VILLAGES STAR

Newsletter of The Villages Astronomy Club

Volume 4, Number 5
May 2023

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

Club Officers & Directors

President	Mark Graybill
Vice President	Ken Katta
Secretary/Historian	Burt Salk
Treasurer	Linda Meng
Education Coord.	Randy Gilbert

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

UPCOMING EVENTS

May 2nd, 6:30pm: Space Academy
Join us for the initial event of our new monthly activity, the Space Academy!

Space Academy focuses on popular subjects of basic astronomy and astrophysics in an approachable way. This first session will be hosted by Toni Graybill, and will include two features, plus discussion on each.

The first will be The History of the Speed of Light by Dr Becky Smethurst. It will last about 25 minutes then be followed by discussion and a break.

Next will be A Grand Tour of the Cosmos by Dr Alex Filippenko. It will last about 30 minutes and likewise be followed by discussion.

May 2nd, 7:30pm: Telescope Workshop
Our monthly telescope workshop will be held at Truman Recreation Center, near the pavilions (behind the pool from the parking area.) Address is 2705 Canal St. in The Villages (just north of 466A.)

Bring your questions, your telescopes or binoculars, and share information with other observers on observing instruments and techniques, accessories, locations, and upcoming events. Those who are just interested in getting a look through a telescope are welcome to attend, and if you're up for more astronomy after Space Academy, this may be the perfect way to get it!.

Executive Directors' Meeting, May 5th, 11am
All members are welcome to join our officers and directors at our monthly meeting to plan future events and activities for the club. We have a number of educational activities that we will be holding for Camp Villages and local summer school programs, as well as advance planning for next fall.

Meetings are at Fishhawk Recreation Center, 2318 Buttonwood Run, from 11a to 12p.

General Meeting, May 16th, 2023:
How We Will Get to The Moon by Mark Graybill

The Artemis Program is NASA's current plan to return humans to the surface of our nearest neighbor in space. It involves two giant

launch vehicles, several smaller ones, and a range of robotic spacecraft as well as crewed ones to get footprints back on the Moon again, and to build a base where we will learn to use water from the Moon to avoid having to haul everything we need all the way from Earth.

SpaceX's Lunar Lander, Starship HLS

May 20th, 5pm: Fruitland Park Astronomy

The Fruitland Park Astronomy Club meets for an evening of observing and talk on the third Saturday of the month every month, conditions allowing, 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.) Village Astronomy Club members and the public are welcome. Bring your telescopes, binoculars, or just your eyes and your interest. Gate opens at 5pm.

Scopes can be set up directly off of tailgates onto pavement, or taken further into the park along paved walks, away from the road to avoid nearby lights. The front of the park has Bortle 5 skies. Power is available.

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

NEWS

Embry-Riddle Open House

On 31 March 2023, Embry-Riddle Aeronautical University's Astronomy-Astrophysics Department hosted an open house for the public. The Villages Astronomy Club represented by Randy Gilbert and Ken Katta received a special invitation from Dr. Terry Oswalt, Associate Dean and Professor of the Astophysics- Astronomy

Tanya King, Randy Gilbert, Ken Katta in ERAU Observatory control Room

Department to have a special tour of the observatory and facility. We were also invited to attend the lecture by Dr. Anna Childs who spoke on "The Formation of Binary Stars and the Tatooine Planets Around Them". Dr. Childs provided interesting information on the methods of detecting exoplanets around binary stars.

Afterward, we were given a tour of the telescope deck where there are about 25 large refracting telescopes available for use by the students. There were very large numbers of the public who stood in line in order to view the Moon and planets through the telescopes. We then were given a tour of the one meter astronomical telescope and observatory.

The most interesting part of the tour was the Control Room for the one meter astronomical telescope.

Terry Oswalt, Ken Katta, Randy Gilbert with ERAU's 1 meter research telescope

We were able to observe the students at work conducting research utilizing the one meter scope. I also was able to discuss the possibility of closer astronomical coordination between the astronomy club and ERAU. There are several research projects ERAU is conducting that could use amateur observers. We will have continuing discussions about this possibility.

This was the final open house for this academic year. These events will resume in the Fall. It is hoped that more mebers for the club will be able to attend these open houses. Both Randy and I really enjoyed ourselves and were privileged to attend the lecture. There will be more lectures encompassing some of the most important topics in current astrophysics. -Ken Katta

Relativity Space 3D Printed Rocket News

On March 22nd Relativity Space successfully conducted their first launch of their Terran 1 rocket. This rocket had over 85% of its structure produced using 3D printing technology.

Unfortunately, the 2nd stage engine failed to produce sufficient thrust to reach orbit, and the 2nd stage and payload descended into the atmosphere.

Relativity has announced that the test provided sufficient data on the performance of the 3D printed structures, having survived Max-Q, the time of maximum dynamic pressure, during launch. They now plan to proceed directly to their next design, the larger Terran R rocket.

They state that Terran R will continue to use 3D printing for many parts that are difficult or expensive to produce using traditional methods, but that it will also use more traditionally manufactured components where testing with Terran 1 showed there was no significant advantage in time, cost, or effort in using 3D printing.

For more information, visit Relativity Space at:

https://www.relativityspace.com/

ULA Vulcan Prepares for First Flight

Hydrogen Leak Destroys Centaur V Stage in Ground Testing

United Launch Alliance continues to prepare for the first launch of the new Vulcan rocket this year. The Vulcan has been designed to replace both the Atlas V and Delta IV launch vehicles at a lower price, with the possibility of future component recovery.

A test of the Centaur V upper stage suffered a mishap on March 29th when hydrogen leaked in a structural test stand at Stennis Space Center, causing an explosion that damaged the Centaur's tanks. At this point it is unknown if the leak was from the Centaur or from the test facility. It is also unknown if this will impact the flight schedule of the first Vulcan to launch, currently slated for June.

It is expected that the results of investigation of the mishap, plus consultations with ULA's flight customer Astrobotic will determine whether the date is moved. Because the payload is a lunar lander, its launch window is only open for a few days each month, so any delay is likely to cause at list a month delay to the flight.

For more information on Vulcan, visit: https://www.ulalaunch.com/rockets/vulcan-centaur/countdown-to-vulcan

For information in Astrobotic's Peregrine Lander: https://www.astrobotic.com/lunar-delivery/landers/peregrine-lander/

SpaceX Starship Integrated Flight Test

SpaceX Starship Integrated Test Vehicle on Launch Mount. SpaceX Image.

On April 20th, 2023 the world got a new most powerful rocket. Far exceeding the thrust of the Saturn V and the Soviet N-1 launch vehicles, the SpaceX Starship system successfully launched to an altitude of about 25 miles (40km).

This was a high risk test, using hardware that in many cases has already been redesigned in the craft that have been built since this test article was constructed. The engines used in this test were Raptor 1 engines, whereas all future Starships will be using the new Raptor 2. The booster vehicle, known as “Superheavy”, uses a hydraulic system to gimbal the inner engines for control of the rocket, the next Superheavy in line, Booster 9, uses electric actuators to gimbal the rockets.

The vehicle, made up of Booster 7 and Starship SN24, was called 7/24. The test objective was to attempt to launch the vehicle and to clear the launch pad without blowing up to verify the booster’s startup sequence and its ability to lift off without structural collapse or mishap.

Beyond that, there was the hope of being able to fly the vehicle through its maximum dynamic pressure, called Max Q, the point where atmospheric drag and the craft’s velocity produce the most stress on the vehicle in flight, before the air begins to thin. Beyond that, there was the hope to stage the vehicle, sending Starship onward as the booster simulated a return to launch site while ditching in the Gulf of Mexico while the Starship continued on to reach orbital velocity.

Once in space, the hope was to be able to simulate a satellite deployment (the door for launching satellites on Starship 7 was not actually functional, and it carried no satellites) before re-entering the atmosphere west of Hawaii.

Then the hope was that Space Force assets in Hawaii could capture data on Starship as it re-entered the atmosphere to help SpaceX assess the effectiveness of the heat shield on Starship 7. That heatshield has since been redesigned as well, but data on the performance of this model would still have been useful to SpaceX.

The actual test achieved the primary goals of SpaceX in launching and clearing the pad. They also achieved the “stretch goal” of flying through Max Q. However, all other test objectives were lost as the vehicle failed to reach sufficient altitude and velocity to achieve staging, and the vehicle destroyed itself as it approached the edge of its allowed airspace for the test.

LAUNCH

SpaceX took a very conservative approach to the engine start sequence for Starship’s 33 Raptor engines. Those engines are arranged in 3 rings--there is an outer ring, an inner ring, then 3 engines in the center of the inner ring. The center engine trio and the ten engines of the inner ring all carry their own startup system on board the Superheavy. The outer 20 engines are started using equipment mounted in the launch stand to save weight on the vehicle. Each set of engines is started separately at an initial low thrust setting while waiting on the other engines to start. Once all engines are running, thrust is increased to launch the vehicle off the pad.

Now, this is the point at which I (Mark) expected the test to come to an end just before launch. The ignition sequence is tricky with these engines, and methane/LOX engines are tricky to ignite as well, the Raptor 1s more so than the new Raptor 2s. I expected a moment of fire, then a shutdown, followed by preparing for a flight on another day.

However, it appears that SpaceX set up their computers controlling the launch to adopt a very conservative approach toward a shutdown and scrub on the launch. Since the lauch itself was one of the highest priorities for this test, regardless of the immediate outcome, this was a reasonable approach to take.

After ignition, the vehicle remained on the pad for what I (as a former rocket test worker) consider a very long time. I expected a shutdown at about T+3 seconds. However, SpaceX allowed the rocket to run and at about T+5 seconds we saw the vehicle lift off the pad. It successfully cleared the tower, performing a “sideslip” tower avoidance maneuver, then flew on downrange from T+15s.

At this point, the vehicle had completed its primary test objectives. It had already given SpaceX a mountain of test data from instrumentation on its engines, its structure, and from its control programming. This alone would be enough to pay back SpaceX for the cost and effort of the launch, allowing them to compare the actual measured performance at liftoff and the first seconds of flight that they could use to both validate the design changes they had already made and to plan any new ones that may be required.

NASA’s Human Landing System team were observers for this test, and have expressed their satisfaction with SpaceX’s progress so far. Starship will be the first human lander for the U.S.’s return to the Moon via the Artemis program, and all elements of the Starship system, from Earth launch to orbital refueling to lunar landing and takeoff need to work for that to occur.

After having cleared the pad, Starship continued to fly. It passed through Max Q, obtaining more valuable information through the instrumentation measuring stress and deflection of the airframe through flight, as well as engine and control system performance through Max Q.

The next major milestone was to have been staging of the Starship. The planned sequence was to have the vehicle perform a “flip” maneuver so that once the Starship was detached from the booster, each would then rotate about their individual centers to continue their flights independently. However, for unknown reasons the two did not separate at the expected time. It is possible that the computer controlling the separation did not see conditions from its instruments that would allow separation, so it did not trigger.

However, the booster’s controller continued to operate as if the separation had

occured. This caused the vehicle to enter the tumble that it experienced at the end of its flight. The booster's flight controller was not able to respond appropriately to the circumstances and thus was unable to properly control the vehicle.

When the vehicle's flight path had deviated sufficiently to reach the edge of its approved flight corridor, the Automated Flight Termination System activated, destroying the rocket.

Close Up Image of Starship Engines After Max Q Shows 6 Engines Out. Thrust is About 13.7Mlbf.

AFTERMATH

Since the launch, there has been a lot of attention paid to the launch pad and its damage. While it was severe, it wasn't entirely unexpected, nor is it beyond repair. The high temperature concrete under the pad was broken through by the force of the engines at launch, and deeply excavated thereafter by the continued force as a result of the slow liftoff of the vehicle.

SpaceX knew this was a risk, but chose not to delay the test for the water cooled deflector to be ready. They had previously tested the concrete with a static fire test at lower power and felt the risk to be acceptable.

When the concrete broke through, many large pieces of concrete were dislodged and thrown up to a quarter of a mile around the area. Dust and dirt were excavated from the ground underneath, and sent up in a plume that was distributed for miles around the pad.

SpaceX states that repairs will take from 2-3 months, though a schedule of 3-5 months is more likely including upgrades of the launch mount area.

The vehicles currently slated for the next flight, Booster 9 and Starship 26, are currently in good condition and should present no delays to launching a second test flight before the end of the year. Starship 26 is said to have an operational dispenser system for Starlink V2 satellites, so if it achieves orbit, it may be used to place some in orbit.

While it is disappointing that we did not get to see the stages separate, and Starship fly on into space, it's important to recognize that the test flight was a success. The primary payload for this flight was the information that was garnered that will go into future tests and eventually into the final design of Starship.

Future tests wiill reach space and test additional aspects of this immense and complex new rocket system until it achieves its design goals of complete and rapid reusability and the ability to refuel and carry crew to deep space destinations.

ACCOMPLISHMENTS

SpaceX has launched the largest and most powerful rocket ever built.

The Starship/Superheavy combination weighs 11 million pounds when fueled (without payload), compared to the Saturn V at 6.2 million pounds when fully fueled and including payload, and the Soviet N-1 which weighed 6.6 million pounds at liftoff.

SpaceX has successfully flown a vehicle with more clustered rocket engines than any previously flown. The Superheavy uses 33 Raptor engines, compared to the Soviet N-1's 30 NK-15 engnes on its first stage.

SpaceX has launched a rocket with more thrust than any other rocket. Superheavy produces a nominal 16.7 million pounds of thrust. Even with engines out and engines operating at

reduced thrust, on this launch it produced a minimum of 15 million pounds of thrust.

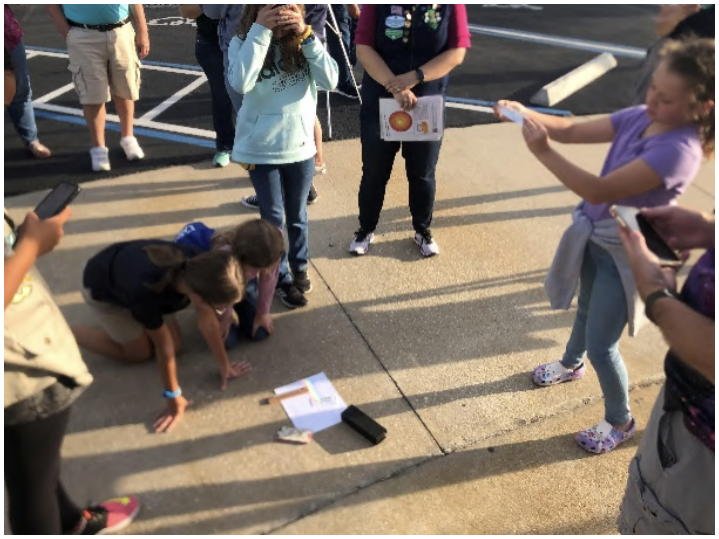
Saturn V produced 7.8 million pounds of thrust, and the N-1 produced 10.2 million pounds of thrust.

Starship is also the tallest, at 390 feet tall versus the Saturn V/Apollo at 363 feet and the N-1/L-3 at 345 feet.

Launching the Starship/Superheavy vehicle is akin to loading an entire Space Shuttle launch stack on to a pair of Saturn Vs then launching the entire combination. It really is that big.

The Starship second stage alone has a thrust of 3.3 million pounds now and will have a thrust of 5.8 million pounds in its future configuration.

April Outreach Events



Girl Scouts Use a Thermometer and Prisms to Measure the Temperature Along the Spectrum, Discovering Infrared Light!

The Club participated in two outreach events in April reaching over 600 people.

On Friday April 21st, we worked with our 4th group of scouts. This time, eight sixth and seventh grade Girl Scouts were able to earn their Space Science Researcher badge at the Wildwood Community Center. The requirements for the badge focused primarily on the nature of light and the spectrum.

The girls worked with a prism as well as a spectrum viewer using a diffraction grating. We discussed the visible and invisible spectrum as well as how the speed of light ties together time and distance, an important concept for astronomy. After splitting light into its constituent colors, we put demonstrated how they can appear to be recombined using a Newton Disk, which the girls constructed.

Club members brought four telescopes allowing the girls to observe and photograph the Sun and Venus prior to clouds entered that shut down further telescope time.

Girl Scouts Take Cellphone Astrophotos of Sun

Several volunteers then headed to Center Hill the following morning to participate in the CEMEX Earth Day open House. This normally annual event returned after a two-year hiatus due to Covid.

CEMEX works with the Sumter County School system to support environmental education and has a small training facility on-site which is used by students during field trips.

We met with participants discussing astronomy, the club and showing the Sun through white light and H-Alpha telescopes.

Approximately 600 people visited us during the four-hour event. We even had some free hotdogs and ice cream.

Several people asked to join the club's email list, we connected with a couple of local schools interested in having us work with their students and one person offered to donate a telescope.

Both dates generated excitement for astronomy, earned the club goodwill in the community and were a lot of fun to do.

Thank you to the volunteers: Frank Ancona, Gregg Cieslak, Nick DiGiore, Randy Gilbert, Mark Graybill, Toni Graybill, Jeff Kahler John Keller, and Linda and Larry who were stymied by the lack of signage in reaching the Earth Day event until late in the afternoon. We appreciate their persistence!

We have future outreach programs in the works for Scouts, Camp Villages, Wildwood Summer Camp and the City of Wildwood, to name a few. If you would like to learn how to help out, please contact Toni Graybill (toni.grayb@gmail.com) or Randy Gilbert (rjgilbert4@gmail.com).

IN THE SKY THIS MONTH

The Moon:
Full Moon, May 5th
Last Quarter, May 12th
New Moon, May 19th
1st Quarter, May 27th
Full Moon, June 3rd

Venus and **Mars** are our evening planets this month. Mars has become very small and requires high powers (>100x) to see any surface detail..

Jupiter rises before the Sun in the morning. It will return to the evening sky in July this year. Likewise, **Saturn** rises in the early morning hours about 45 minutes to an hour before Jupiter. In June it will rise before midnight again to become an evening object.

Uranus disappears behind the Sun early this month, then reappears from behind the sun late this month, to join Jupiter and Saturn in the morning sky. **Neptune** rises shortly after Saturn, and will return to the evening sky in June. Spring is the time for galaxy-hunting. Though most galaxies are difficult to observe in our humid spring skies, there are some that are bright enough to see in binoculars or small telescopes.

M31, the Andromeda Galaxy, is the brightest galaxy in our sky. It covers about 4 degrees of sky, making it impossible to see the whole galaxy in most telescopes. Binoculars can see the entire span of the halo, though, and the nucleus of the galaxy, plus the inner part of its halo, is visible in a telescope.

M81 and M82 are two bright galaxies in the north in Ursa Major that are above the Big Dipper's bowl. They can be seen both at once with binoculars or a low power telescope view. Medium power will bring out some details in each in a telescope.

The Leo Triplet, consisting of **M65**, **M66**, and **NGC 3628** are easy to find, being between the stars Theta and Iota Leonis--the front star of the Lion's haunches and the knee in the back leg. Both stars are easily seen visually, and the trio lies equidistant between them. M65 and M66 are the brightest of the three, but NGC 3628 is visible on a clear night even in binoculars.

Fields of galaxies can be seen in Coma Berenices, behind the flanks of Leo the Lion, and in Virgo near Leo. Under clear dark skies, there can be so many seen at once in binoculars or a

telescope that it is hard to identify the individuals within the masses of dim galaxies.

This time of years also has a number of bright star clusters to see. The signature cluster of the season is Cancer's **Beehive Cluster (M44)**, a cluster of yellow stars spread across a roughly circular area. The cluster is in front of Leo's head, the backward question mark shape with bright Regulus at its base. On clear nights the Beehive looks like a cloudy area in front of Leo. It is positioned about equidistant between the medium-bright stars of Delta and Gamma Cancri.

In the constellation Serpens Caput (the Serpent's Head) is the bright globular cluster **M5**. It is between bright Alpha Serpens and the feet of Virgo the Virgin, above Beta Librae, the balance point of Libra The Scales.

Telrad finder charts for the Messier objects can be found at the following web page: https://sherwood-observatory.org.uk/astronomy/finder-charts/messier-finders

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

Image of M42, The Great Orion Nebula by Randy Gilbert.

Club Calendar

May

2 Telescope Workshop 7:30pm Truman Rec Ctr
First Space Academy Meeting 6:30pm!
5 Exec Meeting 11am Fishhawk Rec Ctr
15 General Mtg 6:30pm Laurel Manor Rec Ctr,
How We Will Get to The Moon by Mark Graybill
19 New Moon
20 Fruitland Park Astronomy 5pm 300 Shiloh Rd Fruitland Park

June

2 Exec Meeting 11am Fishhawk Rec Ctr
6 Telescope Workshop 8pm at Truman Rec Center, Space Academy 6:30pm
17 Fruitland Park Observing 5pm 300 Shiloh Rd Fruitland Park
18 New Moon
20 General Mtg 6:30pm Laurel Manor Rec Ctr.
Cosmology of the Universe by JB Smith

July

3 Wildwood Summer Celebration?
4 *Workshop and Space Academy Cancelled for Holiday*
7 Exec Meeting
15 Fruitland Park Observing
18 General Meeting: Round Table on Astronomy Interests and Desires

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

Image of Globular Cluster M3 by Randy Gilbert.