initially started by McDonnell Douglas, the company was acquired by Boeing while Delta III was still in development. The concept behind Delta III was to couple the Delta II core stage with larger solid rockets and a larger, more powerful second stage. The new second stage would use cryogenic propellants and the Rocketdyne RL-10 engine to carry payloads to geosynchronous orbit, and into deep space efficiently.

Unfortunately, rushed development resulted in a failure of the first test flight due to a design problem. The issue was resolved in the second flight, but a manufacturing error in an RL-10 second stage engine resulted in a failure of that flight as well.

The third flight went on to be successful, carrying a test payload, but by that time the Delta III was already due to be eclipsed.

Delta IV

After the various fixes to Shuttle's reduced capacity had entered service, the time came to look at longer-term solutions toward making spaceflight less expensive. With typical flights still costing in the hundreds of millions of dollars, while relying on launch vehicles that were not as reliable as they should be (aside from Delta II, which became one of the most reliable launchers ever built), it was time to look at a fresh start for the future.

The ICBM-based launch vehicles would come to an end, and a new generation of "clean sheet" designs would be required.

Each of the major launch vehicle companies propsed a new vehicle with an old and honored name. Martin Marietta proposed the Titan V, now powered by Methane and Liquid Oxygen rather than toxic hypergolic propellants. Lockheed, now the owners of Atlas, proposed Atlas V, which used inexpensive Russian/Ukrainian engines now available after the fall of the Iron Curtain. And Boeing proposed the Delta IV series of rockets.

Delta IV Heavy carries the last of the Defense Support Program satellites into orbit, November 11, 2007. USAF/USSF Photo.

To avoid becoming dependant on a single system, two rockets were chosen for production, with the plan to divide launches between them. The winners were Atlas V and Delta IV.

Delta IV was chosen to develop two versions, the Delta IV Medium and the Delta IV Heavy. The largest and heaviest military satellites would require the extra lift capability of the Delta IV Heavy. There was also a proposed Atlas V Heavy, but for cost reasons only one heavy booster was selected for production after a bitter competition.

So bitter, in fact, that after the fact it came to light that Boeing had transgressed the law and contracting rules in the course of obtaining documents on the Lockheed launch vehicle designs. Boeing countered with accusations of multiple discrepencies performed by Lockheed.

By this time, the two programs were well under way, and the delays associated with renegotiation of the contracts and the launch vehicles could not be tolerated. So, the U.S. government forced the two companies to partially divest themselves of their divisions responsible for Atlas and Delta, creating a shotgun marriage between then that created a new jointly-owned entity, United Launch Alliance.

And so, United Launch Alliance became the builder and operator of the Atlas V and Delta IV vehicles. A new manufacturing facility was built, and over time construction of both vehicles was moved there.

Delta IV Medium carries a Defense Support Communications System satellite to orbit, August 29, 2003. USAF/USSF Photo.

Legacy of Delta III

The work on Delta III was not all lost despite the problems it suffered. The upper stage of the new Delta IV was a slightly upgraded

version of the Cryogenic Propulsion Stage flown on Delta III, called the Delta Cryogenic Second Stage (DCSS). Beneath the DCSS stood a new first stage, using American-made RS-68A engines. This increased the cost of Delta IV to more than an Atlas V, but the use of fully U.S. made engines in Delta was part of what gave planners the confidence to also buy the cheaper Atlas V which used foreign-supplied engines. This "dissimilar redundancy" was used throughout the two programs to make sure that one or the other would be able to continue flying, even if one developed a problem.

The Delta IV DCSS lives on today as the second stage of the SLS Block I launch vehicle for Artemis ,known as the Interim Cyogenic Propulsion Stage (ICPS). While ICPS is underpowered for a vehicle as powerful as the SLS, it reduced the development time and costs for the SLS relative to waiting for development of the Exploration Upper Stage that is planned to replace it after the first few flights of SLS.

ICPS version of the Delta Cryogenic Propulsion Stage. NASA image.

Delta IV's approach to cost reduction was to use the same core stage as both a central first stage in the Medium configuration, and as both the core stage and strap-on stages of the Heavy version, putting 3 of the Common Booster Cores side by side to obtain almost as much lift capability as a Saturn I launch vehicle.

Last of the Deltas

After SpaceX's Falcon 9 and Falcon 9 Heavy rockets proved themselves, the writing was on the wall for the Atlas V and Delta IV. Falcon 9 could carry the same payloads as an Atlas V or Delta IV Medium for about one quarter the cost, or less. Meanwhile, Falcon Heavy could carry payloads even heavier than the Delta IV Heavy, at less than half the cost, even while expending the boosters.

NASA launch of Parker Solar Probe on Delta IV Heavy, August 12, 2018. NASA/Bill Ingalls image.

United Launch Alliance's survival depended on developing a new rocket at lower cost. This rocket is the Vulcan, which has recently had its first successful flight. While still more expensive than a Falcon 9 or Falcon Heavy, it is at least competitive and will be retained by the government to avoid dependence on a single line of boosters from SpaceX.

On April 9th, the last Delta was launched from historic launch complex SLC-37. Last year, the next to last Delta IV was launched from the west coast at Vandenberg's SLC-6. Delta IV inherited these launch sites from Titan IV and Space Shuttle, respectively (no Shuttles ever launched from SLC-6 as a result of the Challenger Disaster changes.)

Now, both launch sites have been decommissioned. SLC-6 has been leased to SpaceX to be used for Falcon Heavy launches from the west coast into polar orbits. SpaceX has also expressed interest in leasing SLC-37 at Cape Canaveral for Starship launches, and is currently awaiting an environmental disposition on the agreement.

JWST Captures Top of Horsehead Nebula in Unprecedented Detail

This image of the top of the Horsehead Nebula shows the rich detail in the cloud of gas and dust, as well as a scattering of galaxies that lay beyond the relatively nearby nebula. NASA image.

JWST's NIRCam has captured a highly detailed image of the top of the famous Horsehead Nebula in infra-red light, allowing the viewing of internal details that are invisible to visible light instruments. Infra-red light has longer wavelengths than visible light, allowing it to travel through gas and dust that would block the shorter wavelengths of visible light. JWST's Near Infra Red Camera captures this invisible light, and it is transformed into a visible image through computer image processing to produce a view that mere human eyes can use to see through the clouds.

JWST's view doesn't stop there, however. The background of the image shows a scattering of not only distant stars (which show the characteristic "starburst" pattern created by JWST's hexagonal mirrors), but much more distant galaxies, which do not cause the patter because they are extended light sources, unlike stars that emit all their light from a single point (optical effects cause the spread of that light beyond a single point in images, but for optical effects, they still behave as a single point in low power NIRCam images.)

Looking toward Orion, where the Horsehead resides, we are looking "forward" in the direction of the Sun's orbit around the center of the Milky Way. The galaxies we see here are the result of being able to see beyond the arm of the galaxy in which the Horsehead resides, essentially looking through the Milky Way and out the other side.

Full story:
https://science.nasa.gov/missions/webb/webb-captures-top-of-iconic-horsehead-nebula-in-unprecedented-detail/

NASA's Orion Spacecraft Completes Vacuum Testing for Artemis II

The Orion Spacecraft for Artemis II is lifted from the vacuum chamber where it was tested. NASA image.

NASA is preparing for the Artemis II spaceflight, slated to be the first time humans travel to the Moon since Apollo 17 in 1972. The flight will carry astronauts around the Moon, similar to the Apollo 8 flight of 1968.

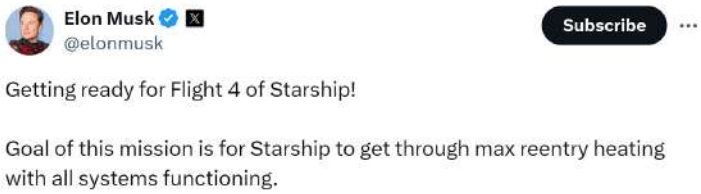
The capsule has just completed vacuum tests of its electronic systems to verify that they will function correctly when exposed to strong electromagnetic fields in the vacuum of space. All tests have gone well, and the capsule will return to the vacuum chamber at Kennedy Space Center to do additional performance checks of its systems in the space environment.

Artemis II is currently scheduled to launch toward the Moon in September 2025.

https://blogs.nasa.gov/artemis/2024/04/30/nasas-artemis-ii-orion-spacecraft-completes-electromagnetic-testing

SpaceX Starship Flight 4 "Before the End of May"

SpaceX's Elon Musk has announced that Starship's Integrated Flight Test 4 is expected to occur before the end of May. Many observers believe the launch date will fall closer to mid-May based on preparations at Starbase, Texas.



Stated goals for this flight include maintaining the orientation and attitude control systems on the upper stage to allow it to keep the heatshield oriented properly during re-entry.

Also, the hope is to perform a controlled descent of the booster stage into the Gulf of Mexico. If this goes well, then Elon has stated that they hope to attempt to catch the booster with the "chopsticks" after flight 5.

The primary goal of flight 4 is to verify the re-entry capability of the Starship second stage, however. Though Elon has stated that Starship recovery will be "further down the road."

The Launch Tower's "Chopsticks" Stabilize Starship Prior to Launch Test 2. SpaceX image.

IN THE SKY THIS MONTH

The Moon:

Last Quarter, May 1st
New Moon, May 7th
1st Quarter, May 15th
Full Moon, May 23rd
Last Quarter, May 30th

The Pre-dawn sky brings a line of planets--**Saturn**, **Mars**, and **Mercury**. On Friday the 3rd, the **Moon** joins the line above and to the west of Saturn. It passes down along the line on the three successive mornings, passing Saturn, then Mars, then finally Mercury on its way toward the Sun and New Moon.

Mercury reaches greatest elongation at 26 degrees from the Sun on May 9th, rising at about 4:15am. It brightens through the course of the month, starting at mag 1.0 then brightening to mag -0.7 by month's end. It recedes from Earth during this time, however, which makes it have the greatest apparent diameter at the beginning of the month, 9.6 arcsec, ending the month at only 5.7 arcsec.

Mercury online viewing chart:
https://in-the-sky.org//data/object.php?id=P1

Mars rises at 3:30am at the start of the month, and 2:10am at the end. It remains at magnitude 1.1 through May, but grows slightly larger at it and Earth draw closer, starting the month at 4.7 arcsec and ending at an almost indistinguishably larger 5.0 arcsec. High powers and still, clear air will be necessary to see any significant detail on Mars' surface. Best viewing will be at about an hour before sunrise, when Mars is high enough to be clear of low level Florida sky haze, and the sky is still dark.

Online observing information for Mars: https://in-the-sky.org//data/object.php?id=P4

Saturn will be easier to view than either Mars or Mercury. It is farther from the Sun, and will therefore be higher in the sky. Its size and brightness will also improve observation. It rises just before 3am at the start of the month, then moves into night owl observing time by rising at 1am at the end of the month. Our Florida haze will keep it from looking its best until an hour after it rises, of course, when it is 15 degrees above the horizon.

Saturn spends the entire month at magnitude 1.2, enlarging slightly from 16.2 arcsec to 17 arcsec over the course of the month, as measured by the planet's disk. The ring will enlarge the apparent width to just under 40 arcsec. The rings are tilted at a low angle of about 3.7 degrees right now. The ring crossing will occur next March, when the rings will seem to disappear briefly.

Saturn finder chart: https://in-the-sky.org//data/object.php?id=P6

Jupiter disappears from the evening sky on the 17th, and reappears in the dawn sky on the 21st, though it will be too close to the sun to observe for a day or two around those dates. After giving us a beautiful display since last fall, we lose if from the evening sky until August.

In the first days of May, it can be caught low on the horizon near sunset. At magnitude -2.0 it shines brightly, even among the bright stars of the winter constellations of Taurus, Orion, Sirius, and Gemini that it lies near. At 33 arcsec apparent diameter, it still displays plenty of detail. In the dawn sky at the end of the month, below and east of Mercury, it will be the same brightness and size.

Jupiter observing information: https://in-the-sky.org//data/object.php?id=P5

Venus rises shortly before dawn throughout the month, and is mostly lost in the Sun's glare. It is farthest from the Sun at the start of the month and should be visible in binoculars shortly before the Sun rises and spoils the sky with its light.

Venus online finder chart: https://in-the-sky.org//data/object.php?id=P2

Uranus is very near the Sun this month, even closer than Jupiter. It crosses from Aries to Taurus through the course of the month, and is very poorly placed for observation. On the 31st, it has a conjunction with Mercury at 1.3 degrees separation.

Uranus finder chart: https://in-the-sky.org//data/object.php?id=P7

Neptune starts the month very near Mars, having had a close conjunction with Mars on April 29th. It remains low in the sky, never appearing more than 11 degree from the Sun, and so is in a poor position to observe this month.

Online finder chart for Neptune: https://in-the-sky.org//data/object.php?id=P8

More information on sky events this month: https://in-the-sky.org/

The Eta Aquarid Meteor Shower runs through May, and is a low rate shower with a wide, shallow peak of activity on the nights of the 5th and 5th of May. The radiant is near the Jug of Aquarius, and meteors will be best observed in

the early morning hours when there is no Moon in the sky. Since the peak falls near the New Moon, this is an especially good year to catch Eta Aquarids. The Zenith Hourly Rate for the Eta Aquarids is 50, meaning that if the radiant point were directly overhead, and the sky perfectly dark, about 50 meteors per hour would be visible (about one per minute.) As it is, the radiant never rises that high before sunrise, so the rate of observed meteors will be less. Expect no more than one every three to four minutes after 3am.

The Eta Aquarids are fast-moving meteors, streaking rapidly across the sky. The best part of their show are “grazers”, meteors that streak across nearly the entire sky, leaving behind a long glowing trail of ionization in the atmosphere. These are most likely to be seen near the time that the radiant rises above the horizon (a bit after 3am.)

Club Calendar

Yellow marks special events hosted by The Villages Astronomy Club
Blue marks events that are not hosted by The Villages Astronomy Club, but which we recommend.
Green Marks Volunteer Events for other groups.

May 2024
3 Exec Meeting 11am Fishhawk Rec Ctr
6 Telescope Workshop 8:30pm/Space Academy 6:30pm Truman Rec Ctr
18 Fruitland Park Observing
21 General Meeting: Mike Petersen, “The Life and Death of Stars”, 6:30pm Laurel Manor Rec Ctr

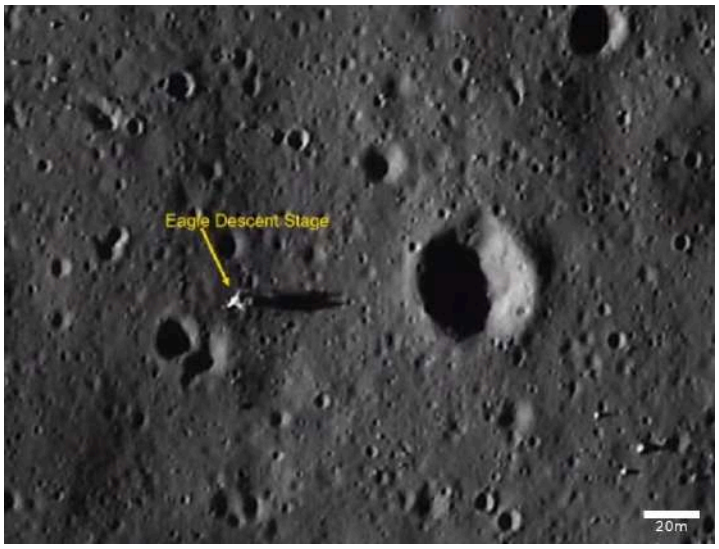
June 2024
3 Telescope Workshop/Space Academy 6:30pm, Combined Scope Wkshop/Space Academy Truman Rec Ctr
7 Exec Meeting 11am Fishhawk Rec Ctr
15 Fruitland Park Observing
18 General Meeting: Rev. Dr. Maynard Pittendreigh, The Astronomical League and its Observing Programs Laurel Manor Rec Ctr, 6:30pm

Club Calendar on the web:
https://vlgastroclub.org/calendar/

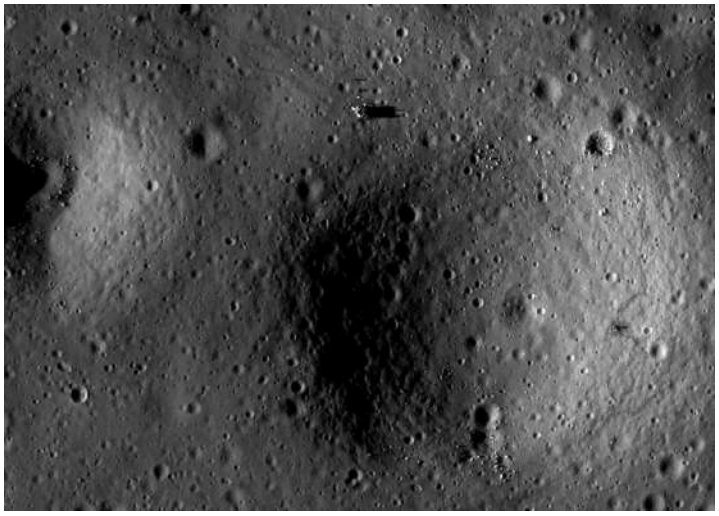
India’s Chandrayaan-2 Lunar Orbiter Images Apollo Landing Sites

India’s Chandrayaan-2 lunar orbiter carries a high resolution camera on board intended to assist in the selection of landing sites for its Vikram lunar lander. The camera has the best resolution of any camera in lunar orbit, seeing details down to just over a foot in size from its orbital altitude of 100km (62 miles.)

ISRO, the Indian space agency, has released images of the Apollo 11 and 12 landing sites that show the Apollo Lunar Module descent stages, and in the case of Apollo 12, the nearby Surveyor 3 lander that Alan Shepard visited while on the Moon, removing components for study.



Chandrayaan Image of Apollo 11 Landing Site ISRO image.



Apollo 12 Landing Site, Apollo 12 at top center, Surveyor 3 on right below center.