VILLAGES STAR
Newsletter of The Villages Astronomy Club

Volume 5, Number 8
August 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
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(please include TVAstro in subject line)

UPCOMING EVENTS

Exec Directors' Meeting, August 2nd, 11am

All members are welcome at our Executive Directors' Meetings, where our directors plan and prepare for future events and meeting. The meetings are held at Fishhawk Recreation Center, 2318 Buttonwood Way, at 11am.

Space Academy, August 5th, 6:30pm

This month's Space Academy meeting will feature a video on how we measure distance in space. Astrophysicists measure distances that range from thousands of miles to billions of light years in space. How do we know how far away things like galaxies are, never mind even stars that are *only* trillions of miles away? We will also have a Chandra X-Ray Space Telescope update! Meeting begins at 6:30pm at Truman Rec Center, 2705 Canal Street.

Telescope Workshop, August 5th, 8pm

Join us to learn how to use or select a telescope, share your knowledge, or get a look at the sky, weather allowing. In the event of thunderstorms, this event will be moved inside to the Studebaker room, to commence after the completion of Space Academy.

The Moon on July 22nd by member John Keller of The Village of Winifred on June 23rd.

EAA Meeting, August 7th, Homestead Astronomy Park, 7pm (see below)

Join us at Homestead Astronomy Park for an evening of observing with smart telescopes! Owners of smart scopes or scopes with smart controllers are welcome as are those who are interested in learning more about the options to get started in Electronically Assisted Astronomy (EAA). For this meeting, we would like to invite astrophotographers and users of EAA devices to come early, at 7pm, to meet with an interviewer with The Villages Magazine to talk about astrophotography (and live imaging.)

We will open the park before sunset for

setup, and open late if weather permits.

August 17th, 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, August 20h, 6:30pm:
Your Astronomy Activities--Round Table

Join us at Laurel Manor Recreation Center, 1985 Laurel Manor Drive, to tell us about the astronomy resources you take advantage of. Books, magazines, YouTube channels, other streaming sources, websites, apps, favorite authors and other sources of information. Also, tools, tips and techniques you use for making observing easier, whether it's for watching the stars or catching views of space launches.

Do you have somewhere you go to watch space launches? Share it with the group! Do you have somewhere you go to observe? Let us know!

The things you share in this meeting will be written up in our annual September resources article in the newsletter to share your helpful suggestions with other members of the club.

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

NEWS

Artemis II Core Stage Arrives at KSC

The core stage for the second SLS vehicle arrived at Kennedy Space Center after a week-long trip aboard the rocket stage transport craft Pegasus on July 24th. The stage was delivered from its manufacturing plant at Michoud, LA.

This stage will be the core of the launch vehicle for the Artemis II mission, the first mission to take a crew to the Moon since Apollo 17. While this mission will not land astronauts on the Moon, it is a critical step in testing the many parts of the SLS launch vehicle and the Orion Crew module prior to the flight of Artemis III, which is slated to land astronauts on the Moon using SpaceX's Starship as a lander.

SLS Core Stage Rolls to VAB at KSC
NASA image.

On July 24th, the Core stage was rolled carefully from the Pegasus barge into theTransfer Aisle of the Vehicle Assembly Building at Kennedy Space Center. There, it will receive about 8 additional weeks of work to prepare it for stacking with the other parts of the SLS.

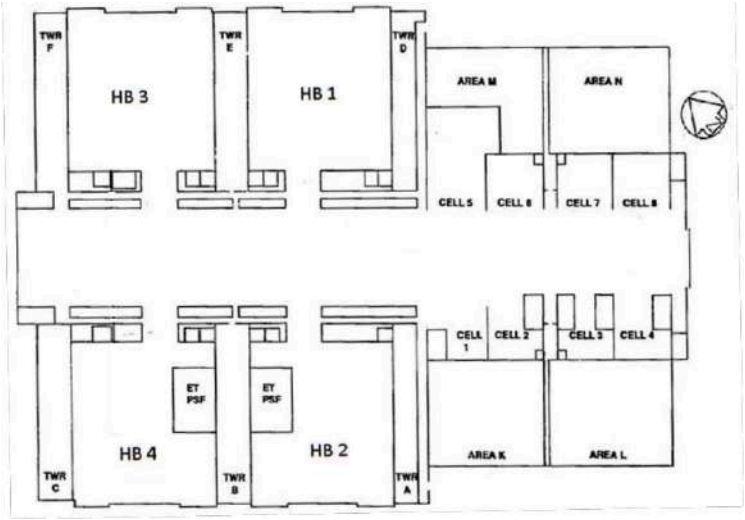
SLS Core Stage Emerges from the Pegasus Rocket Transport Barge. NASA Image.

Preparations for Flight

Currently, the Mobile Launch Pad (MLP) for the SLS is located at launch pad LC-39B, undergoing its own preparations and testing for

Artemis II. In early August, the pad will complete that work and be returned to the VAB's High Bay 3 by the crawler/transporter.

Once there, stacking operations for the Solid Rocket Boosters (SRBs) atop the MLP will begin, as work on the Core Stage continues in the Transfer Aisle.



Vehicle Assembly Building Floor Plan

HB marks High Bays, HB 3 is the bay used for SLS vehicles. The unlabelled area at center is the Transfer Aisle of the VAB.

Once the SRBs have been fully stacked, likely in late fall, the Core Stage will be lifted into place between the two SRBs. This winter additional stacking of the stage adapters, second stage, and finally Orion will be completed in preparation for a rollout to LC-39B.

At the pad, tests of the Crew Access Arm and the slidewire crew rescue system will be conducted, before the SLS is returned to the VAB for final preparations toward launch next year.

Artemis II Hurdles

As the second flight of the SLS launch vehicle, and first flight of a fully fitted out Orion capsule, Artemis II involves a lot of testing both prior to launch and during its flight.

Many changes have been made in the processing of the SLS and Orion prior to launch, and this will be the first test of those changes. Changes include techniques for applying and protecting the Thermal Protection System (TPS) foam to the SLS Core Stage, as there were losses of large pieces of the TPS foam during the first launch. The losses were not a risk to the mission, but they marked a need for improvement to reduce risks to the crewed missions. Also, operation of the Crew Access Arm was suboptimal during Artemis I, so changes have been made there. Multitudinous small changes have been made to software and minor vehicle processing operations as well.

The Orion capsule and its European Service Module have seen many changes as well, most notably the Environmental Control System aboard Orion, which is fully fitted out to support a crew on board for the first time.

Orion Heatshield

Probably the most significant change to the Orion Capsule will be its heat shield. The heat shield for the first Orion capsule flown to the Moon aboard Artemis I suffered damage that was higher than considered acceptable. While it wasn't bad enough that the crew would have been lost if there had been one aboard, it was greater than desired, leaving too little margin for safety for a crew.

At this time, the Independent Review Board commissioned to study the problem has completed its work and is briefing NASA and Orion's manufacturer Lockheed about courses toward correcting the issue. The information coming out of these meetings will likely become public in early August when NASA announces the plan to fix the heat shield for Artemis II.

The problem is not expected to affect the schedule for the flight.

SLS Core Stage Enters VAB Transfer Aisle at South End of VAB. NASA image.

Jose Carvajal-Beltran by Linda Betz

Jose Carvajal-Beltran (right) and James Guenther (left) receive Cambridge International Education Scholarship Awards at Wildwood Middle High School, March 2024. WMHS image.

For the past three years I have had the pleasure of mentoring Jose Carvajal-Beltran, a senior at Wildwood Middle High School who has been quite successful in all academic areas, specifically in the area of physics. Several members of the Astronomy Club, Pauline Schwartz, Mark Graybill, and Ken Katta, have been helpful and encouraging in his endeavors.

Jose is not only an excellent, hard working student, but a polite, caring individual who is admired not only by adults but his fellow students. It is my pleasure to introduce you to Jose, and upcoming physicist and astronomer.

"Hello! I am Jose Carvajal-Beltran, a senior at Wildwood Middle High School. I have always had an interest with tinkering and discovering, whether it was taking apart old laptops and putting them back together, or just looking at the world around me.

“Naturally, this carried over to my academics, especially science. In middle school, I was absolutely obsessed with microbiology, but that changed when I took up a freshman science fair project. I wasn't able to do a project on microbiology so I needed a new idea, it was around this same time that the school launched a Physics Club.

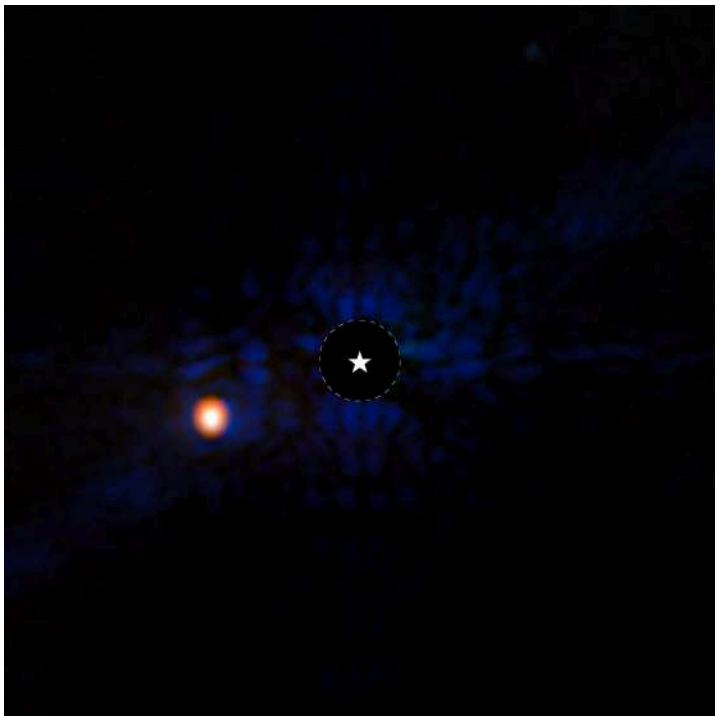
“From here, I fell in love with physics as I took up a project on physics. I have just finished my third year continuing this project, attending the International Science and Engineering Fair 2 times. My project started off with looking at Maple Samara Seeds and their behavior using autorotation.

“Once I had nailed down modeling their descent, I wanted to look at how a space capsule with rotors would behave. Since I didn't have any spare re-entry capsules, I settled with using Helicopter Theory and more to model what the flight might look like in terms of optimal rotor length, heating, etc.

“I must give plenty of credit for my journey to my family for encouraging me at every corner, even if they don't understand how any of the physics works."

You can see Jose’s project online at: https://projectboard.world/isef/project/phys002-dynamics-of-space-capsule-with-rotors

JWST Images Gas Giant Exoplanet



Orange Spot on Left is a Gas Giant orbiting star Epsilon Indi A at a distance of 113 Trillion Km. Central star is covered in image. STSci image.

Using the MIRI instrument, JWST imaged a gas giant orbiting star Epsilon Indi A at a distance of 11.8 light years. The gas giant, identified as Epsilon Indi Ab, orbits its star at a distance of 8.8 Astronomical Units, a little bit closer to its sun than Saturn is to our Sun.

While the image appears as a blob, it is actually still a point source using the James Webb Space Telescope. It is hoped that future telescopes will be able to have enough resolution to obtain direct images of exoplanets at greater than single-pixel size.

Information from a report on X.com by Paul Byrne, @PlanetaryGuy: https://x.com/ThePlanetaryGuy/status/1816128321610227749

SpaceX Falcon 9 Launch Fails

Solid Oxygen Ice Buildup on Falcon 9 Second Stage on July 11th, 2024. SpaceX image.

On July 11th a Falcon 9 launched from Vandenberg Space Force Base in California carrying a set of Starlink satellites. The first stage performed flawlessly, placing the second stage on its trajectory then returning to a safe landing for later reuse.

The second stage had a problem, however, that resulted in the Starlink satellites being placed in an improper orbit that resulted in their loss.

After a run of 325 consecutive successful launches, Falcon 9 has had its first flight failure since its second stage exploded while launching the ISS cargo mission CRS-7 in 2015, and its first vehicle failure since AMOS-6 was destroyed during ground testing in September 2016.

During the second stage burn, video shown on SpaceX's launch video stream showed the thermal blanket at the aft end of the Falcon 9 second stage suddenly inflating, as if it had been pressurised from within. Then ice, apparently frozen oxygen, formed on the outside of the thermal barrier and on the upper side of the Merlin Vacuum rocket engine that powers the second stage.

For this flight, the second stage was intended to initially reach an orbit with a low low point of the orbit (perigee) that would bring it back into the upper atmosphere, then turn off the rocket engine for a coasting phase of flight until it reaches an optimal position to raise the perigee's altitude with a minimum amount of propellant to place the Starlink satellites into a safe orbit above the atmosphere. From there, the Starlink satellites would use their on-board thrusters to raise themselves into their working orbits.

However, when SpaceX tried to restart the rocket engine, it experienced a "RUD", which is industry terminology for "Rapid Unscheduled Disassembly", known more commonly as an explosion.

This left the second stage and Starlink satellites in an orbit that would dip too low into the atmosphere to allow their on-board thrusters to place them into orbit. SpaceX tried, all the same, releasing the Starlinks from the second stage, then reprogramming their thrusters to operate at as high a level of thrust as they possibly can, then hope for the best.

Despite 10 of the Starlinks receiving the command, none of the Starlinks survived. Starlink satellites are designed to break up harmlessly in the atmosphere (for disposal), and all of the satellites did so.

Aftermath and Investigation

The result of any failure like this means that the launch vehicle loses its FAA approval to conduct further launches until an investigation has

been performed and the vehicle is approved to return to flight by the FAA. The vehicle may be under restrictions in its use until certain corrective actions have been performed or until the investigation provides a full root cause determination along with corrective actions.

Despite the Falcon 9's long history of successes, it, like all launch vehicles, is subject to these rules whenever one of these things occurs:

1. Serious injury or fatality.
2. Malfunction on a safety-critical system.
3. Failure of a safety organization or process.
4. High risk of causing serious or fatal injury.
5. Substantial risk of property damage not related to the activity.
6. Substantial unplanned damage to property related to the activity.
7. Unplanned permanent loss of the vehicle.
8.Impact of hazardous debris outside planned areas.
9. Failure to complete launch or re-entry as planned.

In this launch failure, SpaceX has clearly had both 7 and 9 occur, with 2 and 4 both being maybes.

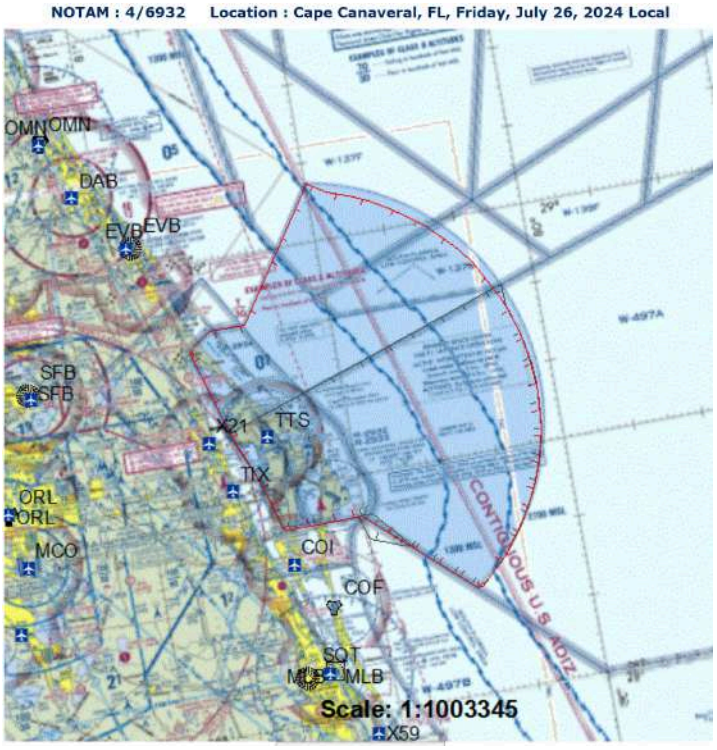
Falcon 9's worthiness to return to flight will depend primarily on the ability of SpaceX to demonstrate that they can protect public safety. That requires an investigation by SpaceX under oversight of the FAA and any other experts the FAA may call on, for example NASA.

Since Falcon 9 not only launches SpaceX's own payloads such as Starlink, but also commercial payloads, national defense payloads, and crews, is that Falcon 9 may be allowed to return to flight for payloads that can accept higher levels of risk of failure (like Starlink), but not for national security or crew payloads until a full investigation is completed.

In fact, it is likely that when Falcon 9 returns to flight we will see SpaceX purposely fly their own Starlink payloads first. For more critical payloads, such as national defense payloads or the most critical NASA payloads, they will need to complete a full investigation, any corrective actions, and complete two flights of Falcon 9 vehicles incorporating the changes.

For crew flights, the requirements are similar but will also include NASA safety board review.

Typically, when a failure on any critical launch system occurs (any launch system that carries critical payloads), there is also a full top to bottom review of the vehicle and its associate launch systems to see if turning over stones reveals any other safety issues that may have been previously overlooked, or developed over time. NASA has formed an independent review board to evaluate the safety of the Falcon 9 as if it were a new launch vehicle being prepared for its first flight to the ISS.



Temporary Flight Restrictions for a possible launch on Friday, July 26th. FAA image.

UPDATE: SpaceX received approval to resume flight on July 25th, with the first launch planned for early morning on July 27th.

During a press briefing on July 26th, NASA stated that they have a target launch date for the Crew 9 mission aboard the Falcon 9 of August 18th, with a launch window that extends into September. They expect to complete their review of Falcon 9 well before that date.

The Falcon 9 returned to service, launching without incident. The booster, number 1069, completed its 17th flight with a landing on a SpaceX drone ship. The second stage operated flawlessly through both its first and second burns.

The sensor that was removed from the second stages may be used again in future flights, as it is used to measure pressures accurately for long duration flights with multiple second stage firings. For most normal flights, SpaceX has described it as unnecessary. It may be used in future flights to geosynchronous transfer orbits, but SpaceX did not specify that.

Meade and Orion Cease Business

Details are few, but it appears that Orion Telescopes, along with the business it purchased such as Meade and Coronado, have ceased all business operations and laid off all staff.

Reports began on July 11th that the companies, owned by Optronic Technologies, Inc. had closed their facilities and laid off all workers. Since then no report has emerged of whether they have filed for bankruptcy protection.

Owners of telescopes under RMA with the company have had no luck contacting them to determine the disposition of their equipment, and no communications have been forthcoming. The website was still operational and accepting orders as of the time of this writing, however.

Little is known at this time, and the suddenness of this action surprised many, especially as formerly discontinued Meade models of ETX Maksutovs, such as the Meade ETX-90 and ETX-125 were recently rereleased by the company. Optronics Technologies manufactures their own equipment under their owned trademarks in their own factory located in Mexico.

Self-described as an employee-owned business, the exact structure of the corporation and the ability of the workforce to manage the company and affect decisions such as this are unknown. It is possible some form of negotiations are ongoing, either with potential buyers or the stockholders in the corporation.

Hopefully the companies and trademarks will find some way to return to business, as the loss of these companies and their products will leave a huge hole in the US astronomy industry.

Europe's Ariane 6 First Flight

Ariane 6 Liftoff from Kourou Space Center
ESA Image

Arianespace and ESA completed the inaugural launch of the Ariane 6 launch vehicle on

July 9th. The flight carried many of small payloads including two small re-entry vehicles.

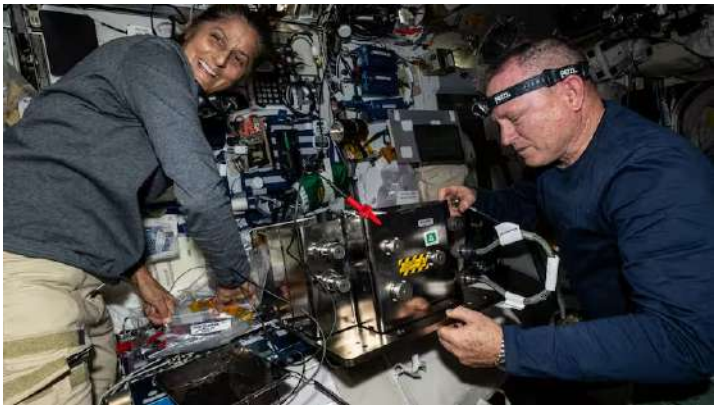
Launch of Ariane 6 has been delayed repeatedly due to development issues including problems found in solid rocket motors that Ariane 6 shares with the Vega-C launcher. After a 4 year delay, Ariane 6 finally was able to take to flight.

The first stage and solid boosters performed flawlessly. The second stage completed a burn to put the vehicle in orbit. Several of the small satellites on board were deployed, then Ariane was supposed to fire its second stage again to reach a new orbit.

Unfortunately, a power unit used to restart the engine failed to operate, leaving the vehicle stranded. The vehicle was left with no ability to control itself, and the remaining payloads, including the two re-entry vehicles, were never deployed.

Over time, the orbit of the upper stage and its remaining payloads will degrade and they will have an uncontrolled re-entry. Since one of the functions of the Ariane 6 is supposed to be the ability of the upper stage to dispose of itself in a controlled fashion, this represents a significant failure of the rocket to perform as desired.

Boeing Starliner Returns in August

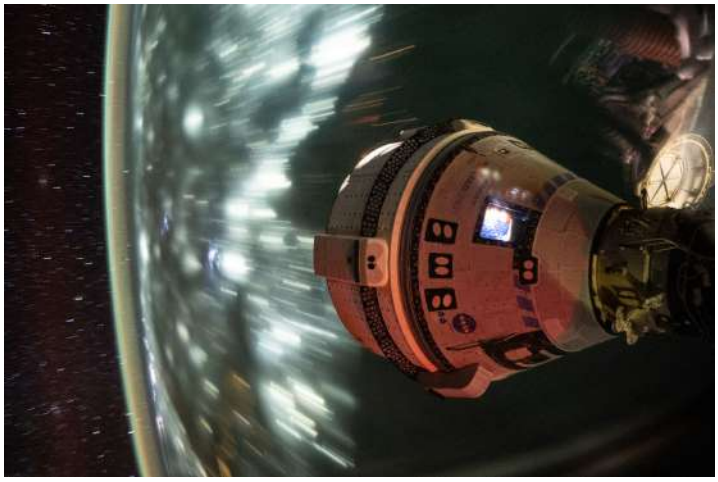


Sunita Williams and Butch Wilmore Contribute to ISS Research Activities While on Extended ISS Stay. NASA Image.

The Boeing Starliner's extended stay at the ISS will soon be coming to an end. Per a NASA briefing, Starliner will detach from the ISS and return to Earth in time for the mid-August launch of SpaceX's Crew 9 mission in order to free up the docking port that Starliner currently occupies.

The extended stay on ISS has had several beneficial outcomes. Among them has been the ability to perform extended testing of the problematic engine systems, and corroborate the findings with tests performed on the ground. Another is the Butch and Suni have been able to assist the ISS crew with their research workload in space, allowing the ISS crew to get ahead on many experiments.

Also, the ISS crew has had time to assist in on orbit testing of the Starliner. Two of the ISS crew joined Butch and Suni in the Starliner for extended tests of its life support system, and to perform human factors tests--like making sure that there's elbow room when there are 4 people on board performing various tasks.



Boeing Starliner in Orbit with ISS Boeing Space Image.

On the weekend of July 27th-28th, Starliner will perform tests of its service module's thrusters as well as pressurization of the helium system. The thruster tests will verify the operation of the thrusters that were last known to be working, and to check the condition of the one that was considered non-functional before.

Pressurization of the helium system will allow them to determine if the leaks in the 3 leaking systems have become any worse since they were last pressurized on July 15th, or if any further leaks have occurred.

At this time, none of the known problems with the Starliner's propulsion and attitude control prevent it from returning safely to Earth with its crew.

The helium leak problem seems to have a solution of larger seals, which is being tested on Earth on a service module that was previously built but removed from flight service.

The problem with the one thruster (out of 28 on board) was replicated on Earth during tests of the same model of thruster. It took many tests to replicate the conditions seen in the thruster that failed on orbit, but now that that has been accomplished, the thruster will be disassembled and studied over the next week to determine the cause of the failure. This will allow results of the test to be known well before Starliner's return from orbit.

Suni Williams and Butch WIlmore Answer Questions on the ISS. NASA image.

The final tests for Starliner will involve its return with crew on board in August. NASA will be watching the environmental control system to see how well it performs during the various phases of re-entry and recovery. They will also be looking forward to the crew's reports on the ride back down to Earth. Instruments have made this landing twice now, but sometimes the numbers don't tell the whole story, so the flight test crew's reactions will provide important data.

The first operational flight of Starliner, known as Starliner-1, is currently scheduled for August of 2025. NASA set this date to give Boeing adequate time to make the changes to the Starliner and its service module for the next flight to correct issues found during this flight. The Starliner-1 flight is double-booked with a SpaceX crew flight, likely to allow the scheduled crew changeout on the ISS in the event of delays with Starliner.

For their parts, both Butch and Suni have enjoyed the extra time in space aboard the ISS. Suni gave up opportunities to fly on ISS crew missions in order to help develop the Commercial Crew Vehicles a long time ago, so this is her first time back on the ISS since 2012.

Suni Williams Video Tour of the ISS (2012):

Station Tour: Harmony, Tranquility, Unity

More Starliner news at:
https://starlinerupdates.com/

IN THE SKY THIS MONTH

The Moon:
New Moon, August 4th
1st Quarter, August 12th
Full Moon, August 19th
Last Quarter, August 26th
New Moon, September 3rd

Saturn will experience a transit of its largest moon, Titan, beginning at 12:55am on August 1st. The moon will pass in front of Saturn's South Polar Region until 4:09am. Saturn will then occult Titan in its orbit, passing in front of

the moon on August 8th from 11:44pm until 2:27am on August 9th. Titan is quite bright, at magnitude 8.4, making it easy to see with any telescope.

Saturn's rings continue to move to a flatter position from Earth's point of view as we approach the ring plane crossing next March. At this point, seeing the shadow of the ring on the planet's disk becomes more challenging.

Saturn rises at about 10:20pm at the start of the month, 9:20pm at midmonth, and 8:16 at month's end. It will remain a bright star in our evening sky through the rest of the year.

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

Astrophotographer Damian Peach's guide to observing Saturn:
https://www.damianpeach.com/sat_best.htm

Neptune rises at about 9:15pm at the start of the month, and shortly after 7pm at month's end. At magnitude 7.7 it will take binoculars or a telescope to see it in our humid skies. Medium to high powers in a telescope (100x or more) will bring out its disk at 3.6 arcsec.

Alongside Saturn, it is our evening planet this month, below the southern Fish in Pisces.

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

Uranus rises next among the planets this month. At magnitude 5.8, it will take at least binoculars to see it in Central Florida. It will look like a blue or green non-stellar object even in binoculars. It rises shortly before 2am at the start of the month, and a bit before midnight at the end of the month. It sits in the body of Taurus, south of the Pleiades.

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

Mars and **Jupiter** have a conjunction this month, coming within half a degree of each other. On the mornings of the 13th, 14th, and 15th they will be close enough to each other to see in a single eyepiece view. They will be closest to each other on the 14th. Both remain early morning objects this month.

Mars rises before Jupiter at the start of the month, at about 2:20am. It trades places with Jupiter for the earliest rising plane during its conjunction with Jupiter on the 14th, and rises at about 1:40am at the end of the month..

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

Jupiter starts the month behind Mars, passing it during their conjunction on the 14th. It rises at 2:50am on the 1st, 1am on the 31st. At magnitude -2.2 it is large and bright, 36.7 arcsec across.

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

Mercury reached greatest elongation on the 7th of July last month on the side trailing the Sun, letting us see it in our evening sky as far away from the Sun as it will get this year. In keeping with its fast-moving namesake, this month Mercury races from one side of the Sun to the other. At the start of the month we will see it in our evening sky, setting shortly after the Sun. It will be lost in the Sun's glare on the 11th or 12th.

Then, on the 19th or 20th it will be seen on the other side of the Sun in the early morning sky, rising just before the Sun. It will continue to rise a bit earlier than the Sun each morning, until it reaches greatest elongation on September 7th.

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

Venus idles near the Sun as an evening star this month. At magnitude -3.9 it is bright enough to see in the setting Sun's glare and for about one hour after sunset. It will remain as an evening star for the rest of 2024, gradually making its way further from the Sun in our sky, setting later and later..

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

Perseid Meteor Shower comes each August, and this year will have favorable Moon conditions with a first quarter Moon that sets before the best viewing times on the peak of the shower on the 11th and 12th. The shower lasts a long time, it starts in mid-July and continues until late August, so you don't have to be out right on the peak to enjoy them. If you can get away from the brightest lights of The Villages, you should be able to see 1-2 meteors per minute on the days around the peak. Fewer the further from the peak you get. There is a change of a sudden increase in meteor rate between midnight and dawn on August 12th as the Earth passes through a stream within the cloud of the tail of Comet Swift-Tuttle, the source of the Perseus meteors.

More information on the Perseids:
https://in-the-sky.org/news.php?id=20240812_10_100

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

Club Calendar

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

August 2024
2 Exec Meeting
5 Telescope Workshop 8pm/Space Academy 6:30pm (possible alternative date for astrophotography wkshop.)
7 EAA Meeting 8pm Homestead Astro Park
17 Fruitland Park Observing Cales Field Fruitland Park
20 General Meeting: Round Table: Your Astronomy Resources. Members share their astronomy resources--favorite video/news channels/vloggers, magazines, books, websites, software/apps, etc.
27 Camp Geneva Volunteer Star Party

September 2024
2 Telescope Workshop 8pm/Space Academy 6:30pm
4 EAA Meeting 7:30p?
6 Exec Meeting 11am Fishhawk
8 *Saturn at Opposition (no event)*
17 General Meeting: TBD, Laurel Manor 6:30pm
17-18 *Partial Lunar Eclipse, 8:41pm to 12:47am, peak 10:44pm barely in Umbra. (No Event.)*
21 Fruitland Park Observing

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

Making Meteor Craters at Camp Villages, July 17th. Member Toni Graybill guides the participants. Photos by member Jeff Kahler.

Member Harry Orlind guides participants in making Newton's Disks.