

IAAS Monthly Astronomy Newsletter

April 2023



The International Association for Astronomical Studies provides this newsletter as a service for interested persons worldwide.



This newsletter is published on the World Wide Web at [The Home of KIØAR](#) - and is received nationally and internationally. Download the [PDF](#) formatted version of the newsletter.

An Open Invitation - For amateur radio operators and scanner enthusiasts, please join the Colorado Astronomy Net on the [Rocky Mountain Radio League's K1DUN](#) repeater on **449.450 MHz** or other repeaters connected to the [SKYHUBLINK](#) system. The net meets on Tuesday nights at 7 P.M. Mountain Time (MST-US) (Wednesday at 0200 GMT). Connecting to the SkyHubLink system will expand our coverage in the U.S., Canada and internationally. All Amateur radio operators worldwide are welcome. If anyone wishes to "listen" to the net, the RMRL provides a "[Live Audio Feed](#)" using Broadcastify.

Obtain your Amateur Radio (Ham) License or your General Radio Operator's License (GROL)! Visit the [South Metro VE Team](#) website for more information. The South Metro VE Team provides test sessions by appointment only. Check the website for current information. All others interested in Amateur Radio, check out the [Amateur Radio Relay League](#) website to find out more information about becoming an Amateur Radio operator.

The [Colorado Astronomy Net](#) and the [IAAS](#) are on Facebook page. Be sure to "Like" us.

Donate to the [IAAS](#)!
Thank you for your support!



Excerpts from JPL mission updates are provided as a public service as part of the [JPL Solar System Ambassador / NASA Outreach](#) program.

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"A diamond ring appears just before totality begins in 2009. This month, a hybrid eclipse that starts and ends as annular but is total for much of the track crosses from the Indian to Pacific oceans." Astronomy Magazine, April 2023, P. 28.
Alan Dyer

The [Month At-A-Glance](#)

The current month's calendar displaying the daily astronomical events.

The Moon

Phases:

- Full Moon occurs on the 6th.
- Last Quarter Moon occurs on the 13th.
- New Moon occurs on the 20th.
- First Quarter Moon occurs on the 27th.

- The Moon is at [perigee](#) (228,645 miles from Earth) on the 15th.
- The Moon is at [apogee](#) (251,220 miles from Earth) on the 28th.



Moon/Planet Pairs:

- The Moon passes 3° south of Saturn on the 15th.
- The Moon passes 2° south of Neptune on the 17th.
- Venus passes 8° north of Aldebaran on the 20th.
- The Moon passes 1.7° north of Uranus on the 21st.
- The Moon passes 1.3° north of Venus on the 23rd.
- The Moon passes 3° north of Mars on the 25th.

For reference: The Full Moon subtends an angle of $\sim 0.5^\circ$.



The Planets & Dwarf Planets

[Planetary Reports](#) are generated by "[TheSkyX](#)" software. These reports provide predicted data for the planets on the first of each month for the current year. The rise and set times for the Sun and the Moon for each day of the month as well as meteor shower radiants are also included in the reports. These reports have been optimized for the Denver, Colorado location, however, the times will be approximate for other locations on Earth.

(All times are local unless otherwise noted.)

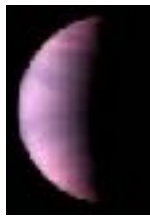
Planetary Highlights for April

"Mercury and Venus put on their best display of the year this month. Watch them each evening, with Mercury at its best in the first two weeks of April. Mars continues to recede from Earth and a nice 1st-magnitude object crossing Gemini. Saturn reappears in the morning sky, with better views late in the month — why not plan to view the April Lyrids and the ringed planet together? Jupiter is too close to the Sun for observation this month, while Uranus and Neptune are challenging." Astronomy Magazine, April 2023, P. 28.



Mercury

Is at greatest eastern [elongation](#) (19°) on the 11th. Mercury is [stationary](#) on the 21st. Mercury sets at 8:41 p.m. on the 1st and about 7:53 p.m. by month's end. Look for Mercury low on the western horizon very soon after sunset. Mercury reaches its best evening appearance for the year this month. Mercury moves from the [constellation](#) of [Pisces](#) into [Aries](#) shining at [magnitude](#) 0.5 on the 15th.



Venus

Sets at 10:34 p.m. on the 1st and about 11:32 p.m. by month's end. Venus continues to climb higher in the western sky as the month progresses. Look for Venus to the west soon after sunset. Venus moves from the constellation of [Aries](#) into [Taurus](#) shining at magnitude -4.1 on the 15th.

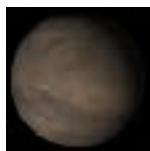


One day before Mercury reaches greatest elongation, Venus sets in the west. See the planets, Uranus is visible, with 5-magnitude star in background. See introduction.



Earth

N/A.



Mars

Sets at 2:14 a.m. on the 1st and about 1:18 a.m. by month's end. Look for Mars in the southern sky in the evening soon after sunset. Mars is in the constellation of [Gemini](#) shining at magnitude 1.1 on the 15th.



Mars passes within 1° of Mercury in Gemini on April 14. Venus is still visible long after sunset as well.



Jupiter

Is in [conjunction](#) with the Sun on the 11th. Jupiter sets at 7:57 p.m. on the 1st. After conjunction, Jupiter returns to the morning sky. Jupiter rises about 5:29 a.m. by month's end. Jupiter is lost in the twilight glow of the Sun and is not visible this month. Jupiter is in the constellation of [Pisces](#) shining at magnitude -2.1.



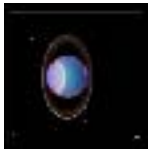
Saturn

Rises at 5:19 a.m. on the 1st and about 3:28 a.m. by month's end. Even though the view of Saturn is difficult at the beginning of the month, it improves significantly by the end of the month.

Saturn is in the constellation of [Aquarius](#) shining at magnitude 0.9.



This appears west of Saturn at April's end. Although several moons are shown, only Mimas, Enceladus, and Tethys may be seen with moderate instruments. Additional moons will show up a hour earlier the weeks closest to the rings, but appear in slightly different locations.



Uranus

Sets at 10:17 p.m. on the 1st and about 8:27 p.m. by month's end. Look for Uranus in the west once the skies darken after sunset. Uranus is in the constellation of [Aries](#) shining at magnitude 5.9.



Neptune

Rises at 6:14 a.m. on the 1st and about 4:18 a.m. by month's end. At the beginning of the month Neptune is too close to the Sun to be seen. After mid-month, Neptune is easier to spot in the morning sky. Neptune is in the constellation of [Pisces](#) shining at magnitude 7.8.

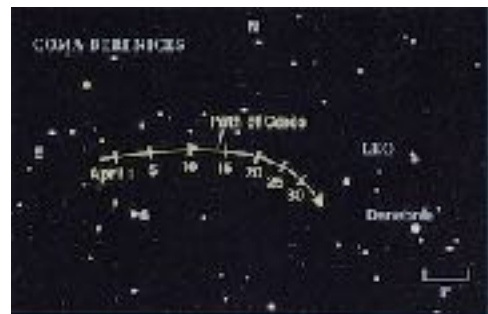
Dwarf Planets



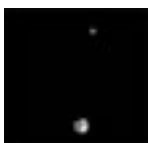
Ceres

Rises at 5:41 p.m. on the 1st and about 3:26 p.m. by month's end. Look for Ceres to the southeast in the evening and early morning hours before sunrise. Ceres is in the constellation of

[Coma Berenices](#) shining at magnitude 7.3.



Light Ceres should be easy to find, its path swinging past and back into the constellation.



Pluto

Rises at 3:50 a.m. on the 1st and about 1:53 a.m. by month's end. Pluto is still low in the morning skies but viewing will be better by month's end. Pluto is in the constellation of [Capricornus](#) shining at magnitude 15.2.

As always, good luck at spotting Neptune, Ceres and Pluto, a large telescope and dark skies will be needed.

Constellation information provided by [Go Astronomy](#).

Astronomical Events



Meteor Showers

- The Lyrids [[meteor shower](#)] are typically visible between April 16 and 25. Maximum occurs during April 21-22. Although the maximum rate is about 10, there have been instances during the last 200 years when rates were near or over 100 per hour. The average magnitude of the meteors is near 2.4 and the speed is described as rapid. About 15% of the meteors leave persistent trains.

For more information about Meteor Showers, visit Gary Kronk's [Meteor Showers Online](#) web page.



[Meteor Shower Radiant Report](#)

[Meteor Scatter](#) (or Meteor burst communications) -- "is a radio [propagation mode](#) that exploits the [ionized](#) trails of [meteors](#) during [atmospheric entry](#) to establish brief communications paths between [radio stations](#) up to 2,250 kilometres (1,400 mi) apart." Tune your shortwave or your HF amateur radio to 54.310 MHz USB CW and see if you can hear any pings. Try other frequencies as well... 6m FT8 digital - 50.313 Mhz & 50.276 Mhz, JP-65 digital mode and the carrier frequencies of the lower VHF bands for TV channels 2, 3 & 4.

[Meteor Rx How-To](#) by Terry Bullett (WØASP).



Comets

- C/2022 E3 ([ZTF](#)) is descending through the constellation of [Triangulum](#) into [Aries](#) this month. Shining at 10th magnitude, the comet will be difficult to spot for northern hemisphere observers, due to its lower proximity to the southern horizon. An 8-inch telescope or larger will be needed as well and dark skies away from city lights will be needed to even get a glimpse.



For information, orbital elements and ephemerides on observable comets visit the [Observable Comets](#) page from the Harvard-Smithsonian Center for Astrophysics.

For more information about Comets, check out Gary Kronk's 6-volume series of books on [Cometography](#).



Eclipses

- A "[Hybrid](#)" [solar eclipse](#) occurs on the [20th](#). The eclipse starts off as an annular eclipse, about the mid-point along the path of totality, the Sun becomes totally eclipsed by the Moon, then finally, the eclipse ends in annularity once more. The path of totality passes over North West Cape, a remote peninsula of Western Australia. South/East Asia, Australia, Pacific, Indian Ocean, and Antarctica will see at least a partial eclipse. [Detailed map of eclipse path](#).
- No lunar [eclipse](#) activity this month.

Observational Opportunities

(from evening to morning)

- Look for Mercury, Venus, Neptune, Uranus and Mars in the evening.
- Look for Saturn in the morning.
- Watch the Lyrids meteor shower peak on the morning of the 22nd.

Asteroids

(From west to east)

- **Pallas** is in the constellation of [Monoceros](#).
- **Iris** is at [opposition](#) on the 30th in the constellation of [Libra](#).

Information about the Minor Planets can be found at the [Minor Planet Observer](#) web site.

Occultations



Information on various [occultations](#) can be found at the [International Occultation Timing Association's \(IOTA\)](#) web site.

Member Meteor Sightings

In this section I will post meteor, fireball, etc sightings that have been published on the [American Meteor Society's](#) web site. I want to make this an active section of the web pages and newsletter and would like to publish the links to member sightings. If you have any published sightings, please provide me with the links and I will post them here for all to enjoy.

<u>Event ID</u>	<u>Date/Time</u>	<u>Location</u>	<u>Observer</u>	<u>Link</u>
3871-2015	2015-11-13 01:55 MST	CO	Charles N	3871a
3587-2015	2015-11-22 17:38 MST	CO	Kevin S	3587aw
3829-2015	2015-12-05 18:06 MST	CO	Burness A	3829a
986-2020	2020-02-21 22:20 MST	CO	Lukas S	986
3716-2020	2020-07-24 23:22 MDT	CO	Lukas S	3716
4774-2021	2021-08-13 21:57 MDT	UT	Lukas S	4774
7044-2021	2021-10-28 20:37 MDT	CO	Burness A	249058
6763-2022	2022-10-06 05:56 CDT	OK	Mike C	6763

[Subscriber Gallery](#)

I have created a web page containing images taken and submitted by subscribers to the email newsletter, check-ins to the Colorado Astronomy Net and readers of the online newsletter and some of my own images. Any one wishing to submit their images to the gallery, please let me know. The images must be taken by the submitter and be astronomy related. Please include a description and your information so that I can give proper credit to your work. I will post the most recent submissions here.

Comet C/2022/E3 (ZTF)

January, 2023



Comet C/2022 E3 (ZTF)

Isabel Streit 2023

Image Courtesy of Isa Streit

For more information on [Comet C/2022 E3 \(ZTF\)](#) please visit Isa's Comet page.

Planetary/Lunar Exploration Missions

(Excerpts from recent mission updates)



JPL Latest News

The Latest from Space

[The Origin of JPL](#) (a Youtube video-1 Hour 29 minutes).

[JPL Latest News](#)

March 15, 2023

NASA's Magellan Data Reveals Volcanic Activity on Venus

[Full Article & Images](#)

"In a first, scientists have seen direct evidence of active volcanism on Earth's twin, setting the stage for the agency's VERITAS mission to investigate.

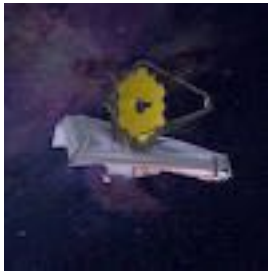
Direct geological evidence of recent volcanic activity has been observed on the surface of Venus for the first time. Scientists made the discovery after poring over archival radar images of Venus taken more than 30 years ago, in the 1990s, by NASA's [Magellan](#) mission. The images revealed a volcanic vent changing shape and increasing significantly in size in less than a year.

Scientists study active volcanoes to understand how a planet's interior can shape its crust, drive its evolution, and affect its habitability. One of NASA's new missions to Venus will do just that. Led by the agency's Jet Propulsion Laboratory in Southern California, [VERITAS](#) – short for Venus Emissivity, Radio science, InSAR, Topography, And Spectroscopy – will launch within a decade. The orbiter will study Venus from surface to core to understand how a rocky planet about the same size as Earth took a very different path, developing into a world covered in volcanic plains and deformed terrain hidden beneath a thick, hot, toxic atmosphere."

Read the latest news and discoveries from JPL's dozens of active space missions exploring Earth, the solar system and worlds beyond.

[Past, Present, Future and Proposed JPL Missions](#)

For special JPL programs and presentations in your area visit the [JPL Solar System Ambassador](#) web site.



James Webb Space Telescope

March 27, 2023

NASA's Webb Measures the Temperature of a Rocky Exoplanet

[Full Article & Images](#)

"An international team of researchers has used NASA's James Webb Space Telescope to measure the temperature of the rocky exoplanet TRAPPIST-1 b. The measurement is based on the planet's thermal emission: heat energy given off in the form of infrared light detected by Webb's Mid-Infrared Instrument (MIRI). The result indicates that the planet's dayside has a temperature of about 500 kelvins (roughly 450 degrees Fahrenheit) and suggests that it has no significant atmosphere.

This is the first detection of any form of light emitted by an exoplanet as small and as cool as the rocky planets in our own solar system. The result marks an important step in determining whether planets orbiting small [active stars](#) like TRAPPIST-1 can sustain atmospheres needed to support life. It also bodes well for Webb's ability to characterize temperate, Earth-sized exoplanets using MIRI."

More information on the James Webb Space Telescope mission is available at [The James Webb Space Telescope](#) website.

The public can follow the mission on [Facebook](#), [Twitter](#) and [YouTube](#).



Juno

January 27, 2023

NASA's Juno Team Assessing Camera After 48th Flyby of Jupiter

[Full Article & Images](#)

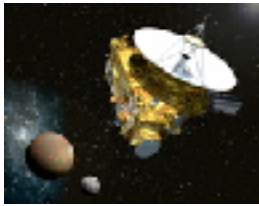
"Engineering data is being evaluated to determine why the majority of images taken by the solar-powered orbiter's JunoCam were not acquired."

The JunoCam imager aboard NASA's Juno spacecraft did not acquire all planned images during the orbiter's most recent flyby of Jupiter on Jan. 22. Data received from the spacecraft indicates that the camera experienced an issue similar to one that occurred on its previous close pass of the gas giant last month, when the team saw an anomalous temperature rise after the camera was powered on in preparation for the flyby."

Images from NASA's [JunoCam](#).

More information on the Juno mission is available at [Juno](#) and [Mission Juno](#).

The public can follow the mission on [Facebook](#) and [Twitter](#).



New Horizons

March 14, 2023

NASA's New Horizons Team Discusses Discoveries from the Kuiper Belt

[Full Article & Images](#)

"More than 5 billion miles from Earth and 17 years into a mission that included the first close-up exploration of Pluto and the first encounter with a planetary building block in the Kuiper Belt, NASA's New Horizons continues to shed light on the mysterious planets and smaller bodies of the outer solar system."

[New Horizons gallery](#)

Find [New Horizons](#) in the iTunes App Store.

For more information on the New Horizons mission -- the first mission to the ninth planet -- visit the [New Horizons](#) home page.



TESS

March 21, 2023

Small stars may host bigger planets than previously thought

[Full Article & Images](#)

"Stars with less than half the mass of our Sun are able to host giant Jupiter-style planets, in conflict with the most widely accepted theory of how such planets form, according to a new study led by UCL and University of Warwick researchers.

Gas giants, like other planets, form from disks of material surrounding young stars. According to core accretion theory, they first form a core of rock, ice and other heavy solids, attracting an outer layer of gas once this core is sufficiently massive (about 15 to 20 times that of Earth).

However, low-mass stars have low-mass disks that, models predict, would not provide enough material to form a gas giant in this way, or at least not quickly enough before the disk breaks up."

For more news and information on the TESS mission, visit the [Latest Tess Stories](#) page.

[Past, Present, Future and Proposed JPL Missions.](#)

Mars Missions

[Be A Martian](#)



Mars website mobile version is here!
Simply type
<http://mars.jpl.nasa.gov>
into your mobile browser.

[MARS WEATHER](#)

Mars Daily Weather Report



Mars on the Go! NASA Be A Martian Mobile App

If you want the latest news as it happens, try out the "Be A Martian" app.

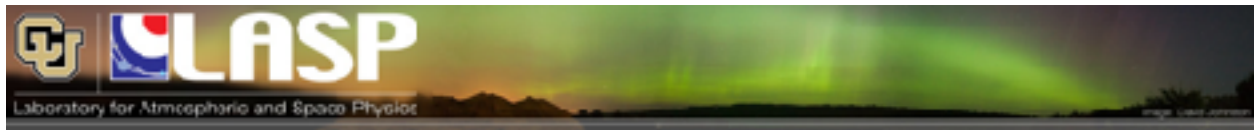
Download on Mobile Devices

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JMARS

[JMARS](#) is an acronym that stands for Java Mission-planning and Analysis for Remote Sensing. It is a geospatial information system (GIS) developed by ASU's Mars Space Flight Facility to provide mission planning and data-analysis tools to NASA's orbiters, instrument team members, students of all ages, and the general public.



Laboratory for Atmospheric and Space Physics

"The Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado Boulder (CU) began in 1948, a decade before NASA. We are the world's only research institute to have sent instruments to all eight planets and Pluto.

LASP combines all aspects of space exploration through our expertise in science, engineering, mission operations, and scientific data analysis. As part of CU, LASP also works to educate and train the next generation of space scientists, engineers and mission operators by integrating undergraduate and graduate students into working teams. Our students take their unique experiences with them into government or industry, or remain in academia to continue the cycle of exploration.

LASP is an affiliate of [CU-Boulder AeroSpace Ventures](#), a collaboration among aerospace-related departments, institutes, centers, government labs, and industry partners."



LASP
March 24, 2023

TSIS-1: Five years of solar science and counting

[Full Article & Images](#)

"For more than four decades, scientists have been using various spaceborne instruments to continuously measure how much of the Sun's energy reaches Earth's atmosphere. This long-term measure of total solar irradiance (TSI), which the Laboratory for Atmospheric and Space Physics (LASP) has contributed to for more than 20 years, is the longest continuous climate record from space.

The Sun is by far the largest source of energy to Earth, so it understandably plays a major role in global climate. Precise and accurate observations are critical for the study of Earth's radiation budget, the balance between incoming and outgoing solar energy, and our understanding of how the Sun influences the Earth system and global and regional climate."



MAVEN
February 14, 2023
A love letter to MAVEN for Valentine's Day

[Full Article & Images](#)

"To Our Dearest MAVEN,

How can we even begin to put in words how much we adore you? You're always the romantic, carrying a [ROSE](#) (Radio Occultation Science Experiment) wherever you go. We can't stand being [SEPA](#)rated from your data – it truly [SWEA](#)ps us off our feet!

You are always collecting data for us to understand the evolution of Mars' atmosphere, especially "the one that got away". [NGIMS](#)-us goosebumps every time we learn something new about Mars. We cannot get over your [MAG](#)netic personality and we are always ec[STATIC](#) to see what data you collected. You are always doing [deep dips](#) into our hearts, helping us explore the Red Planet more and more.

MAVEN, you've taught us to be patient. Years and tears, highs and lows, long nights debugging code. All worth it to watch you, our darling MAVEN, [soar off the launchpad](#) and into the history books. Most of all, you brought us together a team that loves learning, hard work, and scientific integrity to boot! Thank you, MAVEN, and Happy Valentine's Day.

Love,

The MAVEN Team"

Visit [LASP](#) and [MAVEN](#) for more information.



Mars 2020 - Perseverance

February 17, 2023

NASA's Perseverance Rover Set to Begin Third Year at Jezero Crater

[Full Article & Images](#)

"After completing the first sample depot on another world, the rover continues its hunt for Mars rocks worthy of study on Earth.

NASA's Perseverance rover will celebrate its second anniversary on the surface of Mars Saturday, Feb. 18. Since arriving at Jezero Crater in 2021, the six-wheeled, nuclear-powered rover has been examining geologic features and collecting samples of the Red Planet that are central to the first step of the NASA-ESA (European Space Agency) Mars Sample Return campaign. Scientists want to study Martian samples with powerful lab equipment on Earth to search for signs of ancient microbial life and to better understand the processes that have shaped the surface of Mars."

Learn more about the [Mars 2020 \(Perseverance\) mission](#).



Mars Science Laboratory - Curiosity

March 6, 2023

NASA's Curiosity Views First 'Sun Rays' on Mars

[Full Article & Images](#)

"The veteran rover captured a dazzling sunset at the start of a new cloud-imaging campaign.

Martian sunsets are uniquely moody, but NASA's Curiosity rover captured one last month that stands out. As the Sun descended over the horizon on Feb. 2, rays of light illuminated a bank of clouds. These "sun rays" are also known as crepuscular rays, from the Latin word for "twilight." It was the first time sun rays have been so clearly viewed on Mars.

Curiosity captured the scene during the rover's newest twilight cloud survey, which builds on its 2021 observations of noctilucent, or night-shining, clouds. While most Martian clouds hover no more than 37 miles (60 kilometers) above the ground and are composed of water ice, the clouds in the latest images appear to be at a higher altitude, where it's especially cold. That suggests these clouds are made of carbon dioxide ice, or dry ice."

Check out information about NASA's partnership with [Foursquare](#). Visit the [Mars Science Laboratory](#) page.



Mars Reconnaissance Orbiter Mission

June 28, 2022

Help NASA Scientists Find Clouds on Mars

[Full Article & Images](#)

"By identifying clouds in data collected by NASA's Mars Reconnaissance Orbiter, the public can increase scientists' understanding of the Red Planet's atmosphere.

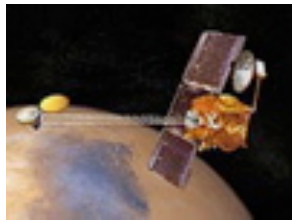
NASA scientists hope to solve a fundamental mystery about Mars' atmosphere, and you can help. They've organized a project called Cloudspotting on Mars that invites the public to identify Martian clouds using the citizen science platform Zooniverse. The information may help researchers figure out why the planet's atmosphere is just 1% as dense as Earth's even though ample evidence suggests the planet used to have a much thicker atmosphere.

The air pressure is so low that liquid water simply vaporizes from the planet's surface into the atmosphere. But billions of years ago, lakes and rivers covered Mars, suggesting the atmosphere must have been thicker then.

How did Mars lose its atmosphere over time? One theory suggests different mechanisms could be lofting water high into the atmosphere, where solar radiation breaks those water molecules down into hydrogen and oxygen (water is made of two hydrogen atoms and one oxygen atom). Hydrogen is light enough that it could then drift off into space."

MARS RECONNAISSANCE ORBITER HIRISE IMAGES

View all of the archived [HiRISE](#) images.
More information about the [MRO](#) mission is available online.



Mars Odyssey Orbiter

March 15, 2023

Engineers Keep an Eye on Fuel Supply of NASA's Oldest Mars Orbiter

[Full Article & Images](#)

"Measuring the fuel supply on Odyssey, a decades-old spacecraft without a fuel gauge, is no easy task.

Since NASA launched the 2001 Mars Odyssey Orbiter to the Red Planet almost 22 years ago, the spacecraft has looped around Mars more than 94,000 times. That's about the equivalent of 1.37 billion miles (2.21 billion kilometers), a distance that has required extremely careful management of the spacecraft's fuel supply. This feat is all the more impressive given that Odyssey has no fuel gauge; engineers have had to rely on math instead."

DAILY MARS ODYSSEY THEMIS IMAGES

Thermal Emission Imaging System ([THEMIS](#)) web site.

The Odyssey data are available through a new online access system established by the [Planetary Data System](#).

Visit the [Mars Odyssey Mission](#) page.



Mars InSight - Journey to Mars

InSight - Revealing the Heart of Mars

December 21, 2022

NASA Retires InSight Mars Lander Mission After Years of Science

[Full Article & Images](#)

"The mission has concluded that the solar-powered lander has run out of energy after more than four years on the Red Planet.

NASA's InSight mission has ended after more than four years of collecting unique science on Mars.

Mission controllers at the agency's Jet Propulsion Laboratory in Southern California were unable to contact the lander after two consecutive attempts, leading them to conclude the spacecraft's solar-powered batteries have run out of energy – a state engineers refer to as "dead bus."

NASA had previously decided to declare the mission over if the lander missed two communication attempts. The agency will continue to listen for a signal from the lander, just in case, but hearing from it at this point is considered unlikely. The last time InSight communicated with Earth was Dec. 15."

Interactive selection of [raw images](#) taken by the cameras aboard InSight.

Learn more about the [InSight mission](#).

Mars Missions Status

New Mars missions are being planned to include several new rover and sample collection missions. Check out the [Mars Missions](#) web page and the [Mars Exploration](#) page.

[Astronomy Links and Other Space News](#)

(If you have a link you would like to recommend to our readers, please feel free to submit it.)

[Colorado Astronomy Links](#)

[Radio Astronomy Links](#)

[Other Astronomy Links](#)

Acknowledgments and References

Much of the information in this newsletter is from "Astronomy Magazine" (Kalmbach Publishing), JPL mission status reports, "Meteor Showers - A Descriptive Catalog" by Gary W. Kronk and other astronomical sources that I have stashed on my book shelves.

The author will accept any suggestions, constructive criticisms, and corrections. Please feel free to send me any new links or articles to share as well. I will try to accommodate any reasonable requests. Please feel free to send questions, comments, criticisms, or donations to the email address listed below. Enjoy!

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Keep looking UP!

73 from KI0AR

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