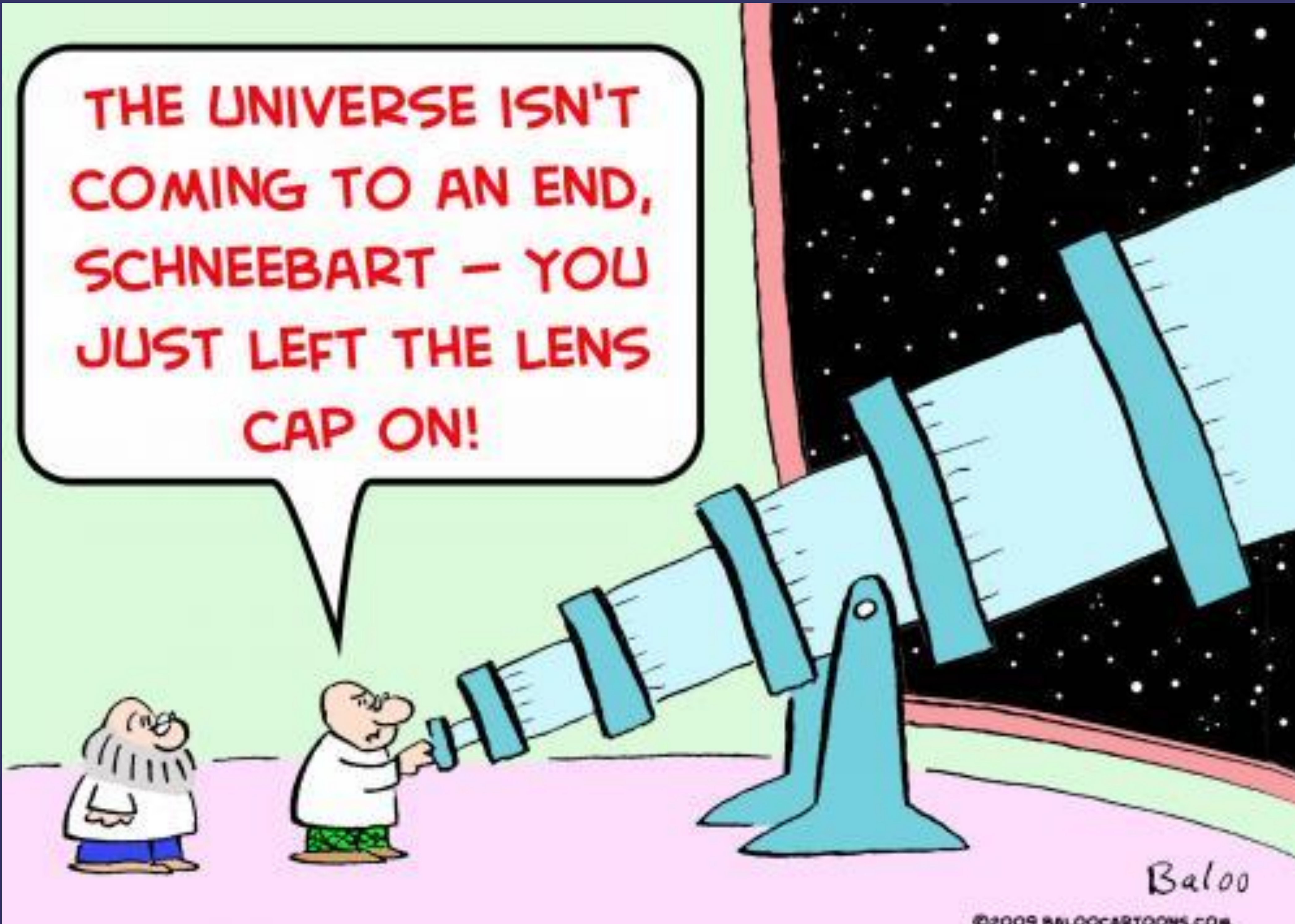

THE UNIVERSE ISN'T COMING TO AN END, SCHNEEBART – YOU JUST LEFT THE LENS CAP ON!
Baloo
©2009 BALOOCARTOONS.COM

CYGNUS • 2024
Valkeakoski, Sääksmäki

TÄHTITIETEELLINEN YHDISTYS URSA

Kauas on pitkä matka

3.8.2024

Hannu Määttänen

CYGNUS • 2024
Valkeakoski, Sääksmäki

TÄHTITIETEELLINEN YHDISTYS URSA

Kauas on pitkä matka
osa I

3.8.2024

Hannu Määttänen

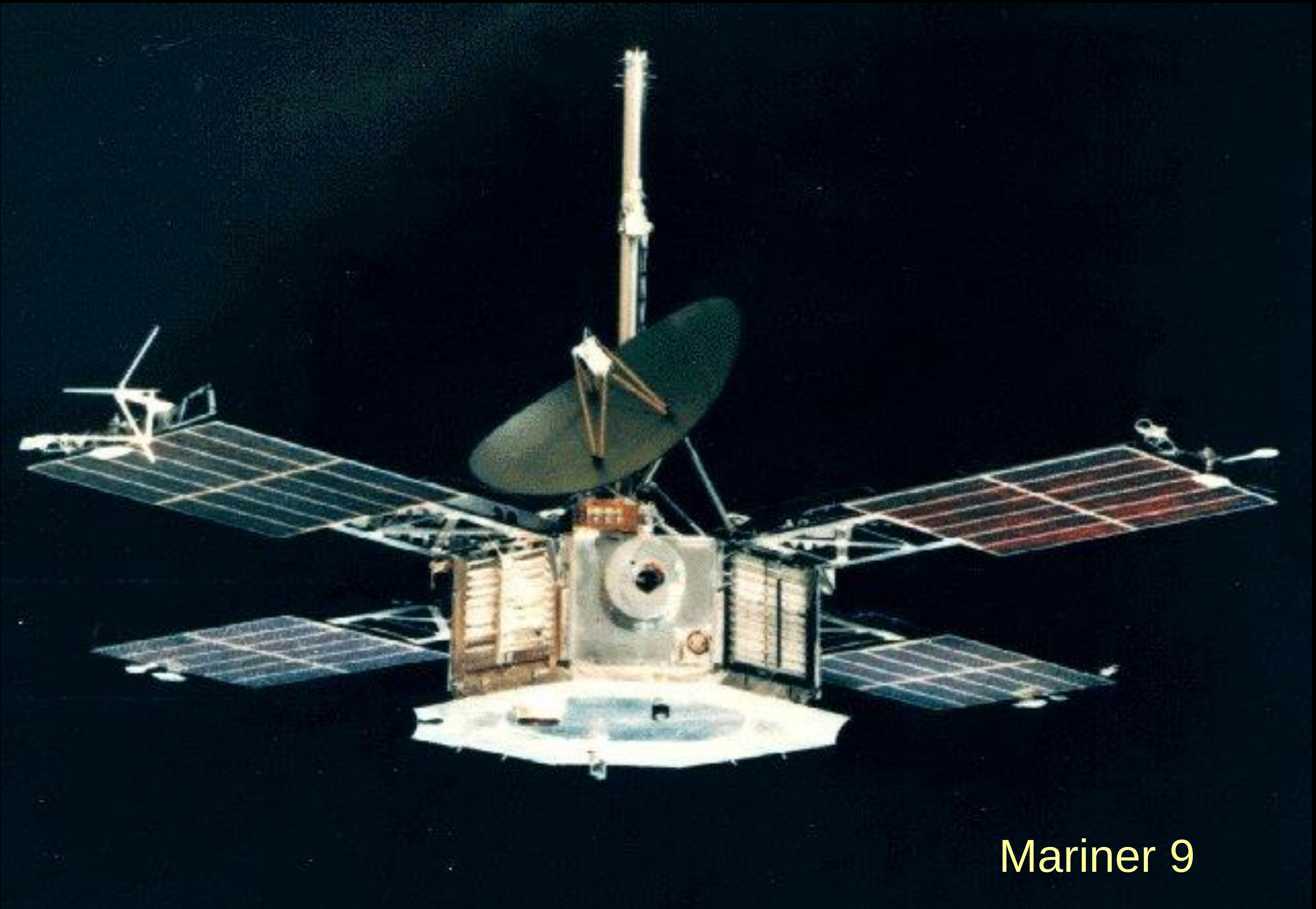
Mistä kyse

Esitelmäsarjan ensimmäinen osa kertoo Nasan varhaisimmista planeettaluotaimista, jotka lähetettiin matkaan vuosina 1962-1977.

Mariner 1 – Voyager 1

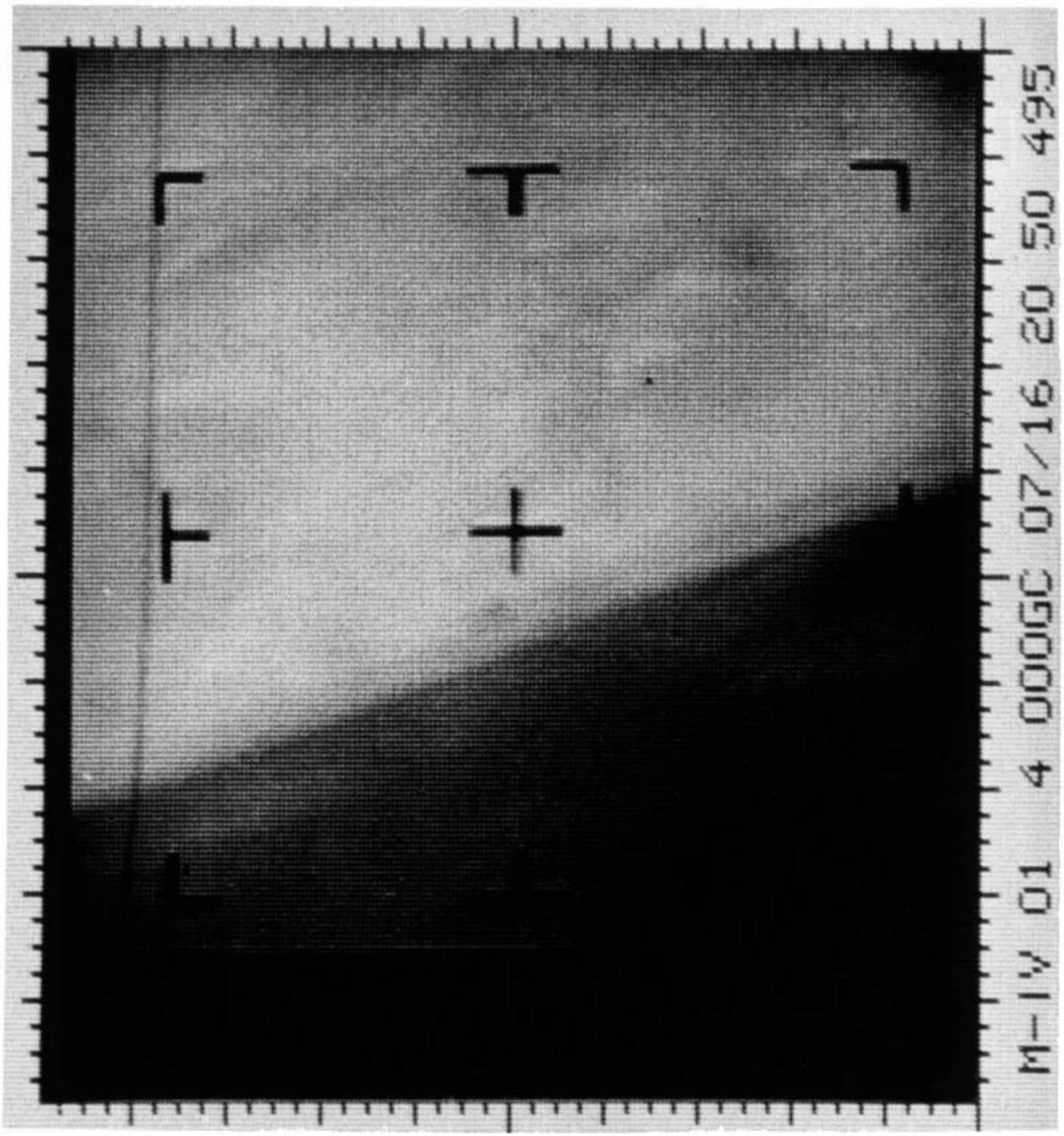
Marinerit

Spacecraft	Launch Date	Objective	Results
Mariner 1	Jul 22, 1962	Venus flyby	Unsuccessful
Mariner 2	Aug 27, 1962	Venus flyby	Successful
Mariner 3	Nov 5, 1964	Mars flyby	Unsuccessful
Mariner 4	Nov 28, 1964	Mars flyby	Successful
Mariner 5	Jun 14, 1967	Venus flyby	Successful
Mariner 6	Feb 25, 1969	Mars flyby	Successful
Mariner 7	Mar 27, 1969	Mars flyby	Successful
Mariner 8	May 9, 1971	Mars orbit	Unsuccessful
Mariner 9	May 30, 1971	Mars orbit	Successful
Mariner 10	Nov 3, 1973	Venus, Mercury flybys	Successful



Mariner 9

Mariner 4



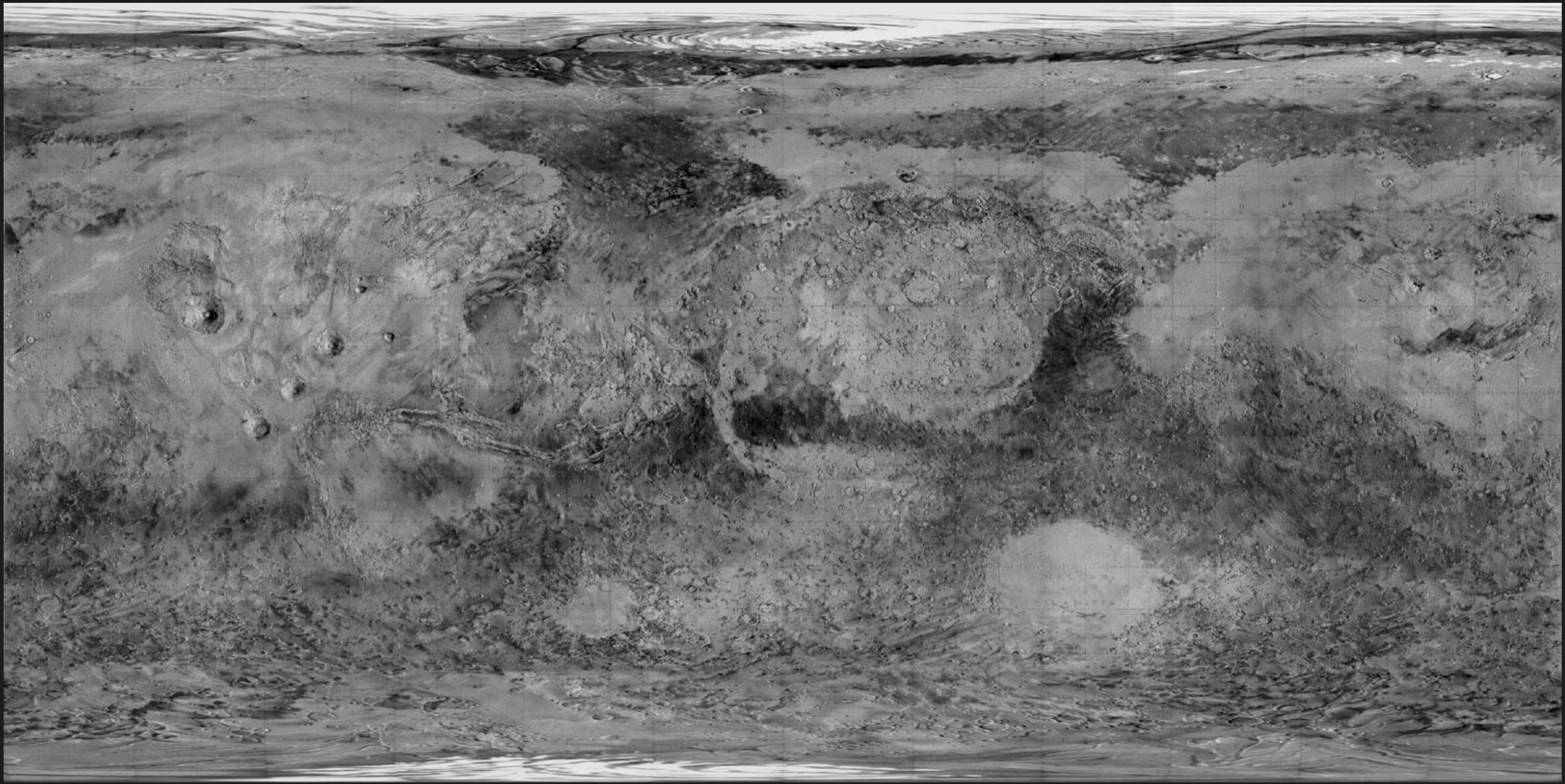
Ensimmäinen kuva
15.7.1965

Mariner 4

Kaikkiaan 21 kuvaa, joiden resoluutio 200 x 200.

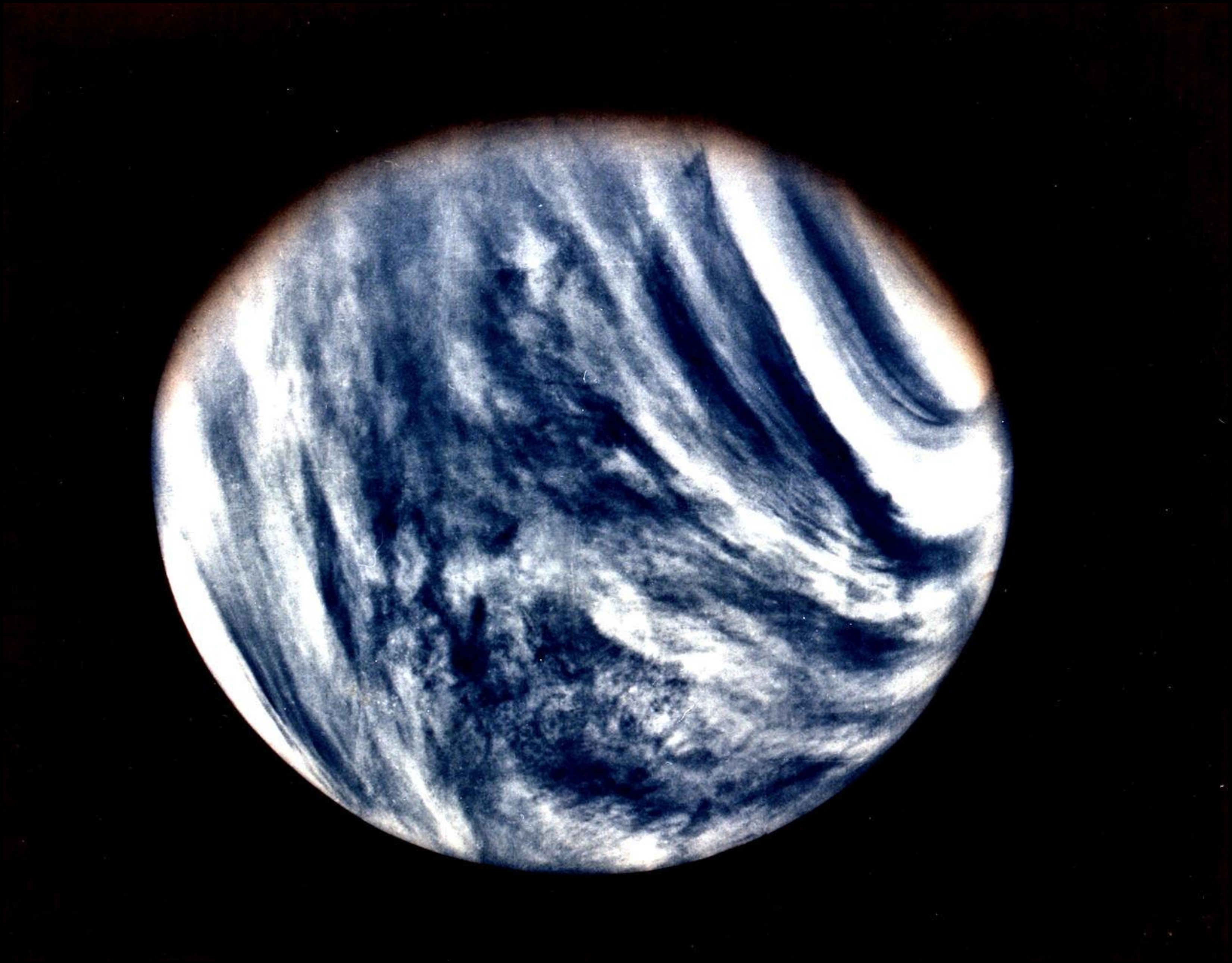
Kuvan lähetys 9 tuntia.

Mariner 9, kooste

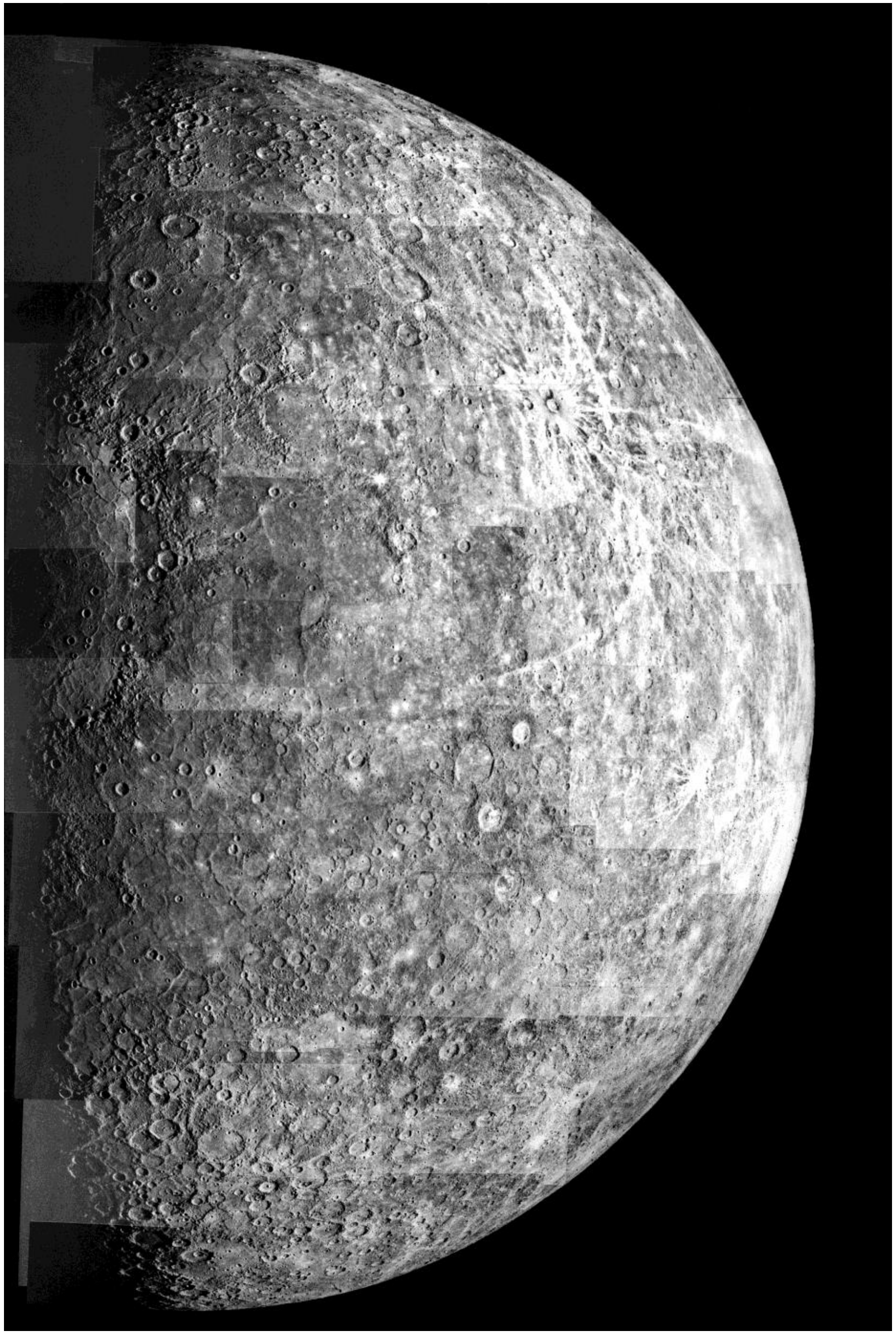


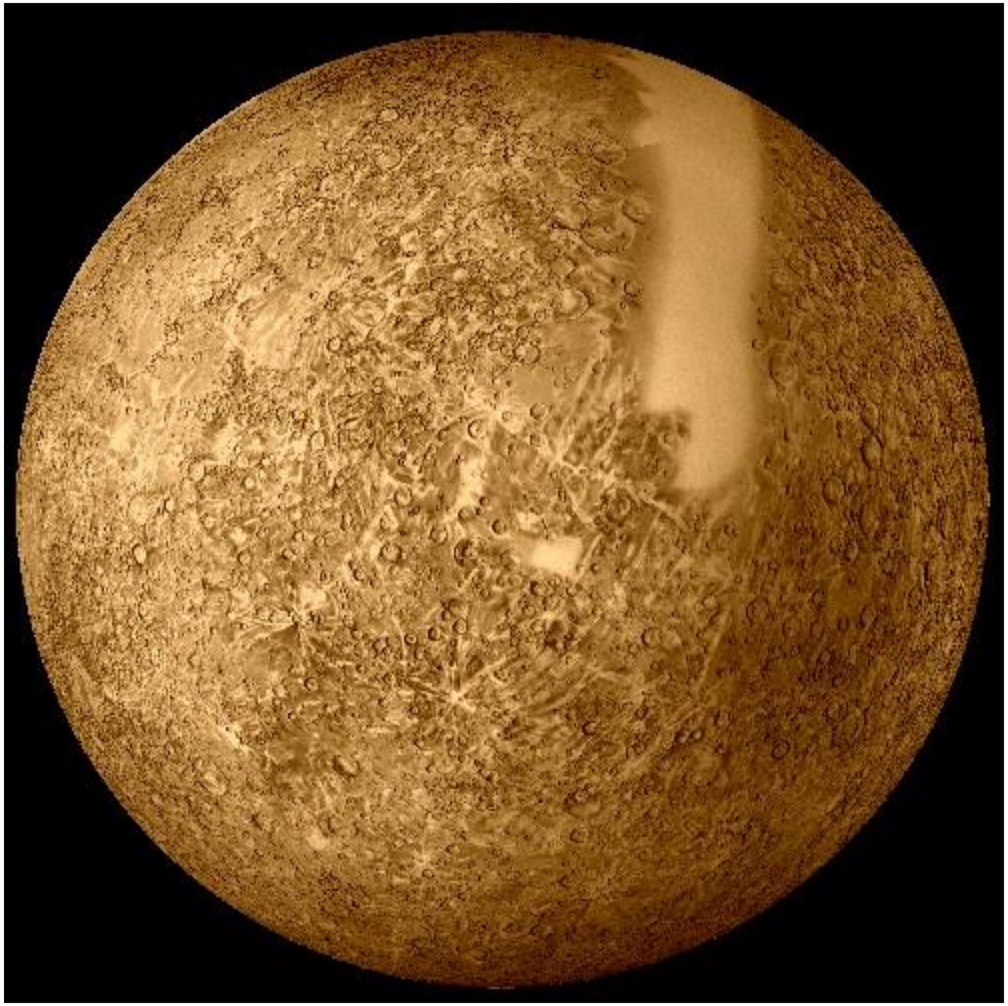
Mariner 9:n hinta137 miljoonaa USD

Mariner 10

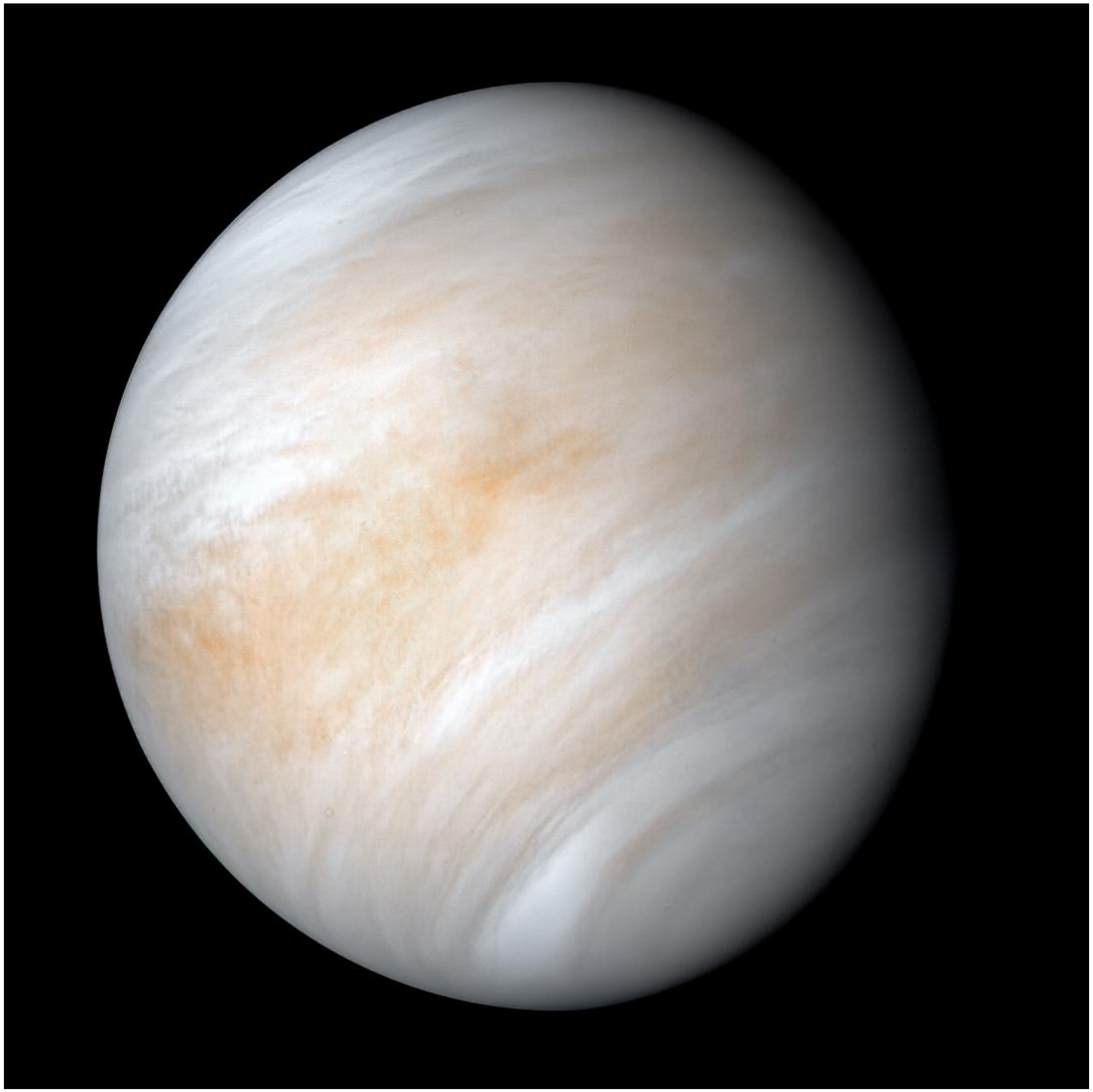


Mariner 10



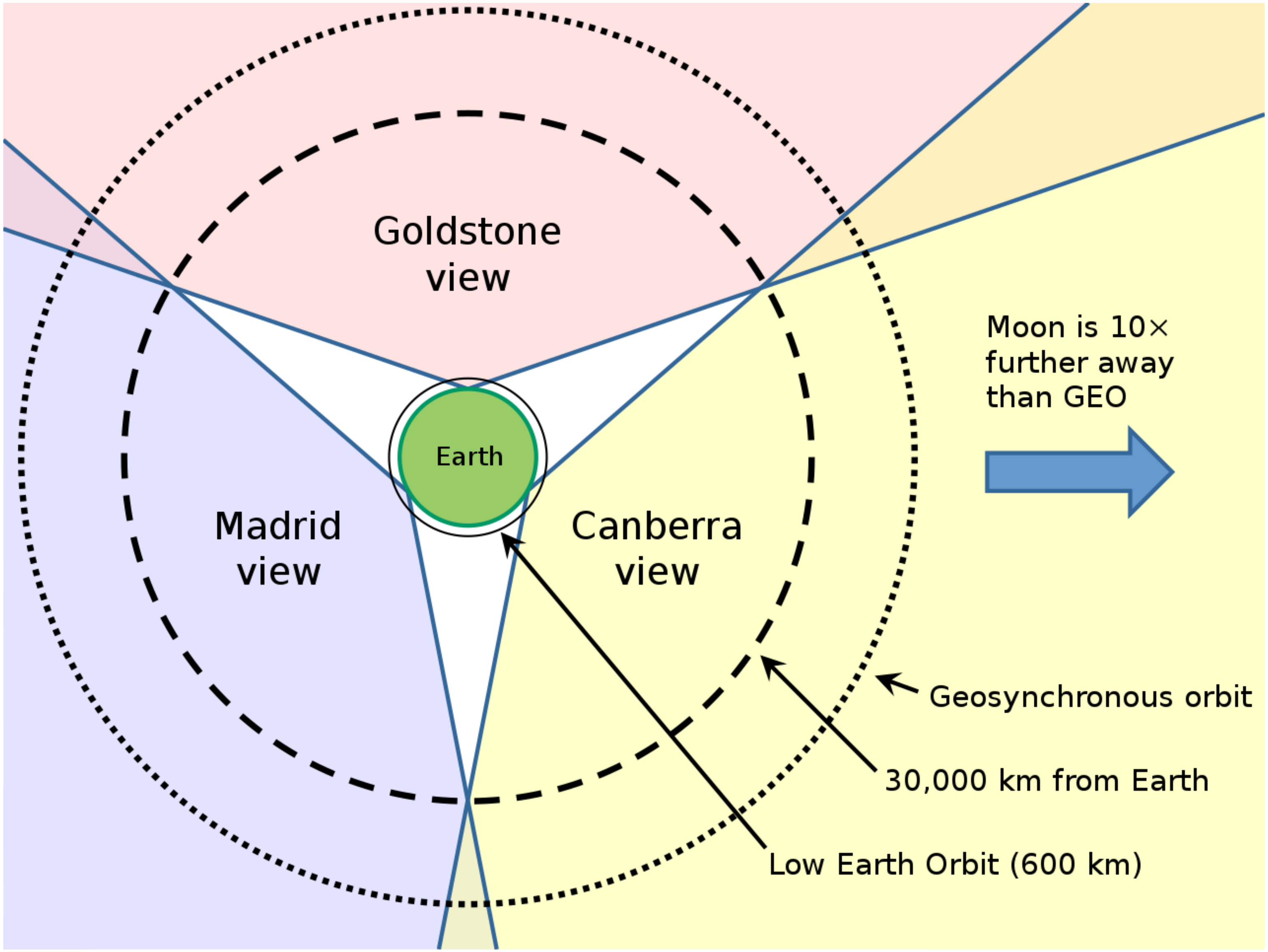


Mariner 10, Venus



Mariner 10
7. ja 8. helmikuuta1974, muutama päivä lähimmän kohtaamisen jälkeen, joka 5.2.1974

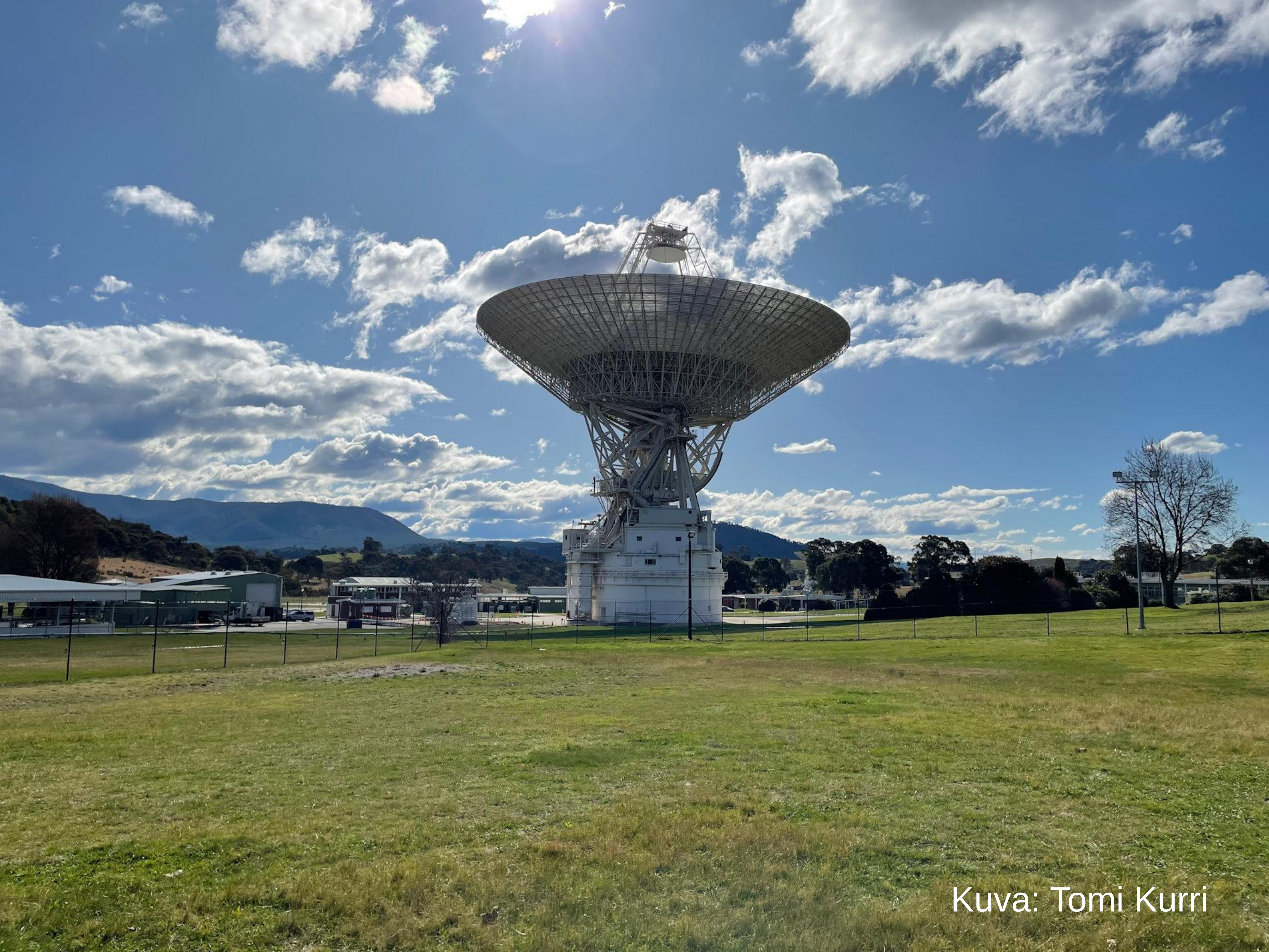
Nykytekniikalla uudelleenkäsitelty kuva.



The Deep Space Network is spread over three locations around the world - California, Spain, and Australia. This allows mission controllers to communicate with spacecraft on the Moon and beyond at all times during Earth's rotation.

The new X-band cone into the 70-meter (230-feet) Deep Space Station 43 dish located in Canberra, Australia. Heinäkuu 2020.

The Voyagers send their findings back to DSN antennas with 13-watt transmitters.


Kuva: Tomi Kurri

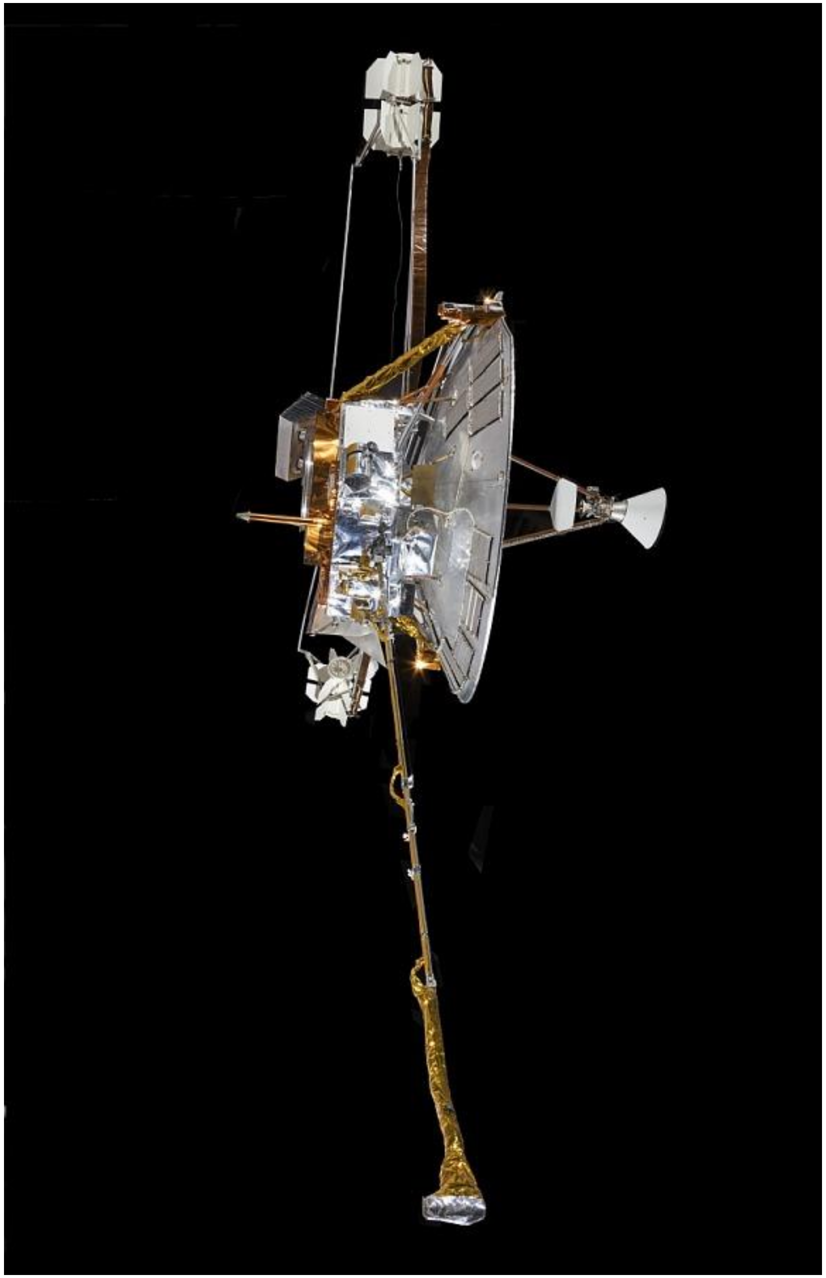
Pioneer 10 was launched on March 3, 1972, at 01:49:00 UTC, aboard an Atlas-Centaur launch vehicle. The third stage consisted of a solid fuel Star-37E stage (TE-M-364-4) developed specifically for the Pioneer missions. This stage provided about 6,800 kg of thrust and spun up the spacecraft. The spacecraft had an initial spin rate of 30 rpm. Twenty minutes following the launch, the vehicle's three booms were extended, which slowed the rotation rate to 4.8 rpm. This rate was maintained throughout the voyage. The launch vehicle accelerated the probe for a net interval of 17 minutes, reaching a velocity of 51,682 km/h.

Pioneer 10 luotain mykistyi 1995.

Pioneer 11 is a NASA robotic space probe launched on April 5, 1973, to study the asteroid belt, the environment around Jupiter and Saturn, solar winds, and cosmic rays.

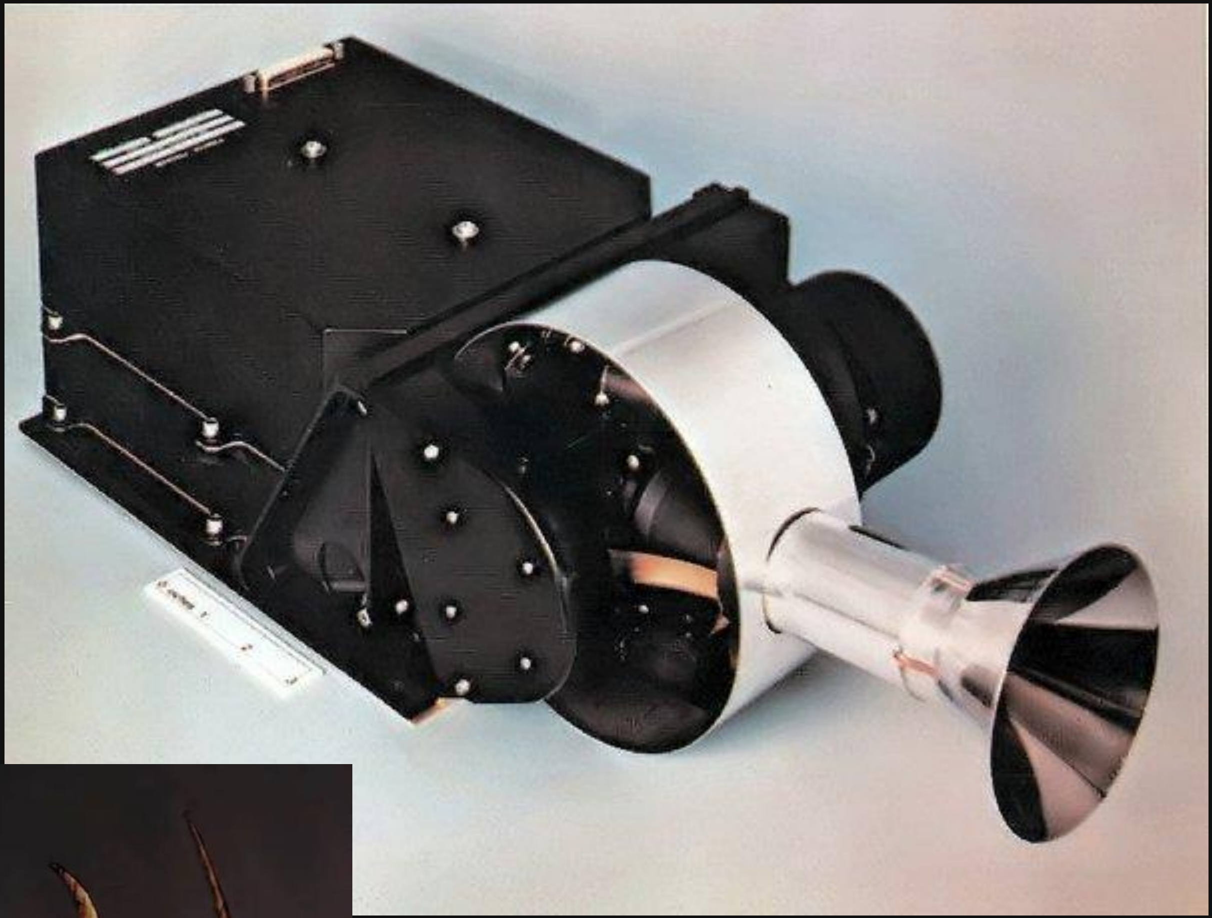
Viimeinen yhteys siihen saatiin 24. marraskuussa 1995, jolloin sen kaksi mittauslaitetta vielä toimi.

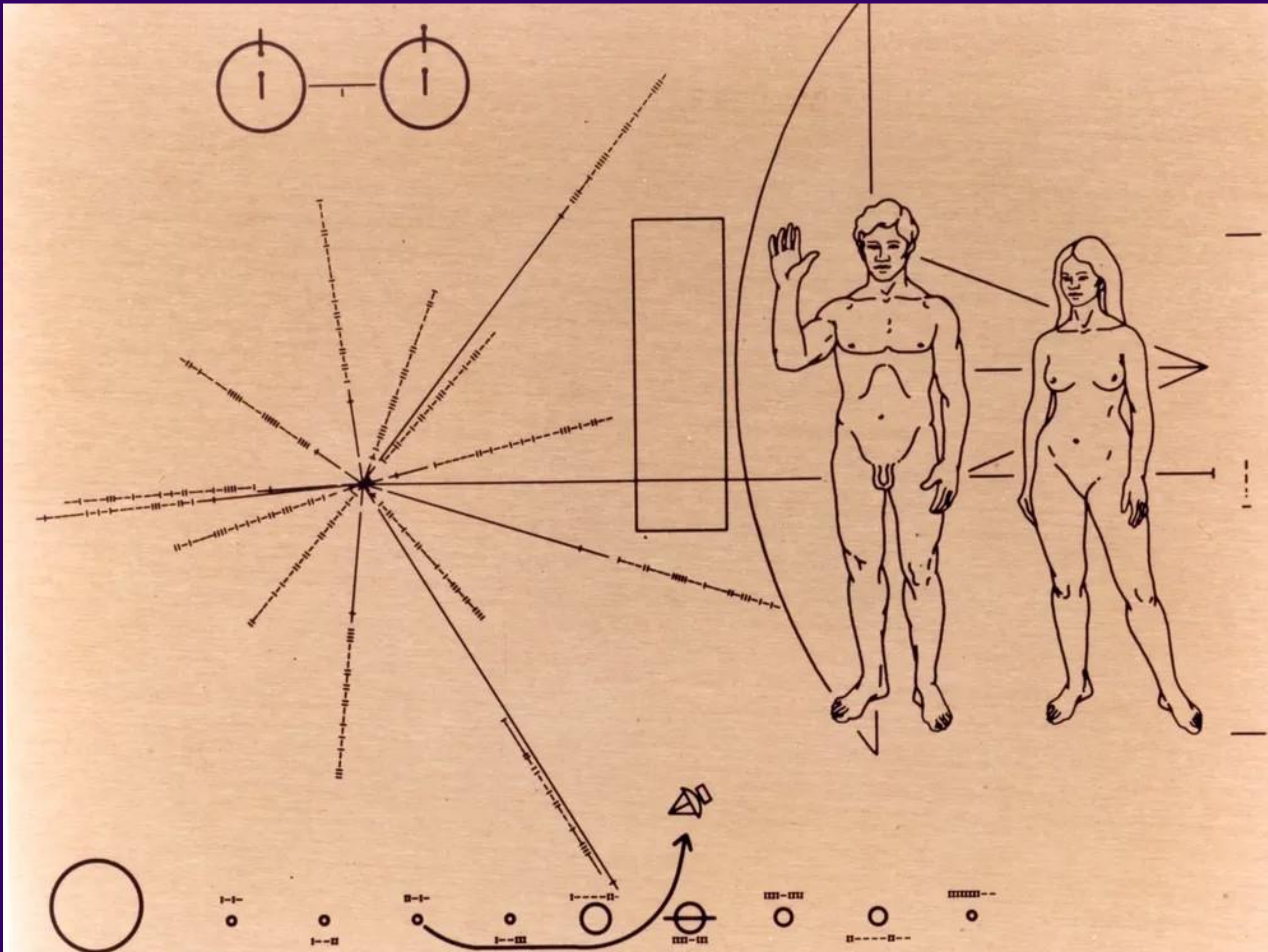
Pioneer 10 ja 11

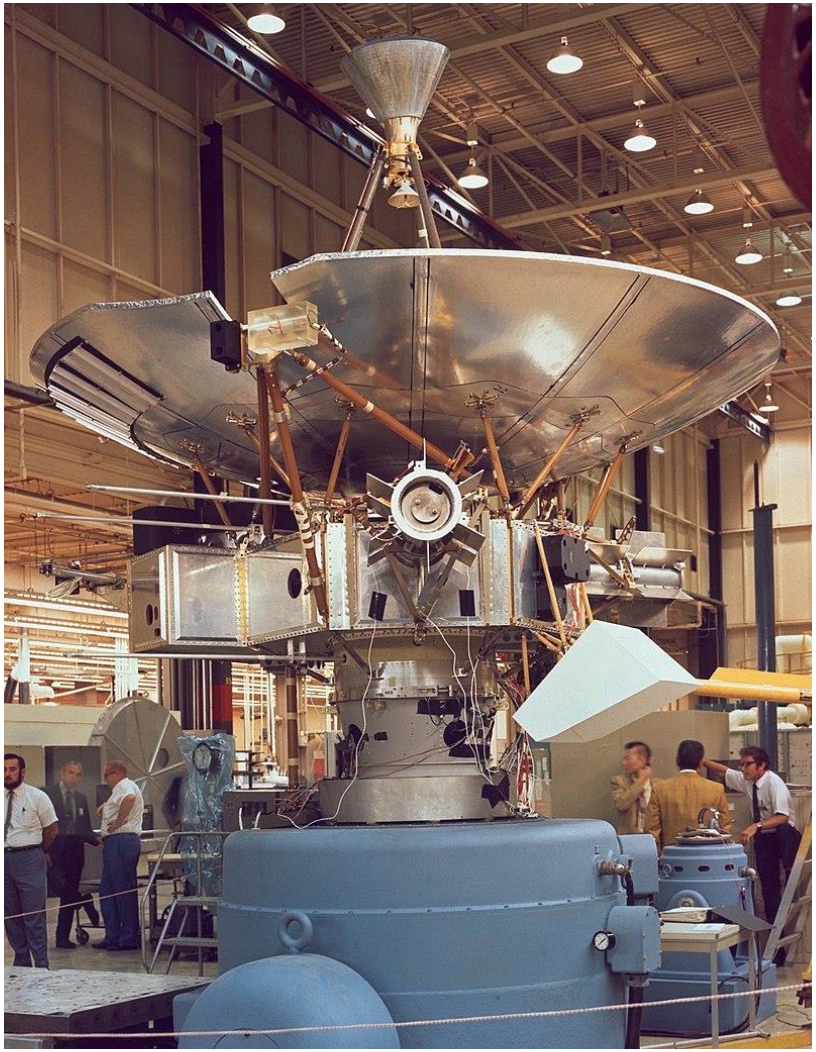


Imaging Photopolarimeter
Helium Vector Magnetometer (HVM)
Infrared Adiometer
Quadrispherical Plasma Analyzer
Ultraviolet Photometer
Charged Particle Instrument (CPI)
Cosmic Ray Telescope (CRT)
Geiger Tube Telescope (GTT)
Sisyphus Asteroid/Meteoroid Detector (AMD)
Meteoroid Detectors
Trapped Radiation Detector (TRD)

Photopolarimeter

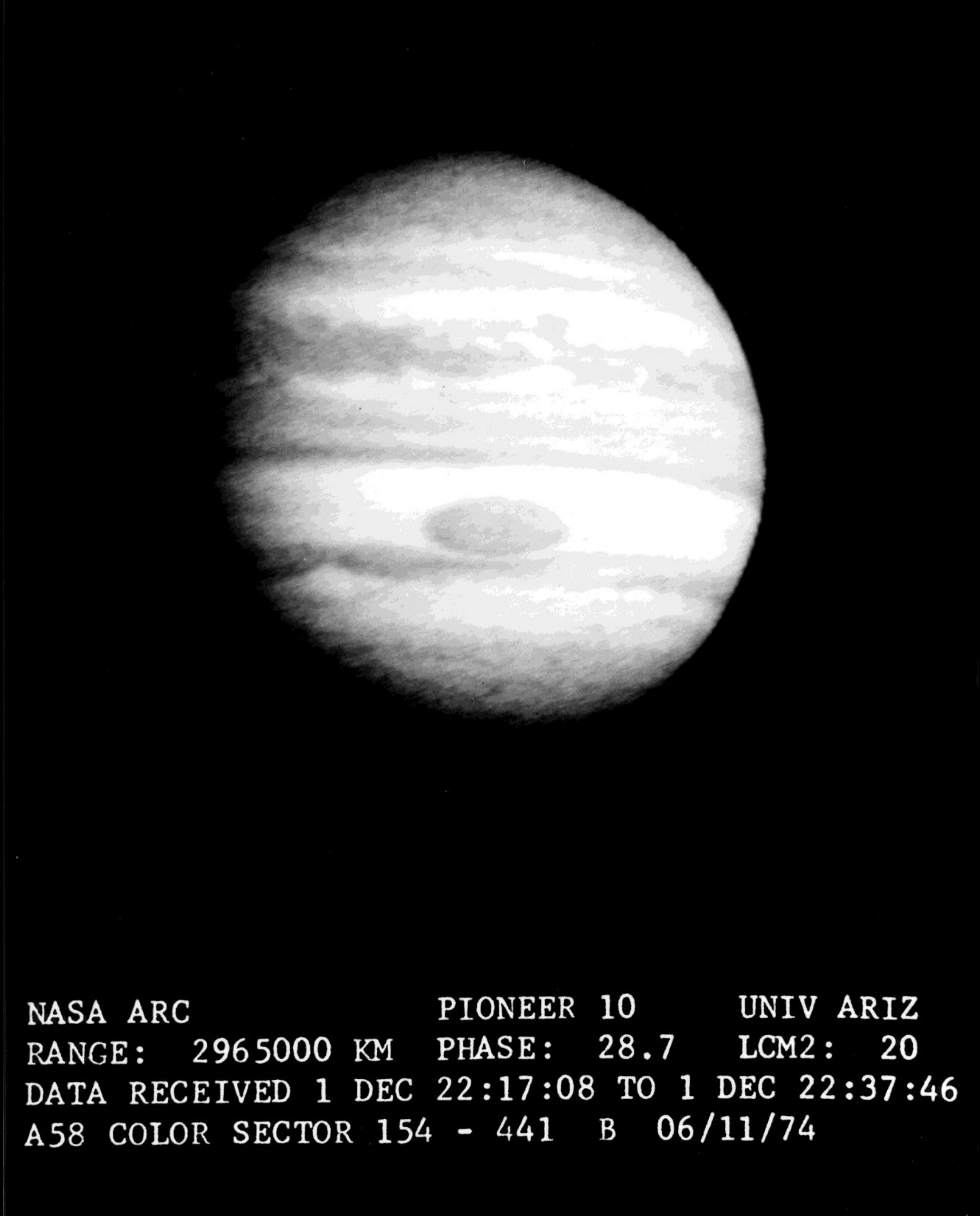


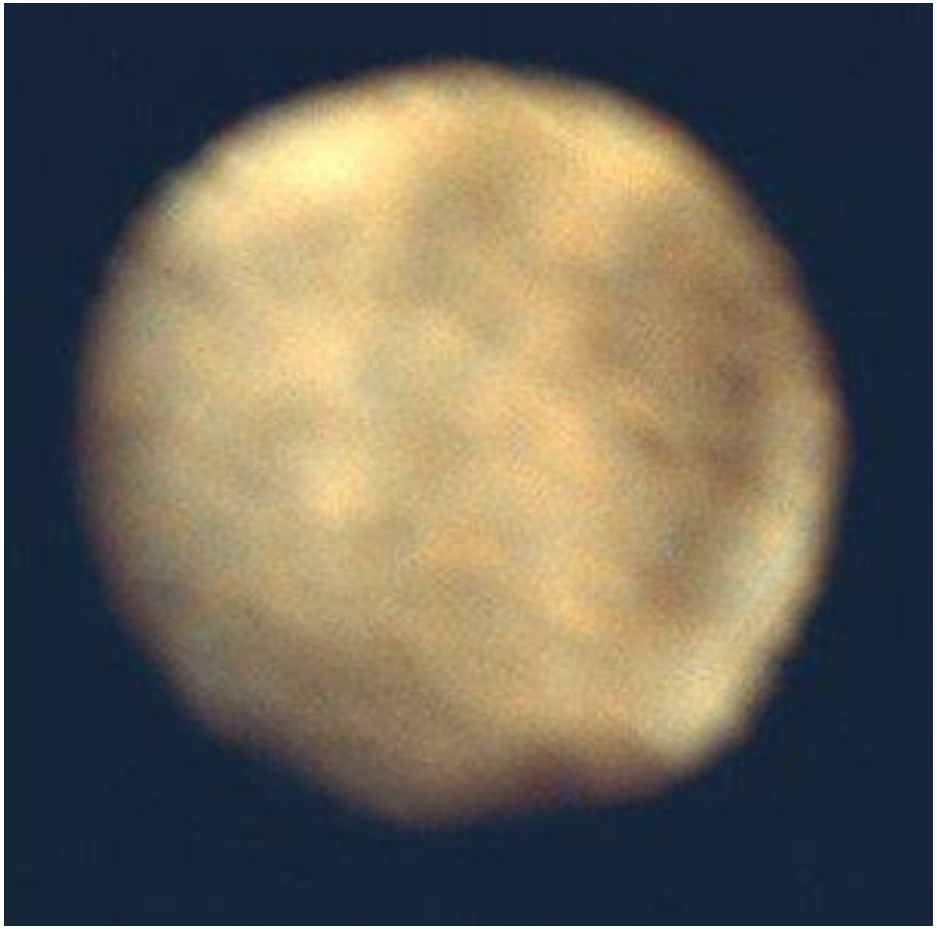




Pioneer 10

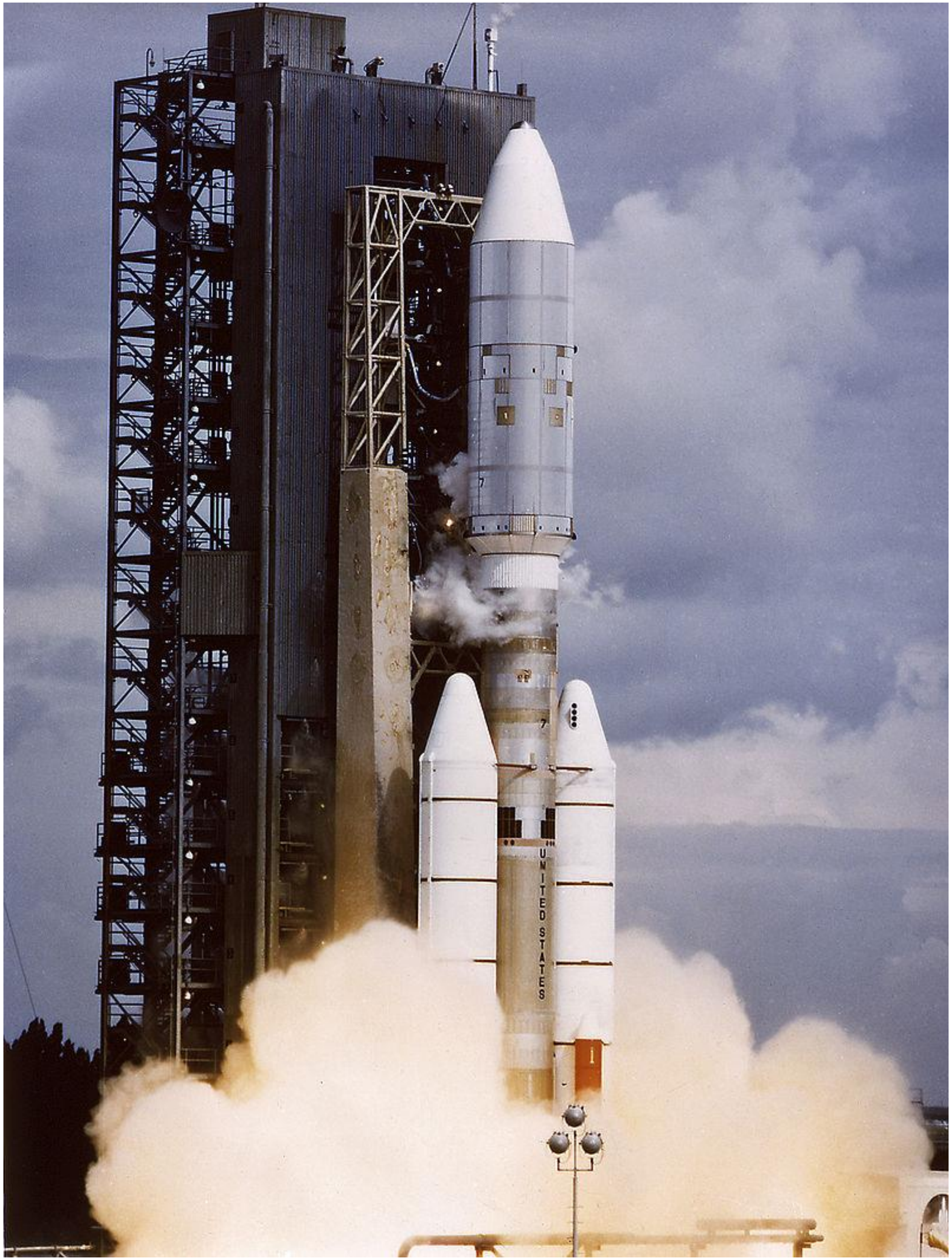
1.12.1974


NASA ARC PIONEER 10 UNIV ARIZ
RANGE: 2965000 KM PHASE: 28.7 LCM2: 20
DATA RECEIVED 1 DEC 22:17:08 TO 1 DEC 22:37:46
A58 COLOR SECTOR 154 - 441 B 06/11/74



Pioneer 10
Ganymedes 1.7.1973

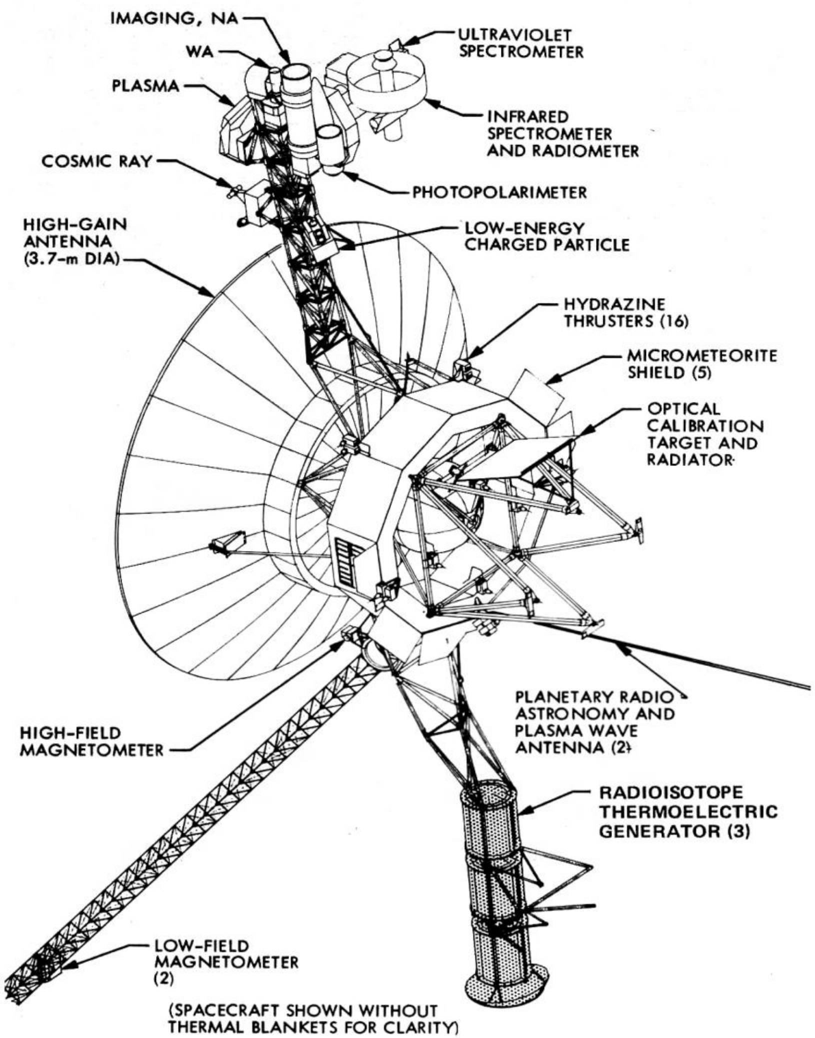
Pioneer 11, 1.9.1979



The Voyager 2 aboard Titan III-Centaur launch vehicle lifted off on August 20, 1977. The Voyager 2 is a scientific satellite that studied outer planets Jupiter, Saturn, Uranus, and Neptune.

Voyager 1 was one of a pair of spacecraft launched to explore the planets of the outer solar system and the interplanetary environment. Each Voyager had as its major objectives at each planet to:

(1) investigate the circulation, dynamics, structure, and composition of the planet's atmosphere;
(2) characterize the morphology, geology, and physical state of the satellites of the planet;
(3) provide improved values for the mass, size, and shape of the planet, its satellites, and any rings; and,
(4) determine the magnetic field structure and characterize the composition and distribution of energetic trapped particles and plasma therein.



Uplink communications is via S-band (16-bits/sec command rate) while an X-band transmitter provides downlink telemetry at 160 bits/sec normally and 1.4 kbps for playback of high-rate plasma wave data. All data are transmitted from and received at the spacecraft via the 3.7 meter high-gain antenna (HGA).

Voyagerin paino

Kuivapaino, 721.9 kg

Paino polttoaineen (hydratsiini N_2H_4) kanssa laukaistaessa 815 kg

Paino muutama vuosi sitten 733 kg ja Voyager 2 735 kg.

Voyagerin tietokoneesta

The master clock runs at 4 MHz but the CPU's clock runs at only 250 KHz. A typical instruction takes 80 microseconds, that is about 8,000 instructions per second.

Voyager cameras

The cameras of Voyager had a resolution of 800 by 800 pixels. There are 8 bits per pixel. One with a 1500 mm telescope with a (horizontal and vertical) field of view of 0.424 degree (25.44 arcminutes) and a theoretical resolution of 1.18 arcseconds. The pixel resolution was 1.908 arcseconds. At the closest approach of Voyager 2 to Jupiter (570,000 km), the resolution was about 5.27 km/pixel.
The other wide angle camera with 202 mm focal length, a field of view of 3.169 degrees and a theoretical resolution of 2.87 arcseconds.

Photopolarimeter System (PPS)

Different frequencies of light interact with different molecules in a planet's atmosphere and on the planet's surface to become polarized. The intensity of light that passes through various color filters and then different polarizing filters can allow scientists to determine the relative abundance of and types of molecules.

The PPS on Voyager consists of a 15 cm telescope that focused light into the path of three overlapping filter wheels, followed by a photomultiplier tube. The polarizing filter wheel contains linear polarizing filters aligned at 0, 60, and 120 degrees, as well as a blank.

A color filter wheel contains notch filters centered at 590 nm, 490 nm, 390 nm, 310 nm, 265 nm, 235 nm, 750 nm, and 727 nm that were used to identify sodium, hydrogen, helium, calcium, carbon monoxide, oxygen, magnesium, silicon, potassium, and methane.

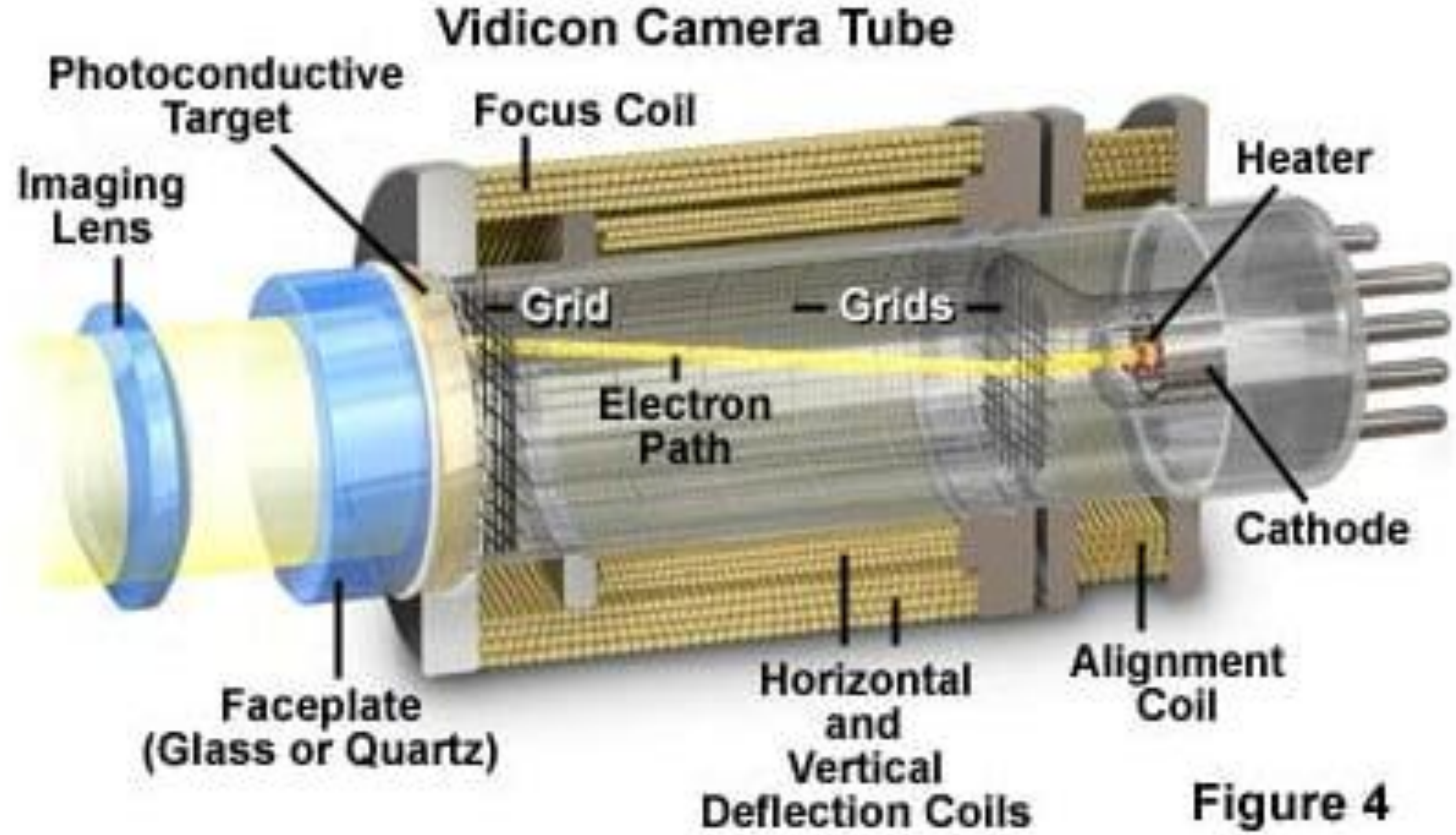
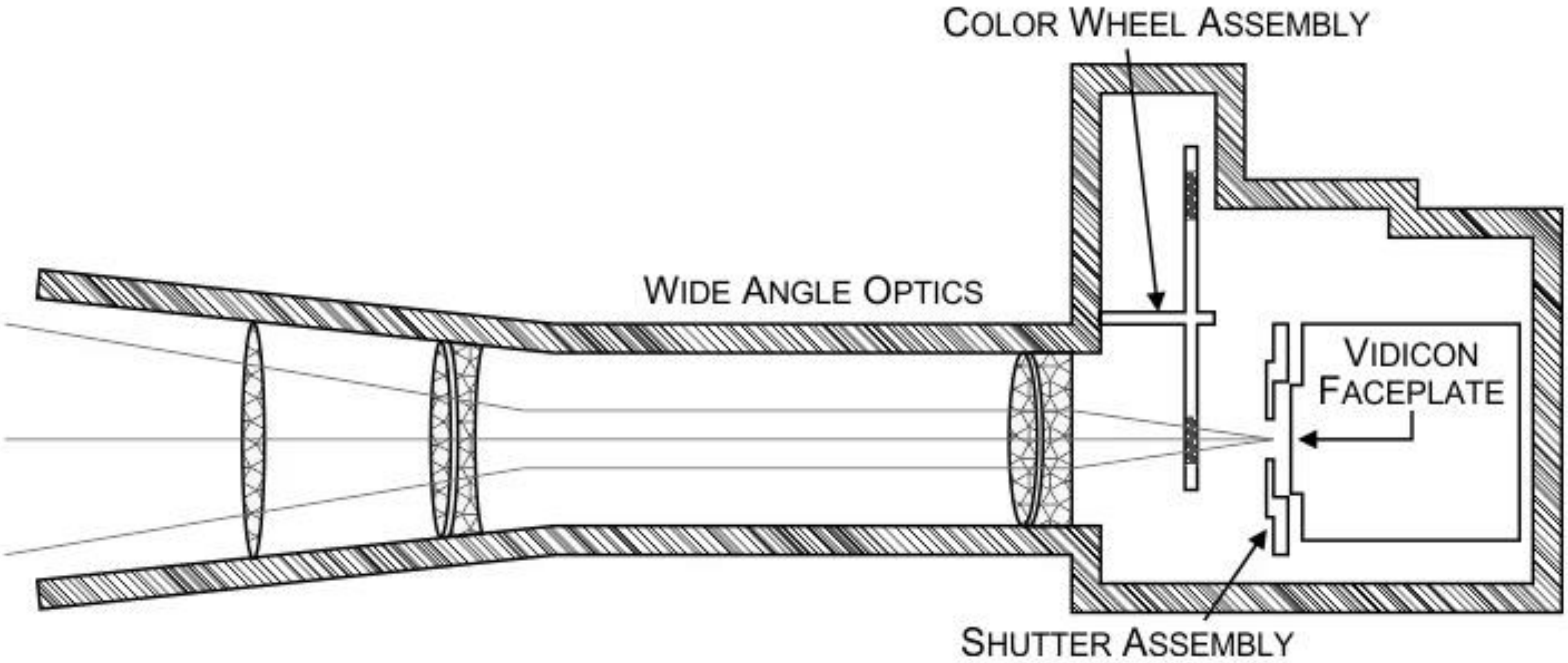


Figure 4

Voyager has two digital video cameras with 800x800-14 µm pixel resolution mounted at the end of its adjustable scan platform. With 8-bits per pixel, each frame required 5,120,000 bits that could be recorded on a magnetic tape with 536 million bits capacity at 115,200 bps or transmitted back to the Deep Space Network receivers on Earth at 8400 or 14,400 bps. The tape backup was necessary to store images during times of occlusion (when a planet or satellite blocked the radio transmission path) and was played back at a lower data rate.

Voyager cameras



The other is a narrow-angle 1500 mm f.l., 176mm aperture, (f/11.8 effective aperture with obscuration and transmission losses) camera that is sensitive to a spectral range of 420 nm to 620 nm that has a field of view of 0.4°. A filter wheel with notch filters in the range of 345 nm to 590 nm filter has two clear filters, two green filters, and one violet, blue, orange, and ultraviolet filter.

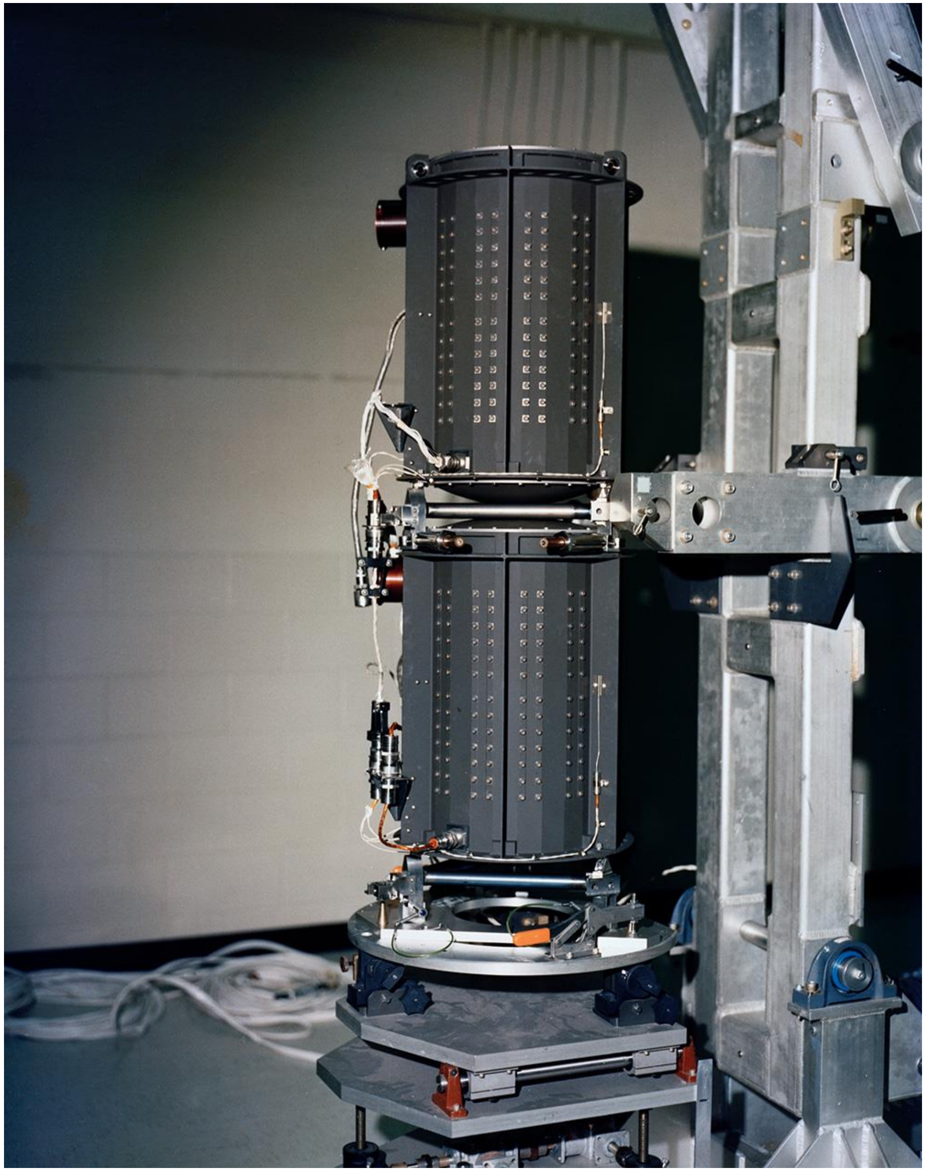
Ultraviolet Spectrometer (UVS)

The Ultraviolet Spectrometer (UVS) covers the wavelength range of 40 nm to 180 nm looking at planetary atmospheres and interplanetary space.

Ultraviolet Spectrometer (UVS) Objective
To determine the scattering properties of the lower planetary atmospheres.
To determine the distribution of constituents with height.
To determine the extent and distribution of hydrogen corona of the planets and satellites.
To investigate night airglow and auroral activity.
To determine the UV scattering properties and optical depths of planetary rings.
To search for emissions from the rings and from any ring "atmosphere."

Voyager RTG

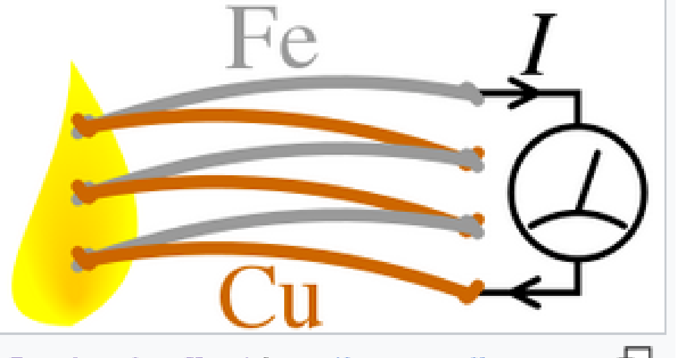
Both Voyager probes power themselves with radioisotope thermoelectric generators (RTGs), which convert heat from decaying plutonium-238 into electricity. The continual decay process means the generator produces slightly less power each year.



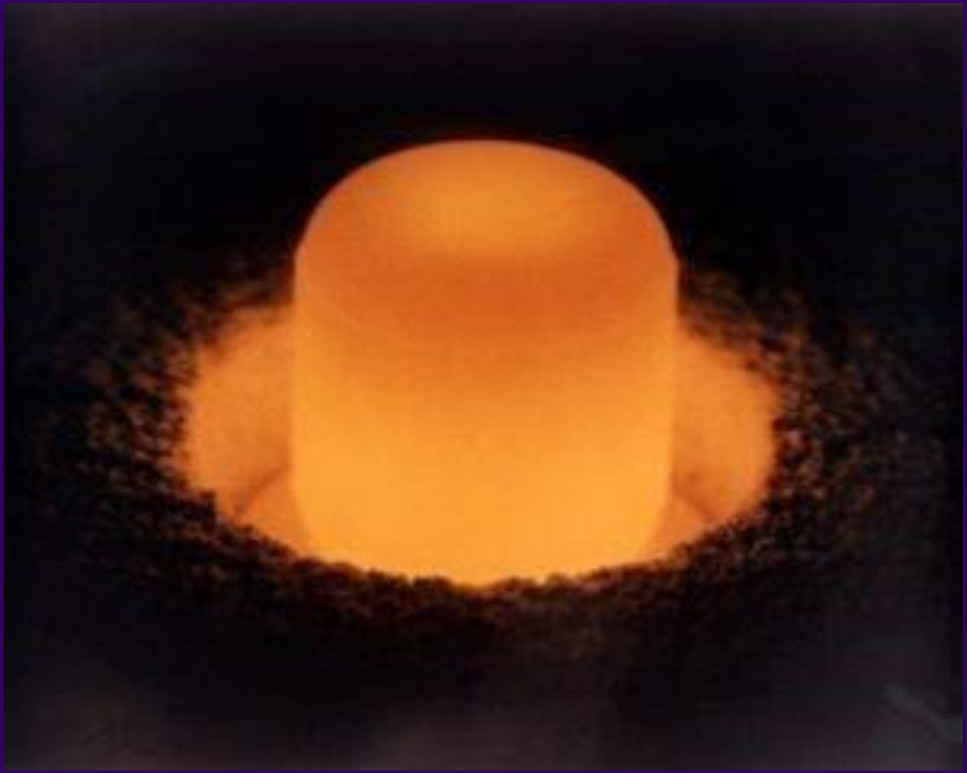
Voyager RTG

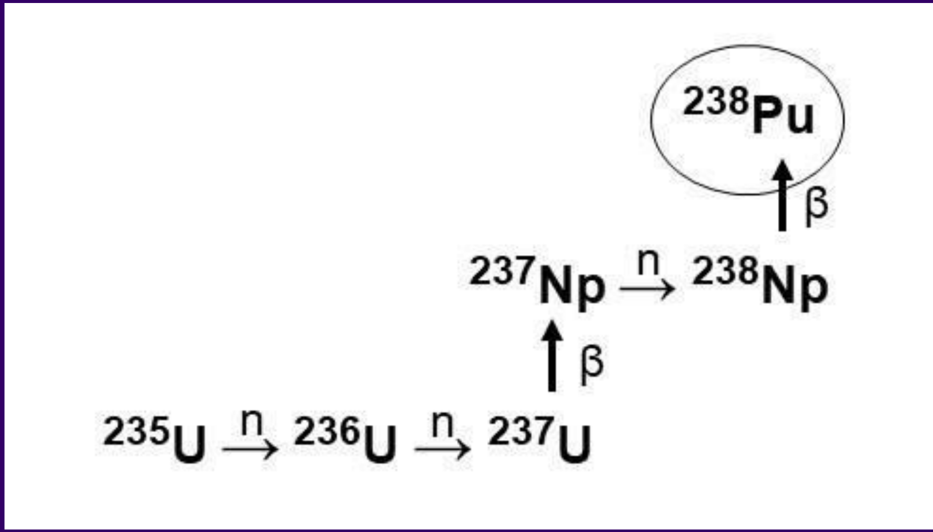
This was required to reject 2.2 kWt of energy at beginning of life, with a beginning of life thermal gradient between the hot and cold shoe of 700º (1273 K/1000º BOL hot side, 573 K/300º BOL cold side). The initial output of the RTGs on Voyager was approximately 470 W of 30 V DC power at launch.

However, the recently available power of 249 watts, combined with the minimal equipment still functional on the spacecraft, allow for 160 bits/s transmission time of the data that is collected.

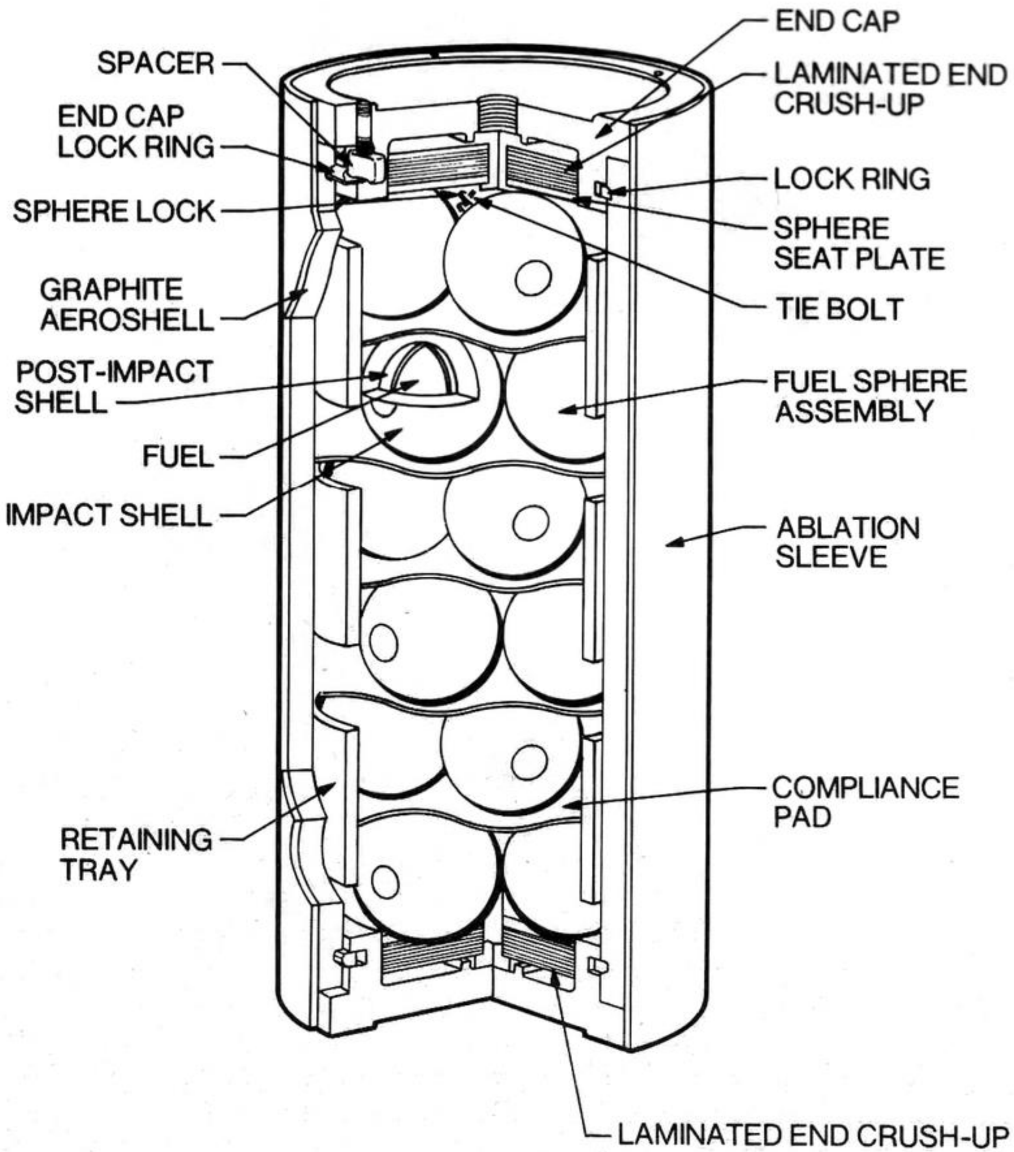


Seebeck effect in a thermopile made from iron and copper wires





A pellet of plutonium-238 oxide glows with heat generated by its radioactive decay. Such pellets are used as fuel in nuclear batteries known as radioisotope thermoelectric generators.
U.S. Department of Energy



Each RTG has a total weight of 37,7 kg including about 4,5 kg of Pu-238 and uses 24 pressed plutonium-238 oxide spheres to provide enough heat to generate approximately 157 Watts of electrical power initially – halving every 87,7 year.

Each RTG initially generated about 2400 Watts of thermal power Conversion of the decay heat of the plutonium to electrical power uses 312 silicon-germanium (SiGe) thermoelectric couples. The initial thermoelectric couple hot junction temperature was 1273 K (1000 °C) with a cold junction temperature of 573 K (300 °C).

Voyager

History Of The Voyager Mission

The Voyager mission was designed to take advantage of a rare geometric arrangement of the outer planets in the late 1970s and the 1980s which allowed for a four-planet tour for a minimum of propellant and trip time. This layout of Jupiter, Saturn, Uranus and Neptune, which occurs about every 175 years, allows a spacecraft on a particular flight path to swing from one planet to the next without the need for large onboard propulsion systems. The flyby of each planet bends the spacecraft's flight path and increases its velocity enough to deliver it to the next destination. Using this "gravity assist" technique, first demonstrated with NASA's Mariner 10 Venus/Mercury mission in 1973-74, the flight time to Neptune was reduced from 30 years to 12.

Voyager

While the four-planet mission was known to be possible, it was deemed to be too expensive to build a spacecraft that could go the distance, carry the instruments needed and last long enough to accomplish such a long mission. Thus, the Voyagers were funded to conduct intensive flyby studies of Jupiter and Saturn only. More than 10,000 trajectories were studied before choosing the two that would allow close flybys of Jupiter and its large moon Io, and Saturn and its large moon Titan; the chosen flight path for Voyager 2 also preserved the option to continue on to Uranus and Neptune.

Voyager 2

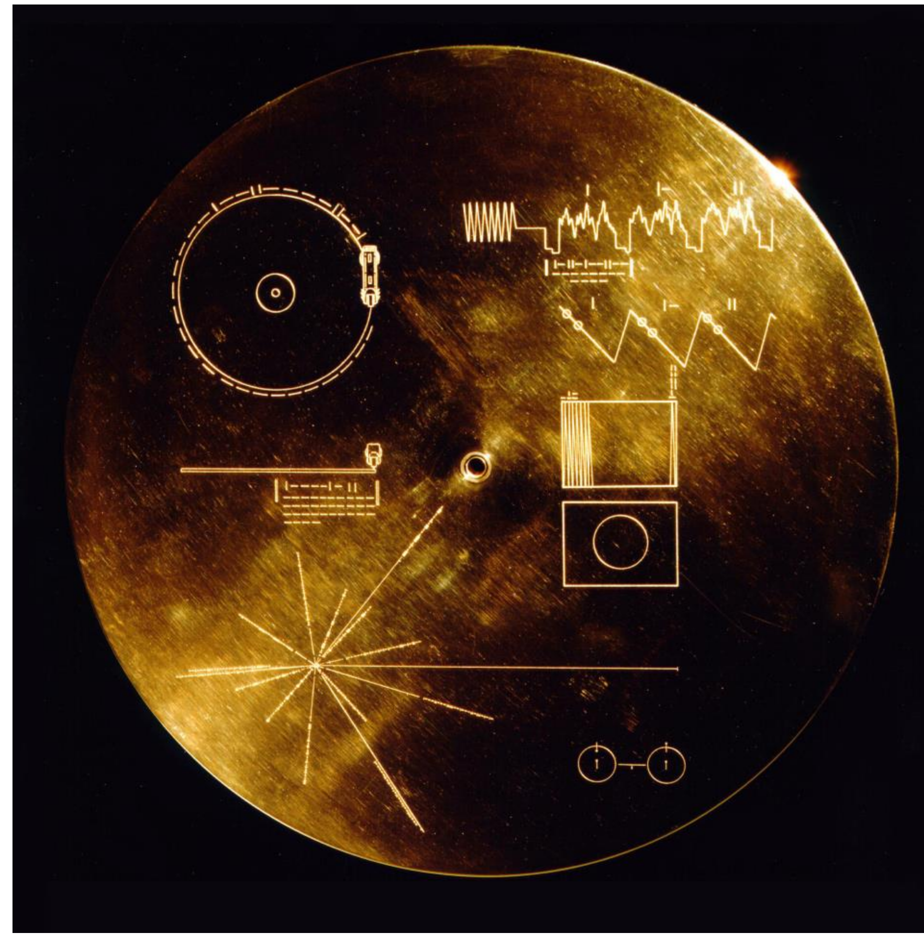
Voyager 2, launched August 20, 1977, visited Jupiter in 1979, Saturn in 1981 and Uranus in 1986 before making its closest approach to Neptune on August 25, 1989. Voyager 2 traveled 12 years at an average velocity of 19 kilometers a second (about 42,000 miles an hour) to reach Neptune, which is 30 times farther from the Sun than Earth is. Voyager observed Neptune almost continuously from June to October 1989. Now Voyager 2 is also headed out of the solar system, diving below the ecliptic plane at an angle of about 48 degrees and a rate of about 470 million kilometers a year.

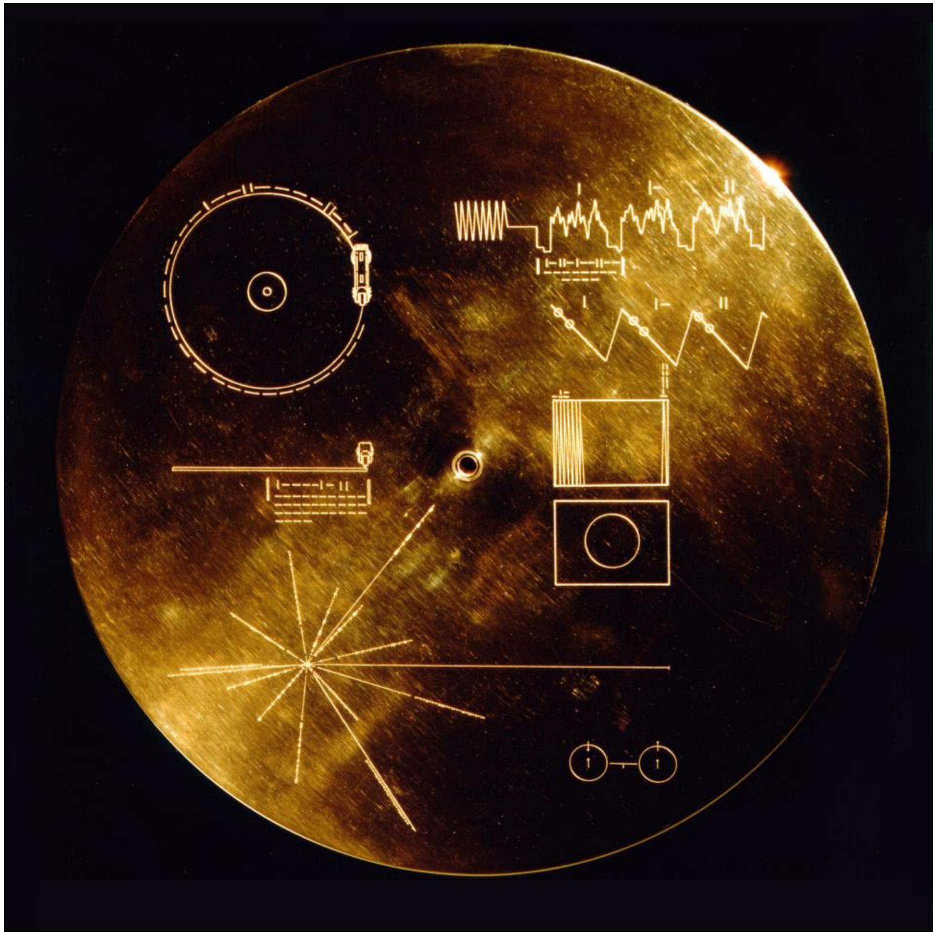
Voyager

Some 18,000 images of Jupiter and its satellites were taken by Voyager 1. In addition, roughly 16,000 images of Saturn, its rings and satellites were obtained.

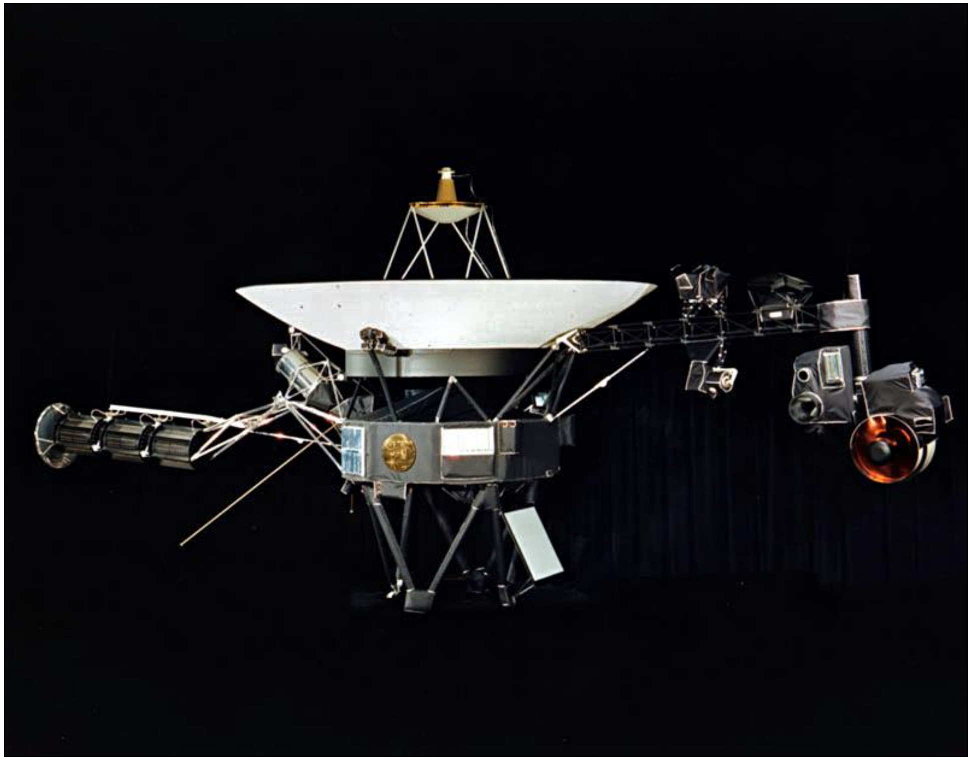
Voyager 1 continues operations, taking measurements of the interplanetary magnetic field, plasma, and charged particle environment while searching for the heliopause (the distance at which the solar wind becomes subsumed by the more general interstellar wind). Through the end of the Neptune phase of the Voyager project, a total of $875 million had been expended for the construction, launch, and operations of both Voyager spacecraft.


THE SOUNDS OF EARTH
Side 1
UNITED STATES OF AMERICA
PLANET EARTH
TO THE MAKERS OF MUSIC - ALL WORLDS, ALL TIMES





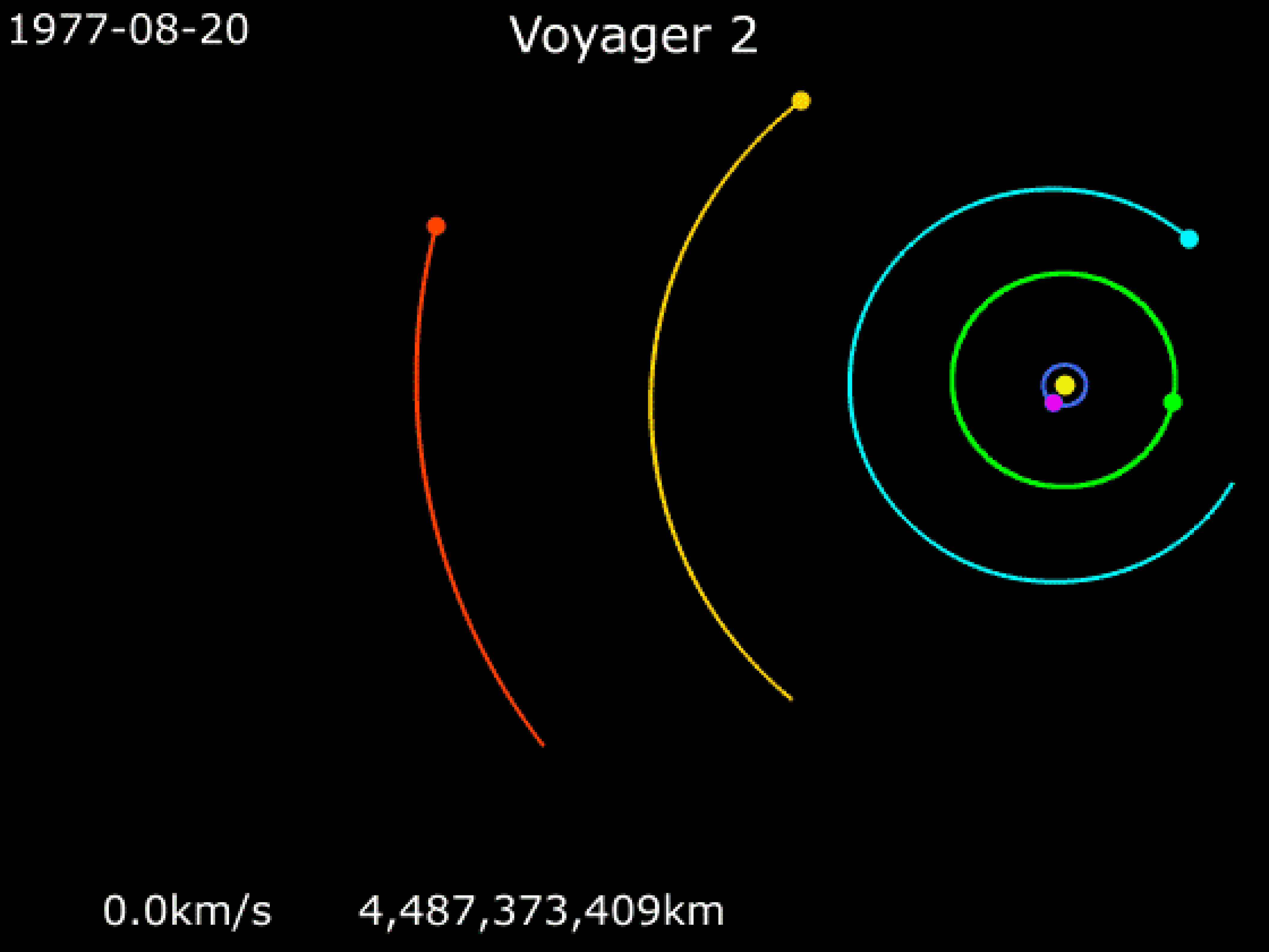
The record's cover is aluminum and electroplated upon it is an ultra-pure sample of the isotope uranium-238 with a radioactivity of about 0.26 nanocuries. Uranium-238 has a half-life of 4.468 billion years.



1898000000000000000000000000 kg

vs

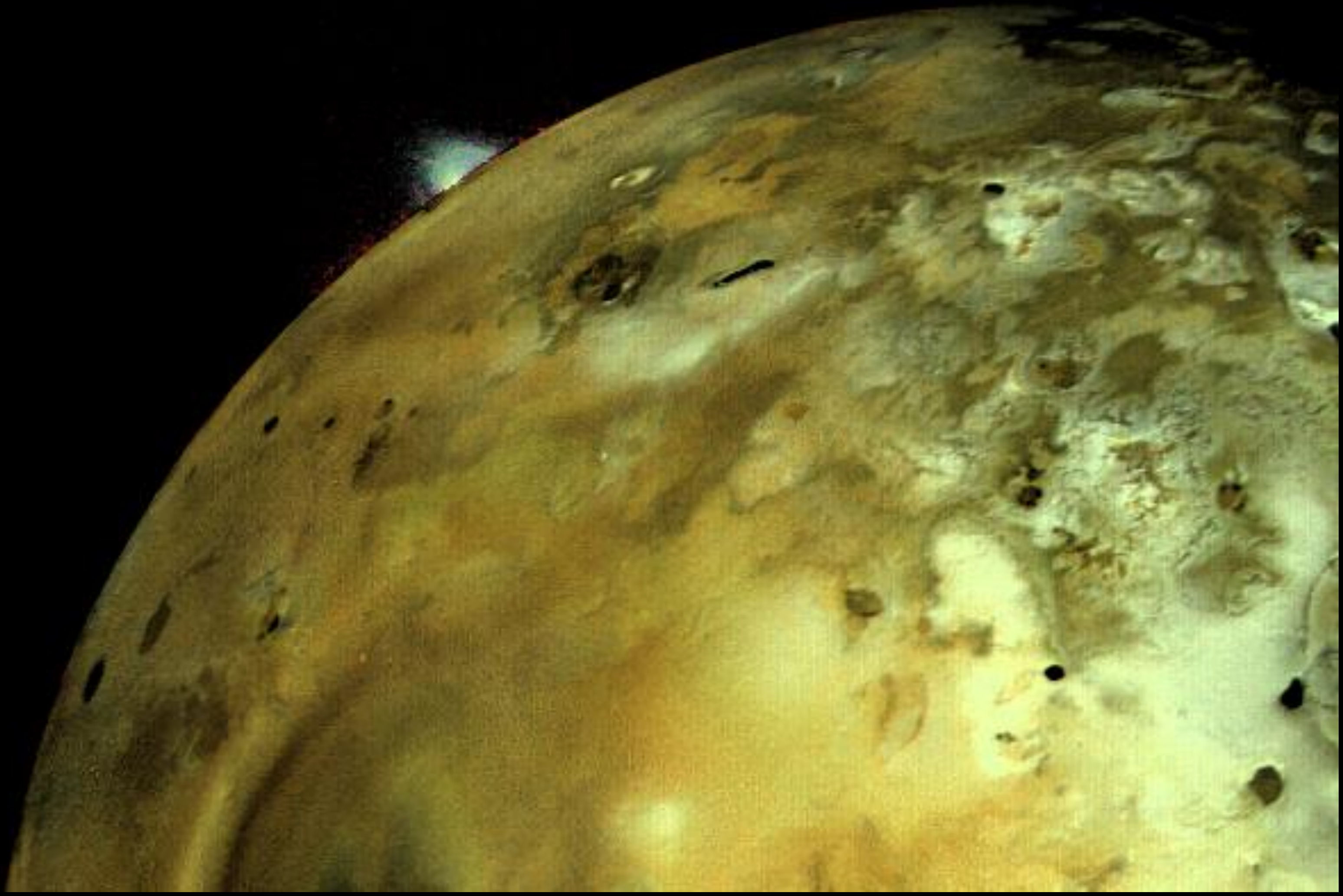
750 kg


1977-08-20
Voyager 2
0.0km/s
4,487,373,409km

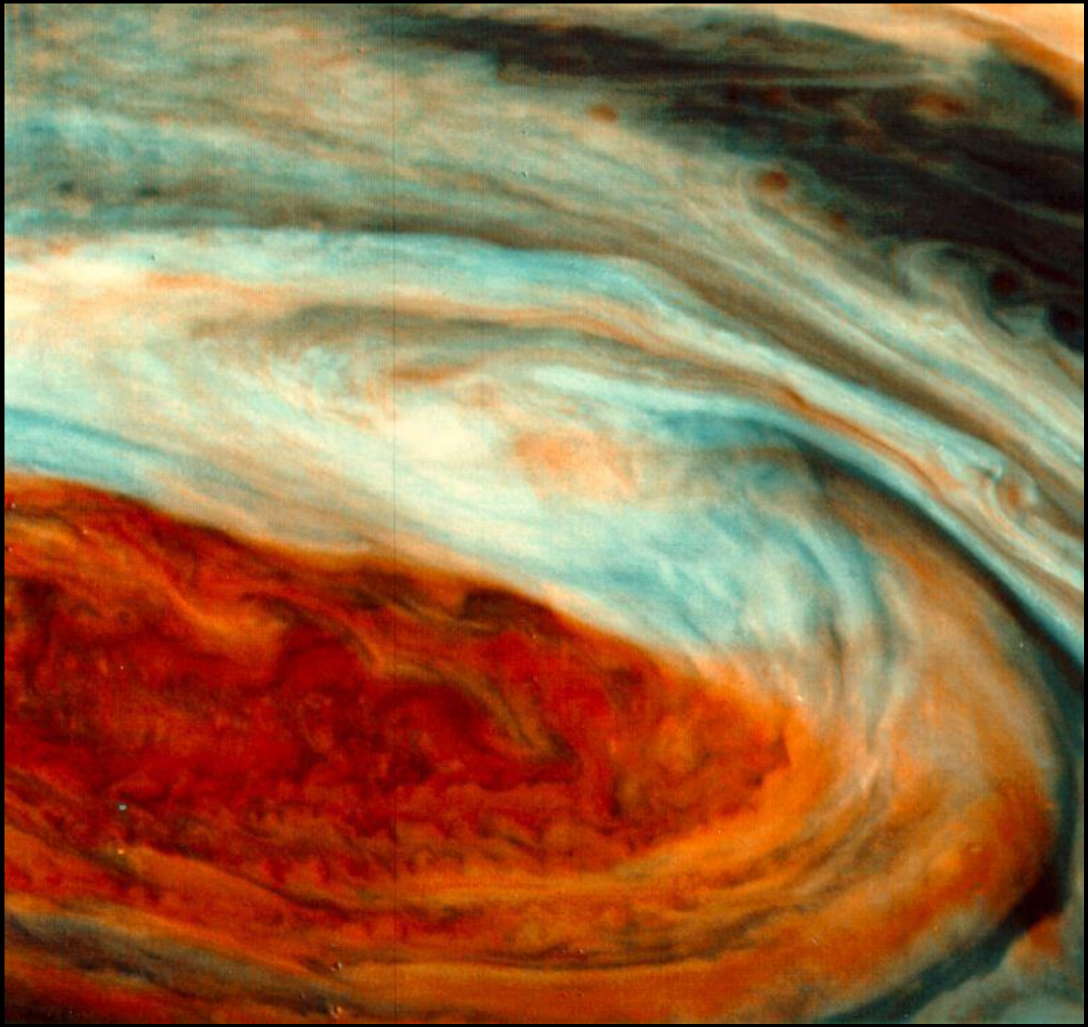
Voyager 1 captured this image of Jupiter and its moon Ganymede (bottom left) when it was just over a month away from its closest approach to the planet in 1979.

Image credit: NASA's Goddard Space Flight Center.

Ganymedes 5262 km



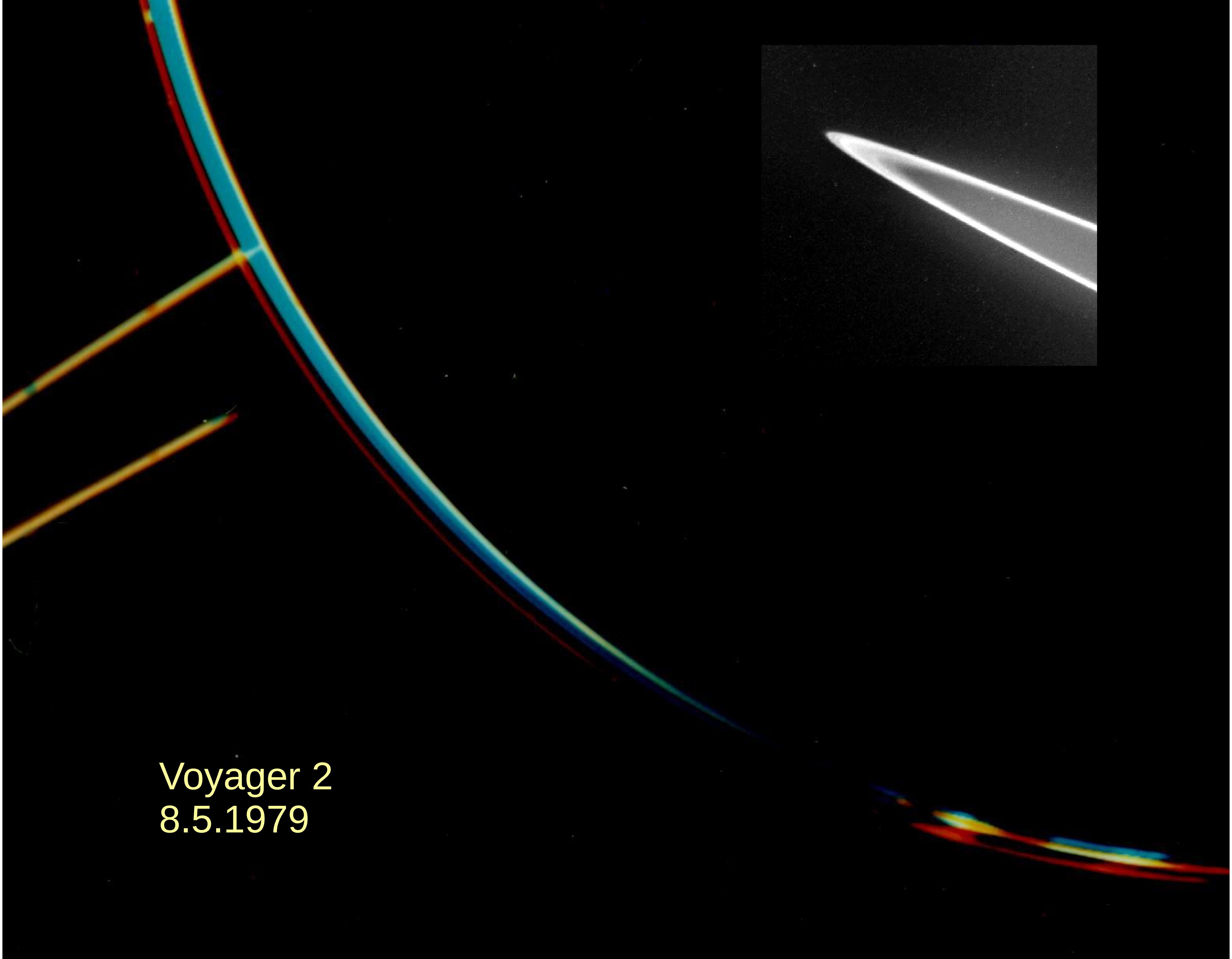
Discovery of active volcanism on the satellite Io was probably the greatest surprise. It was the first time active volcanoes had been seen on another body in the solar system. It appears that activity on Io affects the entire Jovian system.



This view of the Great Red Spot is seen in greatly exaggerated color. The colors do not represent the true hues seen in the Jovian atmosphere but have been produced by special computer processing to enhance subtle variations in both color and shading.

Voyager 1, 6.3.1979

4.3.1979


Voyager 2
8.5.1979

Three Voyager 2 images, taken through ultraviolet, violet and green filters, were combined to make this photograph

Here is a summary of scientific findings by the two Voyagers at Saturn: SATURN Saturn's atmosphere is almost entirely hydrogen and helium. Voyager 1 found that about 7 percent of the volume of Saturn's upper atmosphere is helium (compared with 11 percent of Jupiter's atmosphere), while almost all the rest is hydrogen. Since Saturn's internal helium abundance was expected to be the same as Jupiter's and the Sun's, the lower abundance of helium in the upper atmosphere may imply that the heavier helium may be slowly sinking through Saturn's hydrogen; that might explain the excess heat that Saturn radiates over energy it receives from the Sun.

While Voyager 2 was behind Saturn, its radio beam penetrated the upper atmosphere, and measured temperature and density. Minimum temperatures of 82 Kelvins (-312 degrees Fahrenheit) were found at the 70-millibar level (surface pressure on Earth is 1,000 millibars). The temperature increased to 143 Kelvins (-202 degrees Fahrenheit) at the deepest levels probed - - about 1,200 millibars. Near the north pole temperatures were about 10 degrees Celsius (18 degrees Fahrenheit) colder at 100 millibars than at mid-latitudes. The difference may be seasonal.

The Voyagers found aurora-like ultraviolet emissions of hydrogen at mid-latitudes in the atmosphere, and auroras at polar latitudes (above 65 degrees). The high-level auroral activity may lead to formation of complex hydrocarbon molecules that are carried toward the equator. The mid-latitude auroras, which occur only in sunlit regions, remain a puzzle, since bombardment by electrons and ions, known to cause auroras on Earth, occurs primarily at high latitudes.

Both Voyagers measured the rotation of Saturn (the length of a day) at 10 hours, 39 minutes, 24 seconds

Mimas 392 km

The conspicuous crater on the surface of Saturn's moon Mimas is seen in this image taken by NASA's Voyager 1 on Nov. 12, 1980 when the spacecraft was 540,000 kilometers from the satellite.

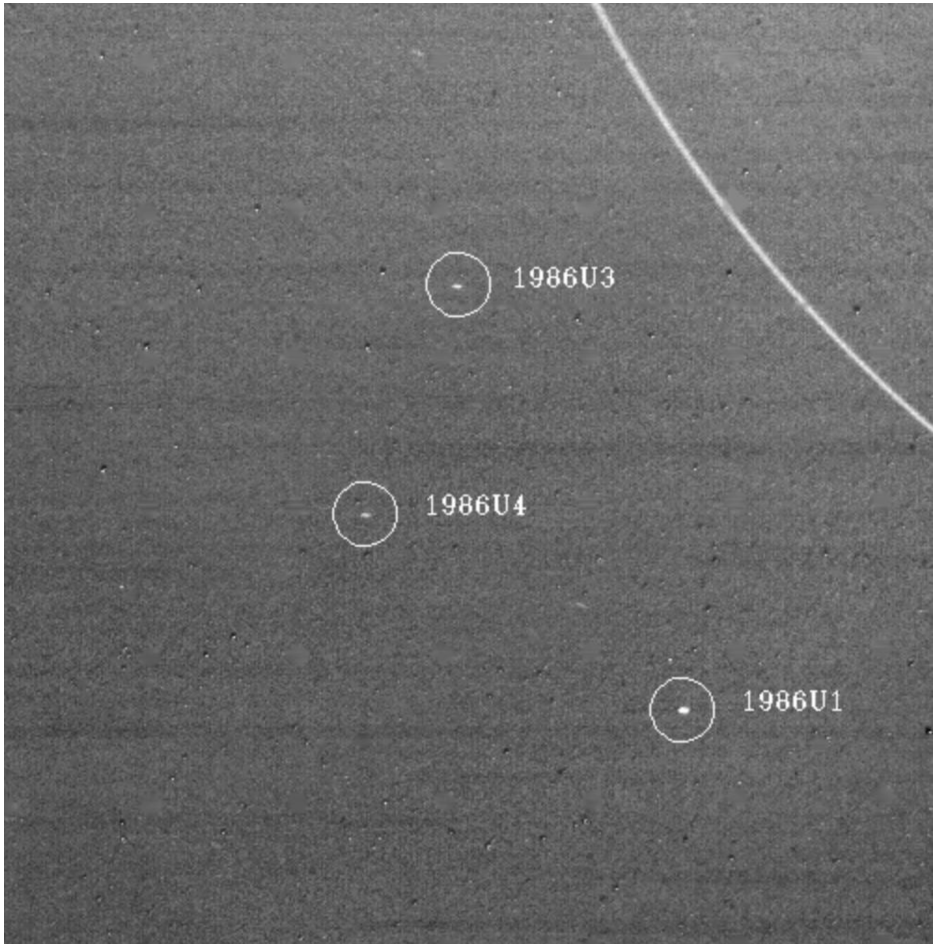
The massive crater, whose proportionate size (approximately 100 kilometers) is about one-quarter of the satellite's diameter (390 kilometers) is without precedent among the explored objects of the solar system.

Dione 1120 km

Large bright streaks are seen to cross the face of Saturn's moon Dione in this photograph taken by NASA's Voyager 1 on Nov. 12, 1980 from a distance of 695,000 kilometers.

This composite shows seven of the very small satellites of Saturn as photographed Aug. 25 by Voyager 2. These irregularly shaped bodies have been highly cratered by the impact of cosmic debris.
The irregularity is probably due to fracturing by large impacts and is sustained by the rigidity of the bodies. The lighting angles and ranges here are different for each satellite; thus, true
relative sizes are not shown. These objects range from about 10 to several hundred kilometers across.

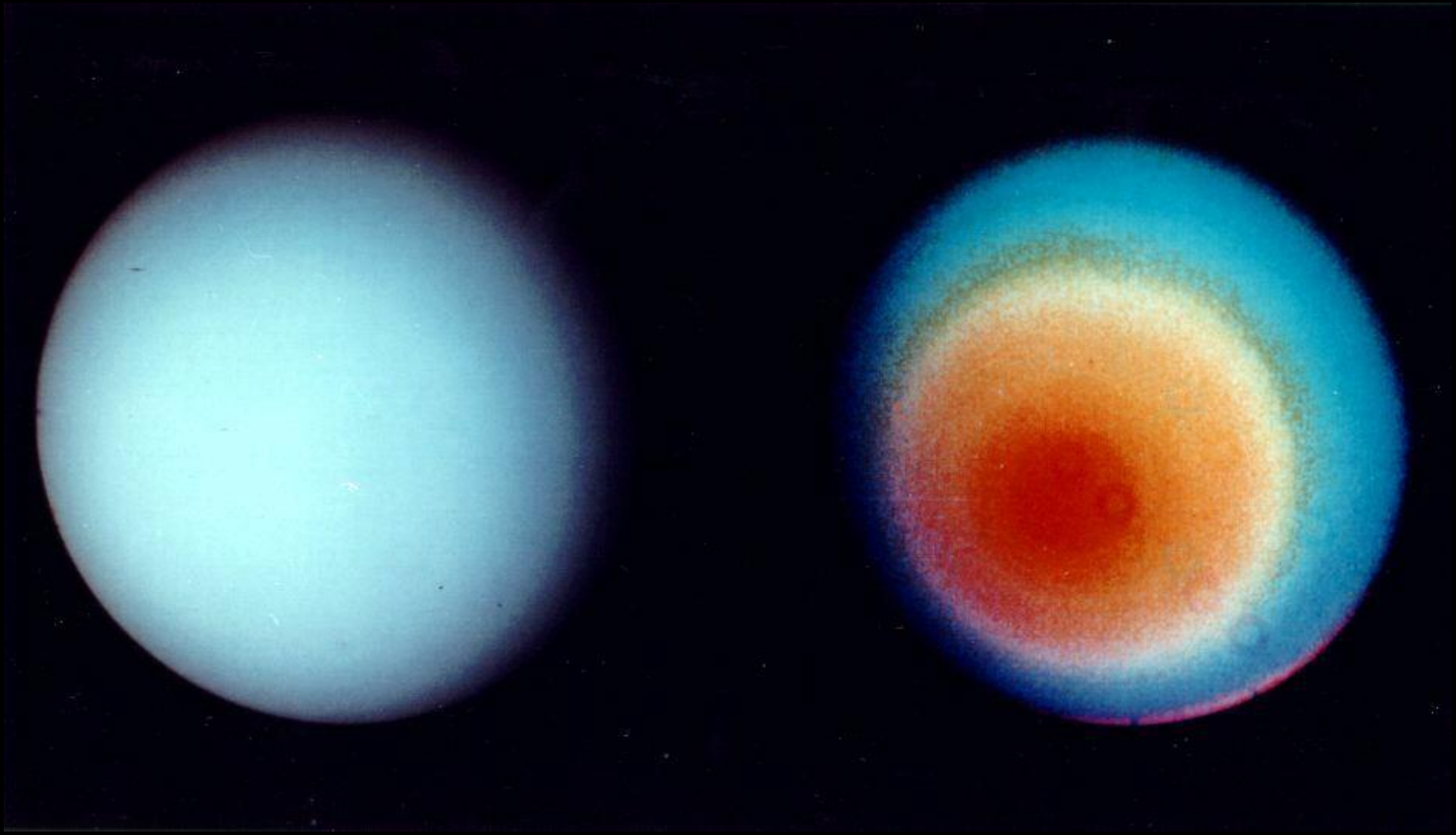
Voyager 2



NEW MOONS OF URANUS DISCOVERED BY VOYAGER 2 Three moons discovered by Voyager 2 lie outside the ring system in this view from January 18, 1986. The moons are Portia (1986U1), Cressida (1986 U3), and Rosalind (1986 U4).

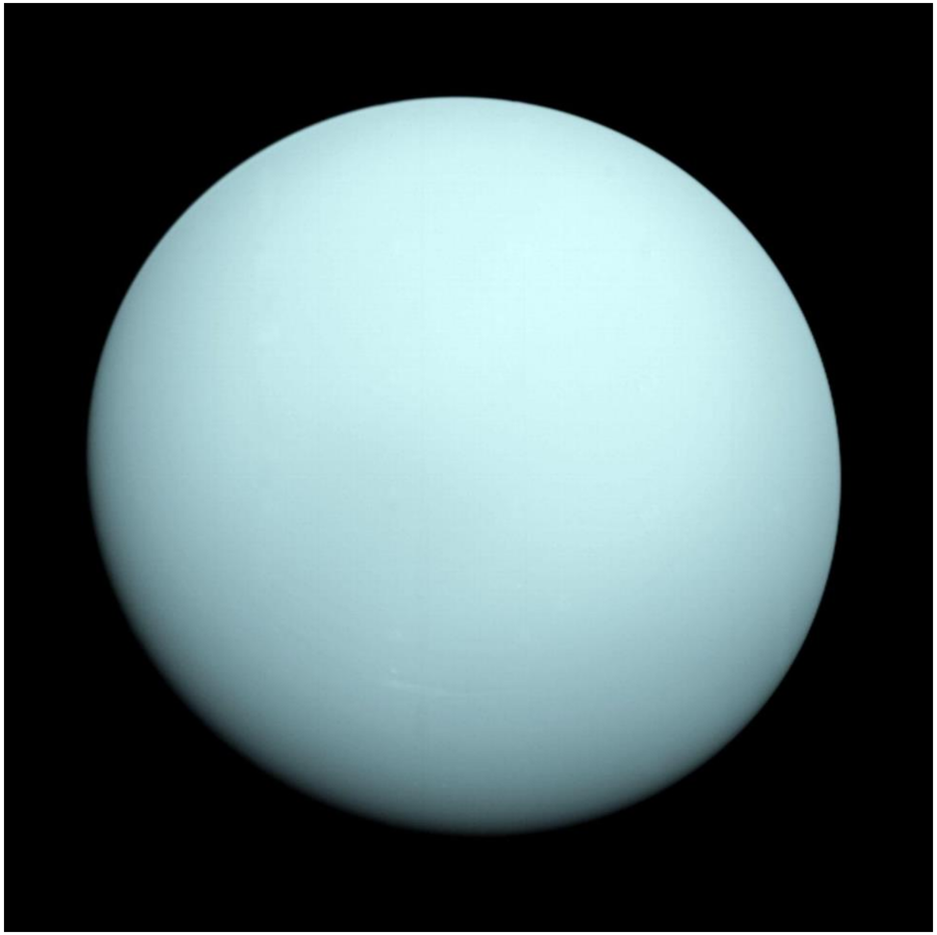
Voyager 2

Voyager 2 captured the images that were used to create these mosaics of some of the moons of Uranus during its closest approach to the planet on January 24, 1986.

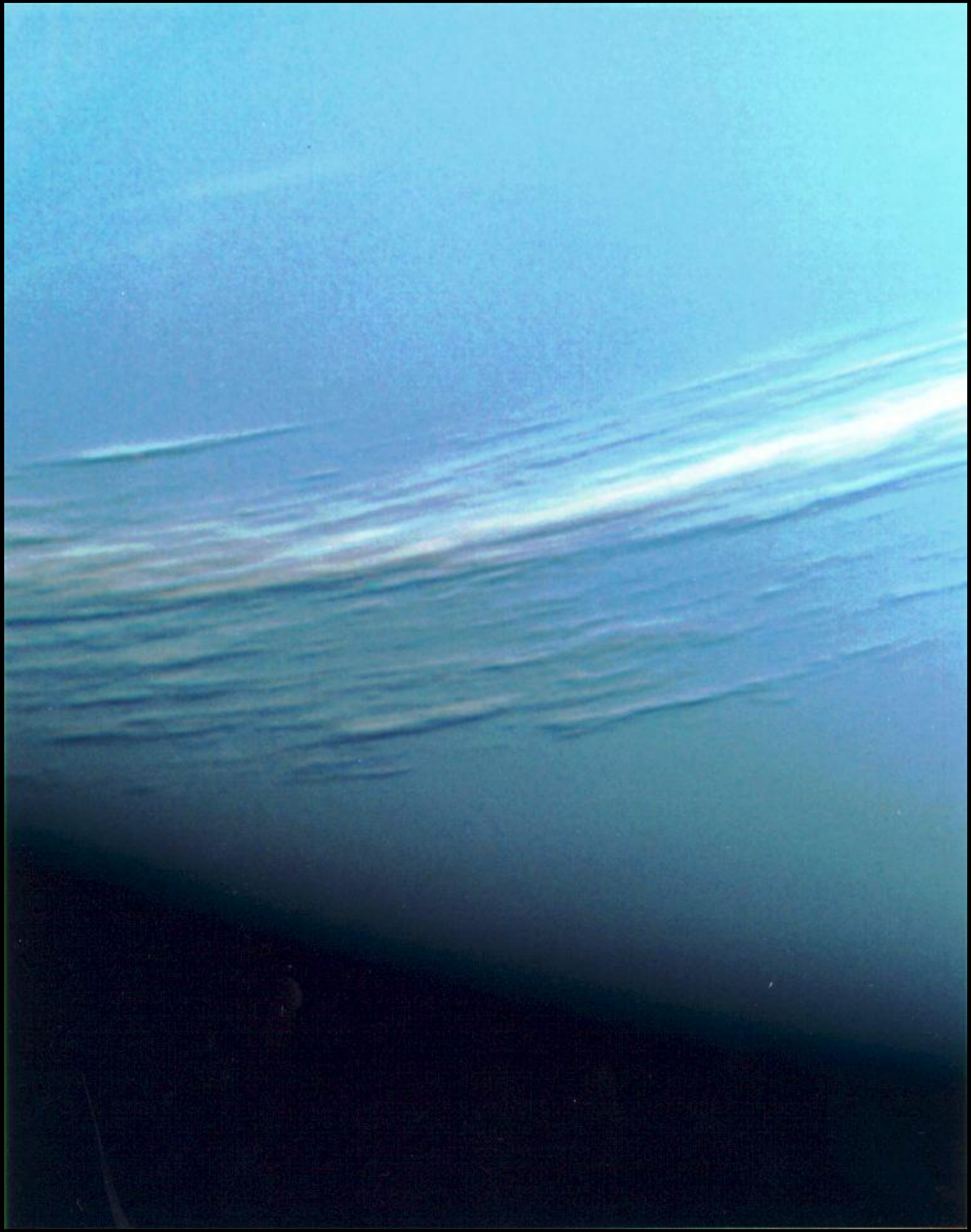


These images were taken by the Voyager 2 spacecraft during its flyby of Uranus. The images, one true color (left), the other false color (right) were compiled from images taken by the narrow-angle camera and were returned on 17 January 1986.

Uranus

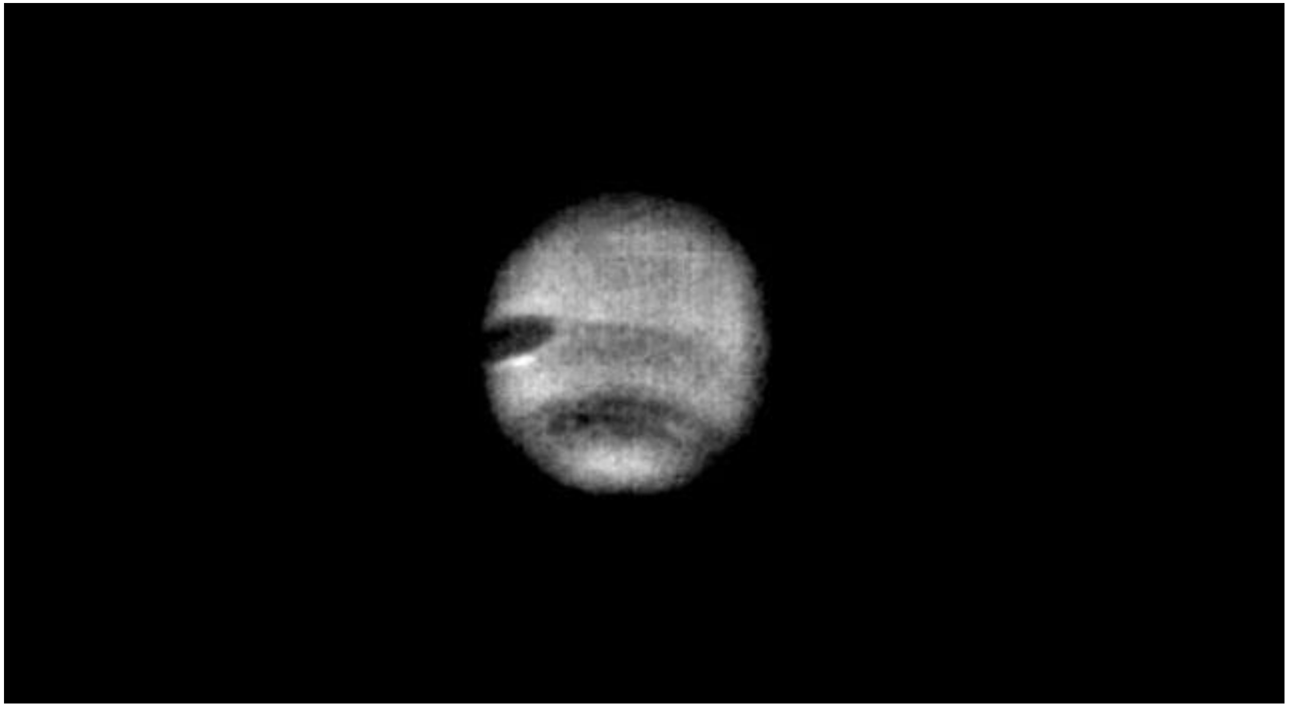


Voyager 2 took this image as it approached the planet Uranus on Jan. 14, 1986. The planet's hazy bluish color is due to the methane in its atmosphere, which absorbs red wavelengths of light.



This Voyager 2 high resolution color image, taken 2 hours before closest approach, provides obvious evidence of vertical relief in Neptune's bright cloud streaks. These clouds were observed at a latitude of 29 degrees north near Neptune's east terminator.

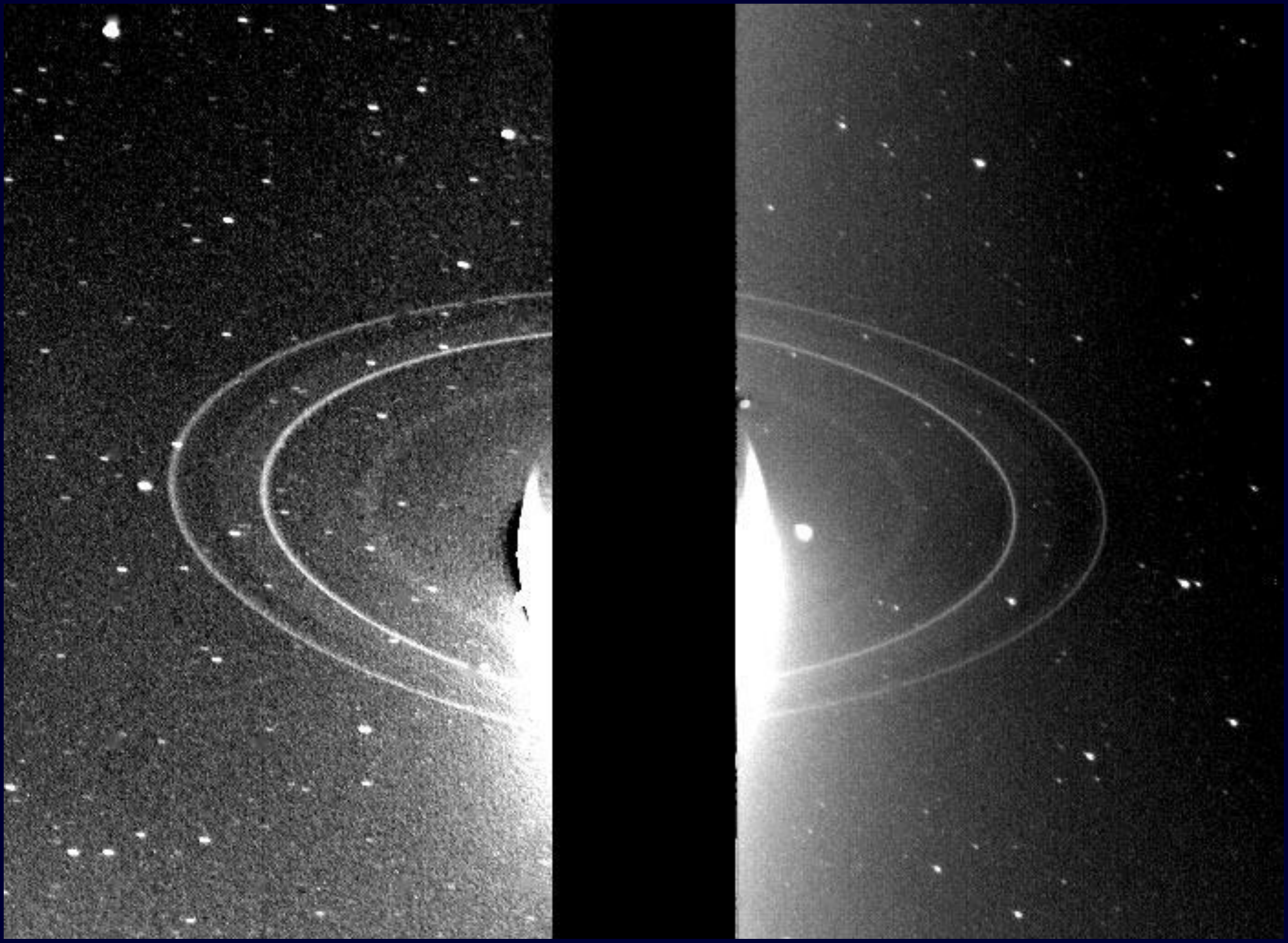
The linear cloud forms are stretched approximately along lines of constant latitude and the sun is toward the lower left. The bright sides of the clouds which face the sun are brighter than the surrounding cloud deck because they are more directly exposed to the sun.



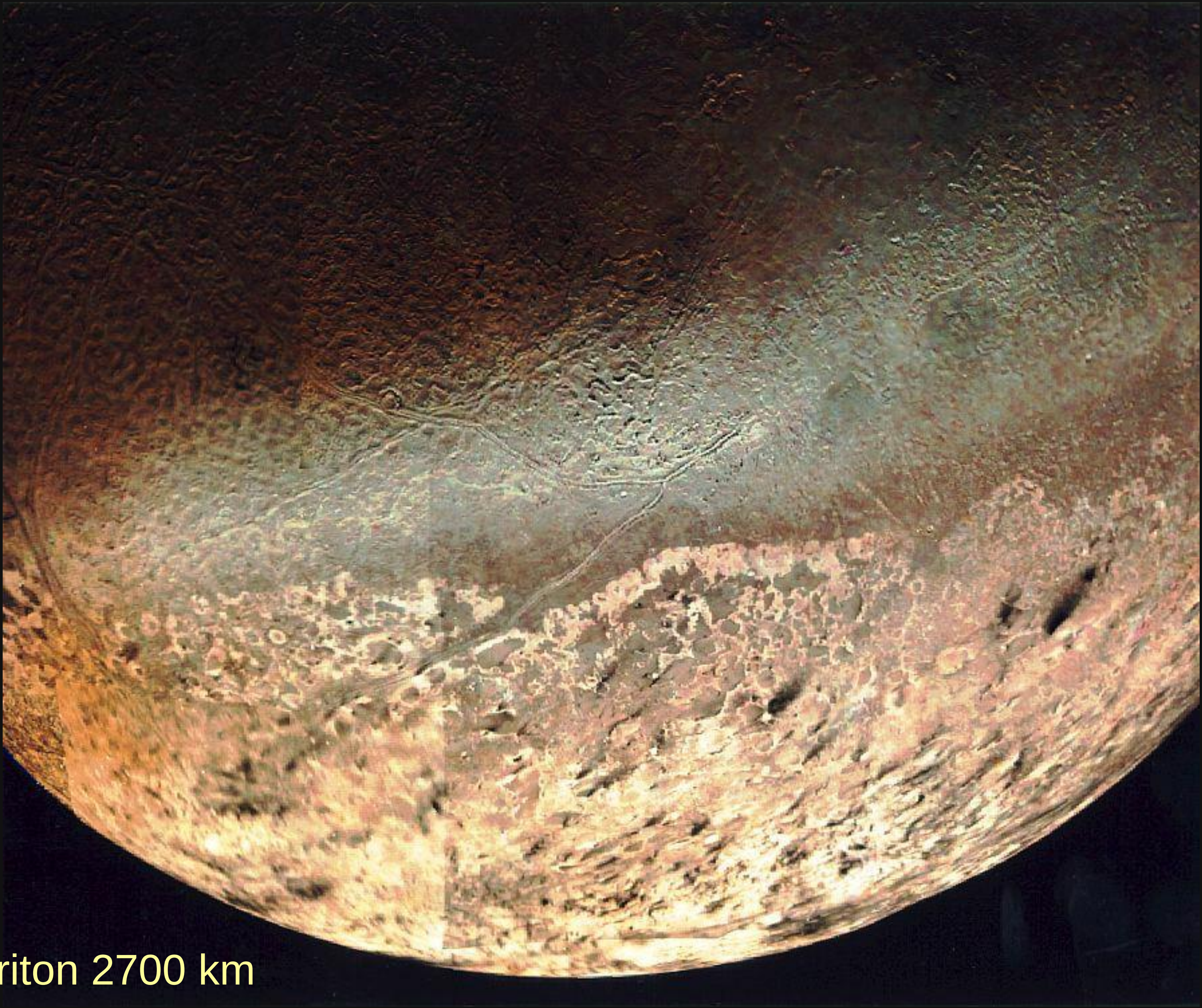
Voyager 2's view of Neptune, 57,000,000 kilometers away.

In the summer of 1989, NASA's Voyager 2 became the first spacecraft to observe the planet Neptune, its final planetary target. Passing about 4,950 kilometers above Neptune's north pole, Voyager 2 made its closest approach to any planet 12 years after leaving Earth in 1977. Five hours later, Voyager 2 passed about 40,000 kilometers from Neptune's largest moon, Triton, the last solid body the spacecraft will have an opportunity to study.

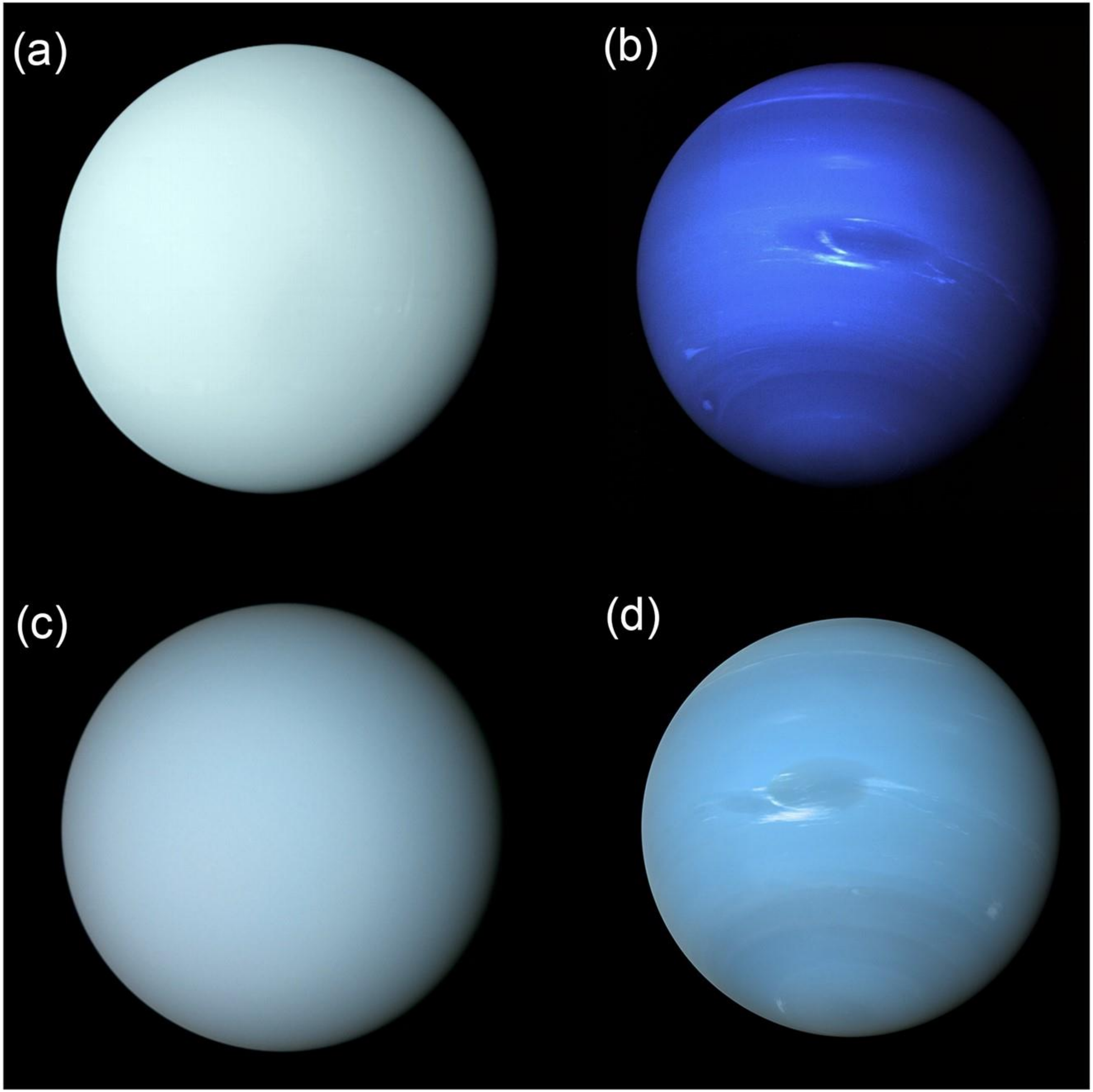
Neptunus



Neptunuksen rengasrakennetta, lähes 10 minuutin valotukset



Triton 2700 km


(a)
(b)
(c)
(d)

Voiko kameran vielä käynnistää?

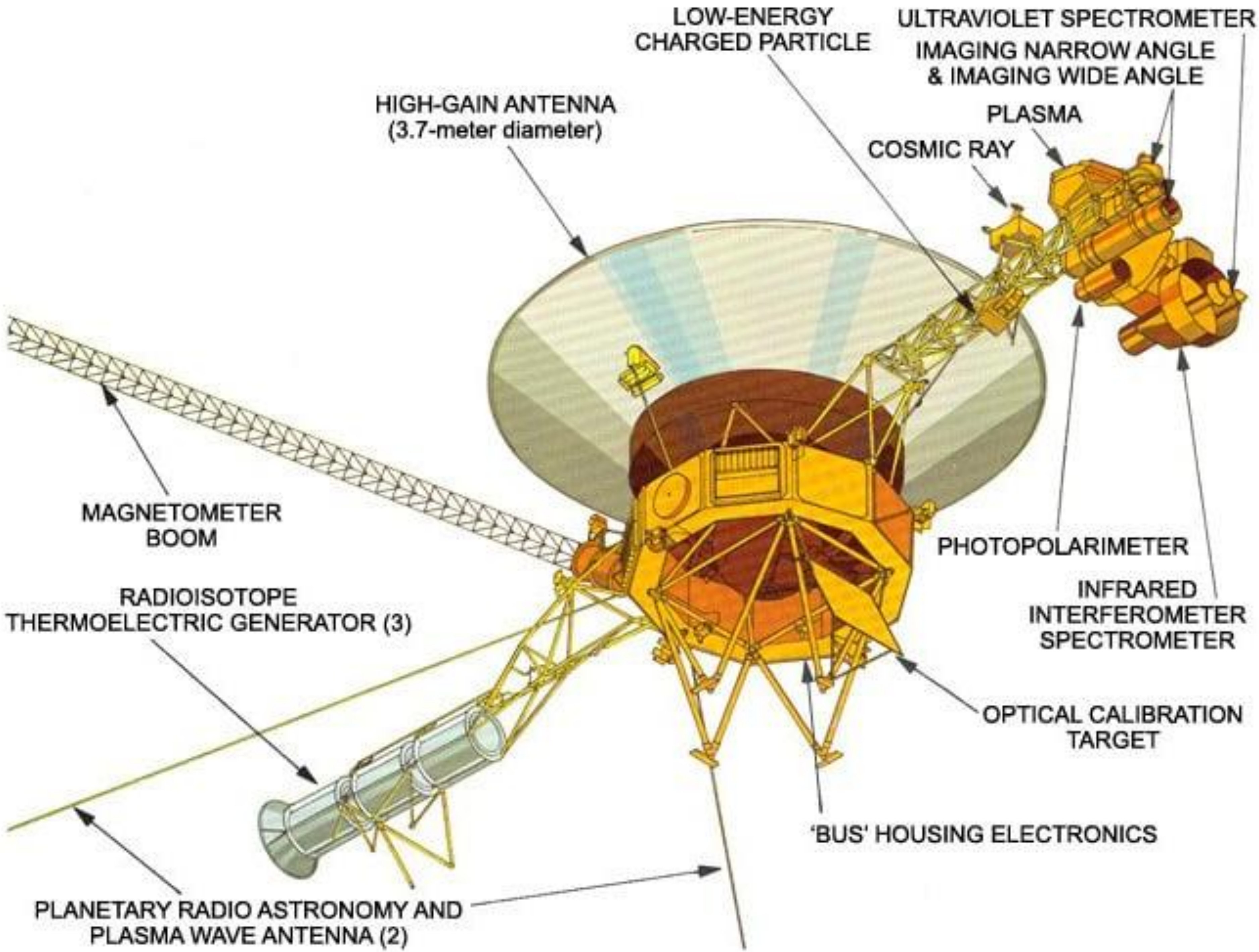
After Voyager 1 took its last image (the "Solar System Family Portrait" in 1990), the cameras were turned off to save power and memory for the instruments expected to detect the new charged particle environment of interstellar space. Mission managers removed the software from both spacecraft that controls the camera. The computers on the ground that understand the software and analyze the images do not exist anymore.

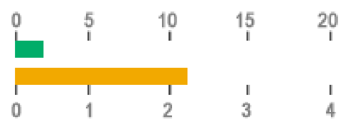
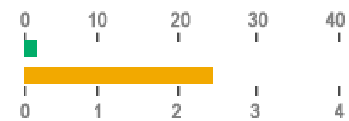
Voyager 1 on Herkuleen alapuolella Käärmeenkantajassa

Voyager 2 on Riikinkukon tähtikuviossa eteläisellä taivaanpuoliskolla

Voyager 1

Voyager 1 will leave the solar system aiming toward the constellation Ophiuchus. In the year 40,272 AD (more than 38,200 years from now), Voyager 1 will come within 1.7 light years of an obscure star in the constellation Ursa Minor (the Little Bear or Little Dipper) called AC+79 3888.


LOW-ENERGY
CHARGED PARTICLE
ULTRAVIOLET SPECTROMETER
IMAGING NARROW ANGLE
& IMAGING WIDE ANGLE
HIGH-GAIN ANTENNA
(3.7-meter diameter)
PLASMA
COSMIC RAY
MAGNETOMETER
BOOM
PHOTOPOLARIMETER
RADIOISOTOPE
THERMOELECTRIC GENERATOR (3)
INFRARED
INTERFEROMETER
SPECTROMETER
OPTICAL CALIBRATION
TARGET
'BUS' HOUSING ELECTRONICS
PLANETARY RADIO ASTRONOMY AND
PLASMA WAVE ANTENNA (2)

	Voyager 1	Voyager 2
Launch Date	Mon, 05 Sept 1977 12:56:00 UTC	Sat, 20 Aug 1977 14:29:00 UTC
Mission Elapsed Time	46 : 04 : 03 : 09 : 41 : 39 YRS MOS DAYS HRS MINS SECS	46 : 04 : 19 : 08 : 08 : 39 YRS MOS DAYS HRS MINS SECS
Distance from Earth	24,379,427,050 km	20,376,935,892 km
	162.96640411 AU	136.21140326 AU
Distance from Sun	24,275,591,178 km	20,260,862,072 km
	162.27230418 AU	135.43549770 AU
Velocity with respect to the Sun (estimated)	16.9995 kps	15.3741 kps
One-Way Light Time	22:35:21 (hh:mm:ss)	18:52:50 (hh:mm:ss)
Cosmic Ray Data		

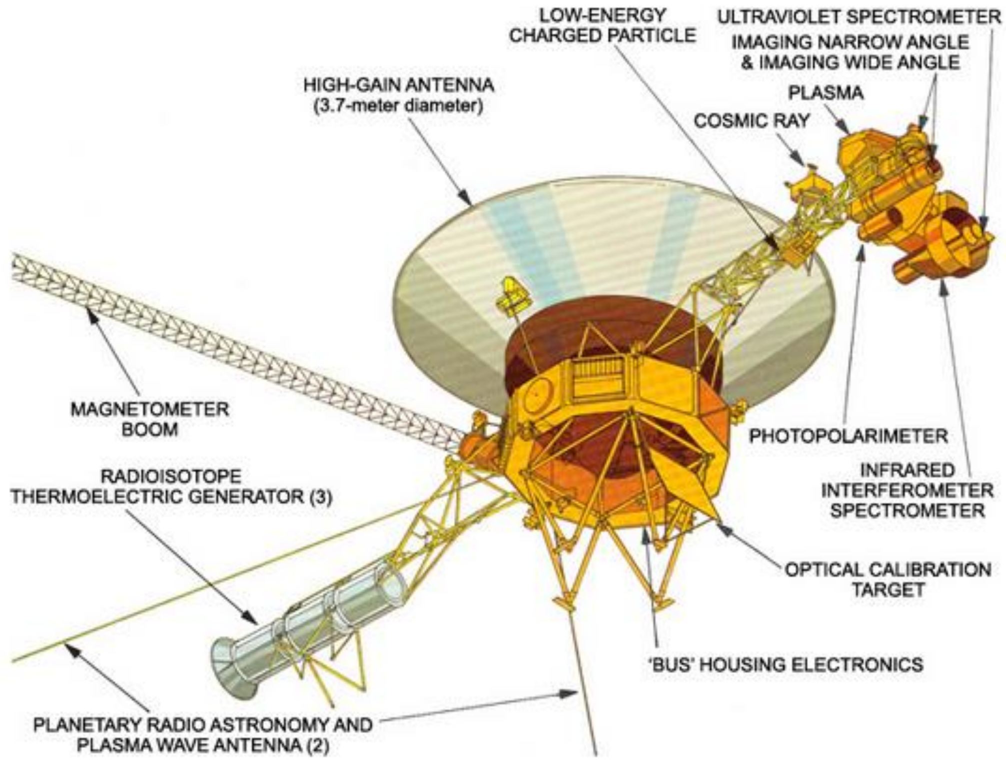
IMP MET

Tilanne 9.1.2024

https://voyager.jpl.nasa.gov/mission/status/#where_are_they_now

Instrument Status

Instrument	Voyager 1	Voyager 2
Cosmic Ray Subsystem (CRS)	ON	ON
Low-Energy Charged Particles (LECP)	ON	ON
Magnetometer (MAG)	ON	ON
Plasma Wave Subsystem (PWS)	ON	ON
Plasma Science (PLS)	OFF	ON
Imaging Science Subsystem (ISS)	OFF	OFF
Infrared Interferometer Spectrometer and Radiometer (IRIS)	OFF	OFF
Photopolarimeter Subsystem (PPS)	OFF	OFF
Planetary Radio Astronomy (PRA)	OFF	OFF
Ultraviolet Spectrometer (UVS)	OFF	OFF



The computers aboard the Voyager probes each have 69.63 kilobytes of memory, total.

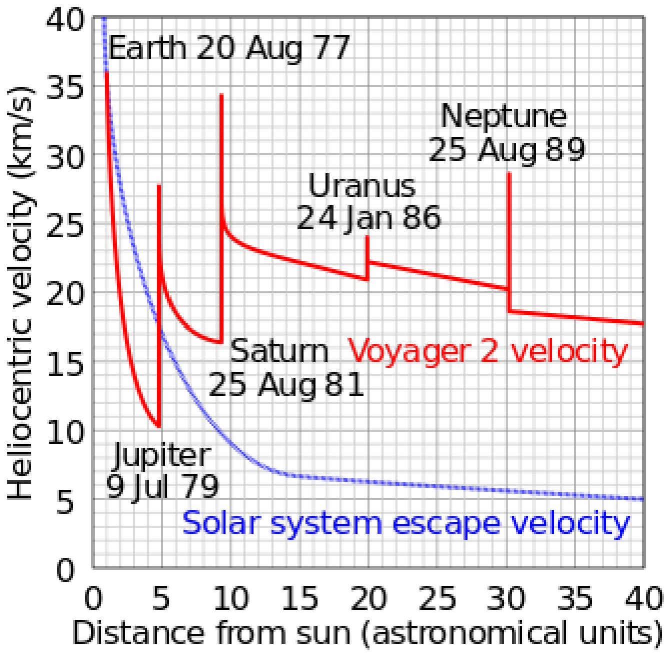
The magnetometer boom is 13 meters long

After leaving Earth but before its encounter with Jupiter, Voyager 2 lacked enough speed to escape the sun's gravity. During the Jupiter encounter, Voyager 2 gained enough speed to enable it to leave the solar system - the blue curve stays above the red curve beyond Jupiter. It gained about 10 km/s at Jupiter, about 5 km/s at Saturn, about 2 km/s at Uranus, and lost about 2 km/s at Neptune.

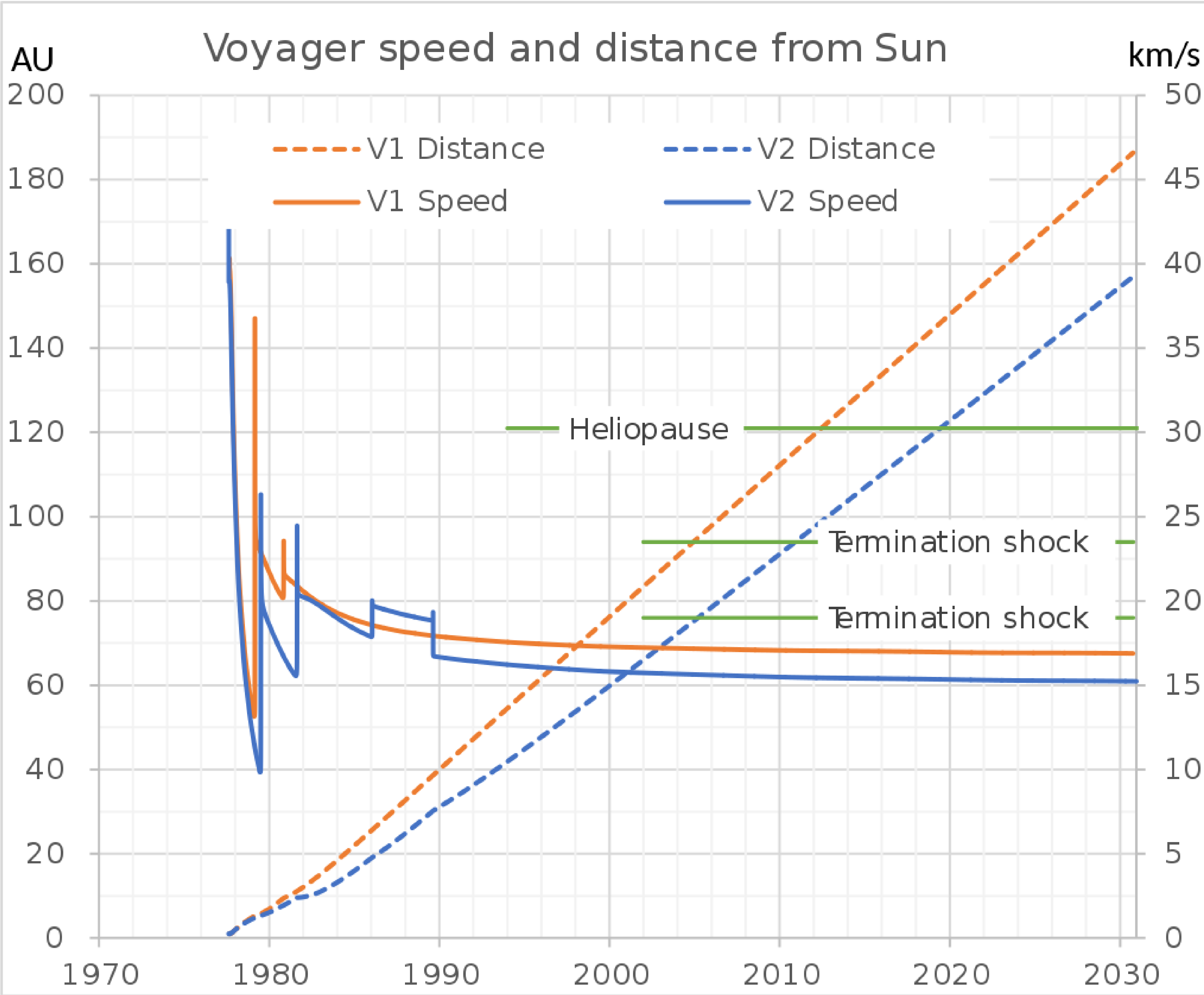
Luna 3
The gravity assist maneuver was first attempted in 1959 for Luna 3, to photograph the far side of the Moon. The satellite did not gain speed, but its orbit was changed that allowed successful transmission of the photos.

Mariner 10
The Mariner 10 probe was the first spacecraft to use the gravitational slingshot effect to reach another planet, passing by Venus on 5 February 1974 on its way to becoming the first spacecraft to explore Mercury

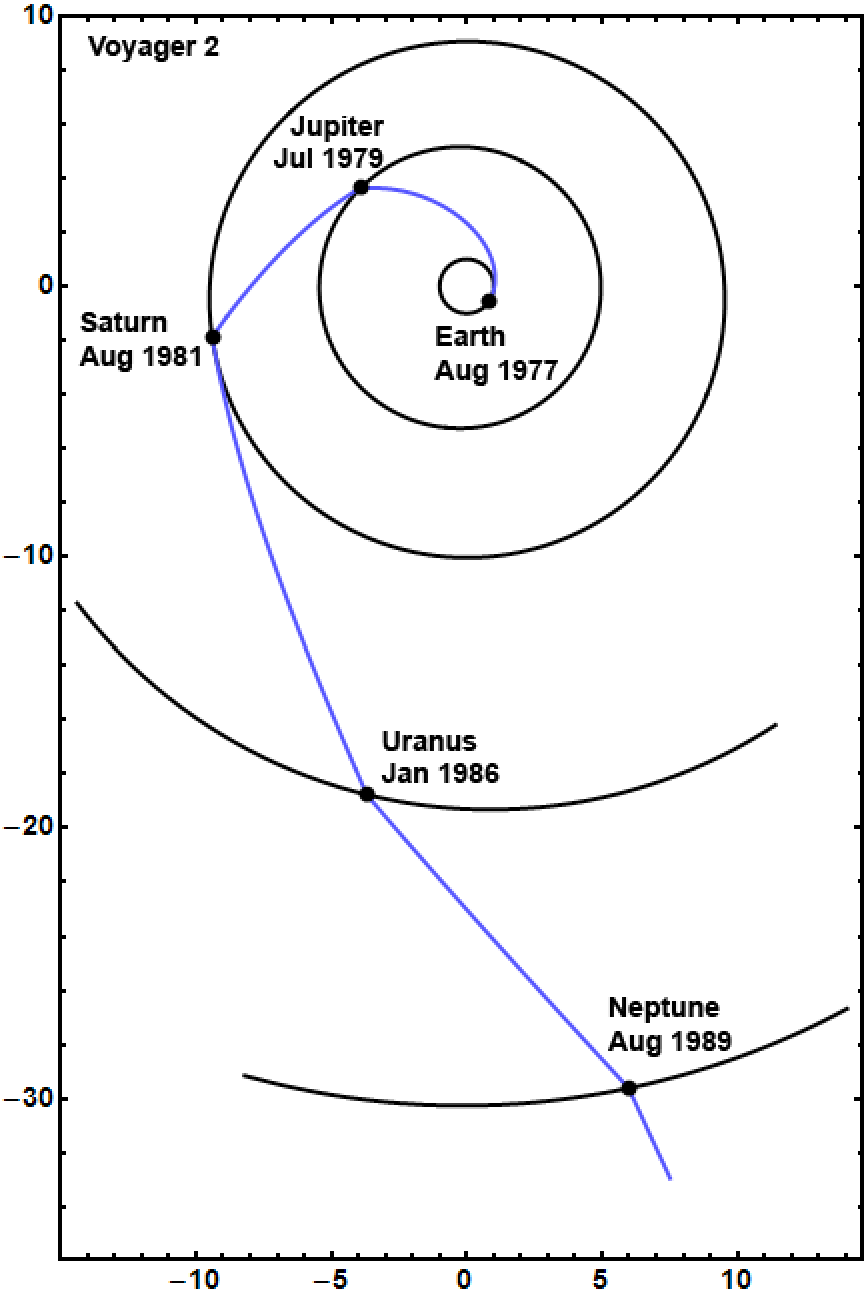
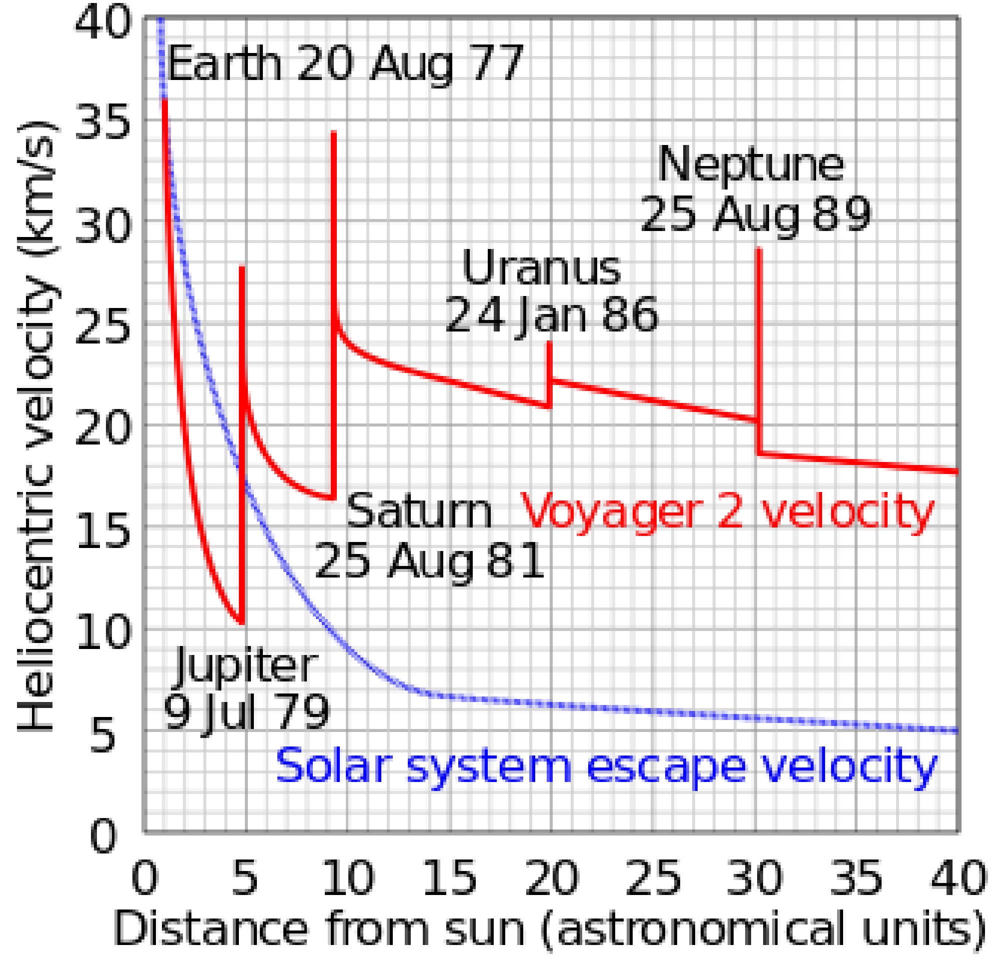
Pioneer 10
NASA's Pioneer 10 is a space probe launched in 1972 that completed the first mission to the planet Jupiter. Thereafter, Pioneer 10 became the first of five artificial objects to achieve the escape velocity needed to leave the Solar System. In December 1973, Pioneer 10 spacecraft was the first one to use the gravitational slingshot effect to reach escape velocity to leave Solar System.



Plot of Voyager 2's heliocentric velocity against its distance from the Sun, illustrating the use of gravity assist to accelerate the spacecraft by Jupiter, Saturn and Uranus. To observe Triton, Voyager 2 passed over Neptune's north pole resulting in an acceleration out of the plane of the ecliptic and reduced velocity away from the Sun



Voyager speed and distance from Sun
AU
km/s
V1 Distance
V2 Distance
V1 Speed
V2 Speed
Heliopause
Termination shock
Termination shock
200
180
160
140
120
100
80
60
40
20
0
50
45
40
35
30
25
20
15
10
5
0
1970
1980
1990
2000
2010
2020
2030


Voyager 2
Jupiter
Jul 1979
Saturn
Aug 1981
Earth
Aug 1977
Uranus
Jan 1986
Neptune
Aug 1989
10
0
−10
−20
−30
−10
−5
0
5
10

Earth 20 Aug 77
Neptune
25 Aug 89
Uranus
24 Jan 86
Saturn
25 Aug 81
Voyager 2 velocity
Jupiter
9 Jul 79
Solar system escape velocity
Heliocentric velocity (km/s)
Distance from sun (astronomical units)
0
5
10
15
20
25
30
35
40
0
5
10
15
20
25
30
35
40

ISSUE DATE: 01/10/24 07:39

PST: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0

THURSDAY
JANUARY 4, 2024
004-005

UTC: 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8

S/C 31
INITIAL CONDITIONS

RTLT: 45h 9m 6s

CCSL: A129

FDSL: 11AF
TWNC: ON
SB: OFF
XB: LOW
PYR: .05/.40/.50
GYROS: OFF

1200 RTLT 45h 9m 8s
0000 RTLT 45h 9m 10s
2242 FDS CMD ENABLE (19:52)
2246 FDS MDS I/O A (19:56)
2306 FDS POR (20:16)
0007 FDS POR/TIM/DET CIR B (21:16)
0027 5 FDS POR'S (21:36)
0238 LOW SUBCARRIER (23:48)
0243 TMU POR (23:53)
0249 LOW SUBCARRIER (23:58)
U/L 0315 TLC (SHORT-FORM)

FDS MODE: CR-5T
XB DATA RATE(MI): 160(32)

31 DSN COVERAGE

1225 14 [D] 1545
10
2155 43 [HT] 0345
40
0450 63 [D]
60
60

32 DSN COVERAGE

1805 43 [D] 2035
43 [D] 1225
40
40

S/C 32
INITIAL CONDITIONS

RTLT: 37h 44m 44s

CCSL: B202

FDSL: 11AF
TWNC: ON
SB: OFF
XB: LOW
PYR: .05/.30/.95
GYROS: OFF

1200 RTLT 37h 44m 50s
0000 RTLT 37h 44m 56s

FDS MODE: CR-5T
XB DATA RATE(MI): 160(32)

NASA’s Jet Propulsion Laboratory announced June 13 2024 that the four instruments on the spacecraft, which measure plasma waves, magnetic fields and particles in interstellar space, have started returning data again. Two of the instruments started up immediately after commands were sent to the spacecraft May 19 while the other two required what JPL called “some additional work” to resume operations.

Reaaliaikainen tieto
https://voyager.jpl.nasa.gov/mission/status/#where_are_they_now

Kuvia:
https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1977-084A

You can view pictures from Voyager and other missions at several locations:

NSSDC Planetary Image Catalog http://nssdc.gsfc.nasa.gov/imgcat

Planetary Photojournal http://photojournal.jpl.nasa.gov/

NSSDC Photo Gallery http://nssdc.gsfc.nasa.gov/photo_gallery

Pioneer 10 is headed towards the constellation of Taurus

Pioneer 11 is headed toward the constellation of Aquila

Voyager 1 is escaping the solar system at a speed of about 3.5 AU per year

Voyager 2 is also escaping the solar system at a speed of about 3.1 AU per year

To leave the solar system, they need to pass beyond the Oort Cloud. Voyager 1 was the first-ever object to reach interstellar space on August 25, 2012 when it passed beyond the sun’s realm of plasma influence (the heliosphere) and it is the most distant human-made object. But it will take about 300 years for Voyager 1 to reach the inner edge of the Oort Cloud and possibly about 30,000 years to fly beyond it.

14.2.1990

Voyager 1 looked back toward Earth and saw a 'pale blue dot,' " an image that continues to inspire wonderment about the spot we call home," said Ed Stone, project scientist for the Voyager mission, based at the California Institute of Technology, Pasadena.

The image of Earth contains scattered light that resembles a beam of sunlight, which is an artifact of the camera itself that makes the tiny Earth appear even more dramatic. Voyager 1 was 40 astronomical units from the sun at this moment. One astronomical unit is 93 million miles, or 150 million kilometers.

These family portrait images are the last that Voyager 1, which launched in 1977, returned to Earth. Mission specialists subsequently turned the camera off so that the computer controlling it could be repurposed.


'Pale Blue Dot' 14.2.1990