THE EXPANSE

KUXΛKU

2357-02-06 (397-16-10)

Contents

Kuxaku

Noun

1. space, void, vacuum

Etymology

Japanese kuuhaku

Here we have notable Sol System bodies and distances between them for communication and travel. This is a living document: positions of bodies change over the time. Effective date can be seen in the image and table titles.

Legend

System maps use two different scales, either Gm or AU. Gm is a standard SI unit gigameter (million kilometers). AU is an astronomical unit: distance from the Earth to the Sun (roughly 150 million kilometers or 150 Gm). Gm is used within gas giant systems (Jupiter and Saturn).

System objects are displayed as small filled circles. Sun is yellow, Earth is blue and Mars is red. Otherwise, following colors are used:

Green Important planets.

Purple Permanent human colonies.

Orange Artificial constructs.

Gray Other system objetcs.

Notable objects have orbit dots displaying their future positions. Orbit dot color is the same as the object color. Legend info in the map tells the time interval between dots. Note that some objets may have retrograde orbits rotating in opposite direction.

All asteroid labels include their number. Objects without number are either planets, moons or artificial constructs.

Image above shows relative sizes of the major Sol system objects.

1 Inner System

The inner system map (page 8) shows positions of notable objects inside Jupiter's orbit. Future orbit positions are displayed for some bodies at one month intervals.

Mercury

Mercury is the closest planet to the Sun. The smallest planet in the Sol System, it has no natural satellites. Besides impact craters, its only known geological features are lobed ridges or rupes that were produced by a period of contraction early in its history. Mercury's very tenuous atmosphere consists of atoms blasted off its surface by the solar wind. Its has relatively large iron core and thin mantle.

There has been several scientific stations in orbit around Mercury. The lastest one in a stationary orbit has just started operation.

Venus

Venus is the Sol System's second planet, and while similar in size and mass to Earth, it is strikingly different in almost every other way. Venus has a retrograde rotation, meaning it rotates clockwise, as opposed to the counter-clockwise rotations of most of the Sol System's other planets. Although Venus' gravity is just slightly lower than that of Earth, the planet's incredibly dense carbon dioxide atmosphere results in crushing atmospheric pressure at the surface 92 times greater than Earth's. It also creates a powerful greenhouse effect, leading to surface temperatures of 735 K, making Venus the hottest planet in the Sol System — hotter even than the surface of Mercury.

Although it was the first planet to be visited and landed on by unmanned spacecraft from Earth in the 20th century, Venus has never been colonized by humans.

Earth

The third planet from the Sun and the birthplace of humanity, Earth stands as the cultural, political, and economic center of the Sol System. It remains the only world in the system with a breathable atmosphere where people can live outdoors under an open sky. Home to 30 billion people, Earth struggles under the effects of climate change, environmental pollution, overpopulation, and widespread unemployment, but its corporations are the wealthiest and most powerful in the system. It is heavily reliant on the resources of the Belt to keep the engine of its economy running, yet the grip Earth once held on its interplanetary colonies is slowly slipping away.

Luna Luna is Earth's only natural satellite. It is only a quarter of Earth's diameter, with a gravity of 0.16 g — lighter than many spin stations in the Belt. Only 384,402 kilometers away from Earth, Luna was the site of humanity's first landing on another planet, as well as the location of Earth's first interplanetary colony, established in the early 21st century. This first permanent lunar base was a shared military and scientific endeavor, and while elements of both remain, Luna is now much more of a civilian station. Like Earth, Luna is governed by the United Nations, and the approximately one billion inhabitants of Luna are considered full UN citizens.

Mars

Mars is the fourth planet from the Sun and the second-smallest planet in the Sol System, being larger than only Mercury. It has a surface gravity of 0.38 g and a surface area only slightly less than the total area of Earth's dry land. The the iron oxide prevalent on Mars's surface gives it a reddish appearance distinctive among the astronomical bodies visible to the naked eye. Mars is a terrestrial planet with a thin atmosphere, with surface features reminiscent of the impact craters of the Moon and the valleys, deserts and polar ice caps of Earth.

The Martian Congressional Republic rules over four billion people who are spread across Mars, associated orbital stations, and the small but highly advanced military fleets cruising the Sol System. Settled in the 21st century after a number of lengthy exploratory missions, Mars is a world of dreamers, devoted to a single vision: the greening of the red planet.

Phobos Phobos is the innermost and larger of the two natural satellites of Mars. It is a small, irregularly shaped object with a mean radius of 11 km. Phobos orbits 6,000 km from the Martian surface, closer to its primary body than any other known planetary moon. It is so close that it orbits Mars much faster than Mars rotates, and completes an orbit in just 7 hours and 39 minutes. As a result, from the surface of Mars it appears to rise in the west, move across the sky in 4 hours and 15 minutes or less, and set in the east, twice each Martian day.

Deimos Deimos was the smaller and outermost of the two natural satellites of Mars. It no longer exists as such. Following nuclear annihilation of the Earth-Mars joint Phoebe Research Station and the Saturnian satellite in the wake of the Eros Incident, the United Nations destroyed one of Mars' two moons. Prior to becoming a smudge in the Martian sky, Deimos hosted military facilities and a deep radar station.

1.1 Near-Earth Objects

A near-Earth object is any small Sol System body whose orbit brings it into proximity with Earth.

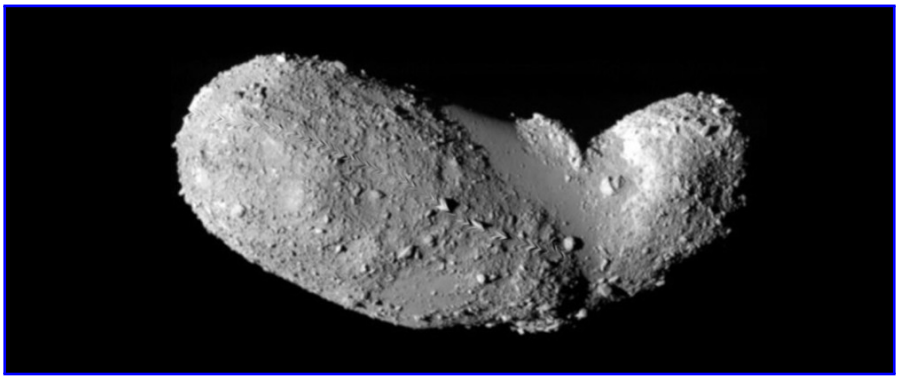
Atira asteroids are asteroids whose orbits are entirely confined within Earth's orbit. They are by far the smallest group of near-Earth objects. Earth-crossers whose semi-major axes are smaller than Earth's are Aten asteroids. The remaining ones are Apollo asteroids, which are the largest group of near-Earth objects.

Amor asteroids is a subgroup of the near-Earth asteroids that approach the orbit of Earth from beyond, but do not cross. The most famous of these was, of course, Eros.

1036 Ganymed A stony asteroid on a highly eccentric orbit, classified as a near-Earth object of the Amor group. With a diameter of 35 kilometers, it is the largest of all near-Earth objects.

1862 Apollo Apollo is a stony asteroid, approximately 1.5 kilometers in diameter. It is the namesake and the first recognized member of the Apollo asteroids.

25143 Itokawa Itokawa is a sub-kilometer near-Earth object of the Apollo group. The peanut-shaped S-type asteroid has a rotation period of 12.1 hours and measures approximately 330 meters in diameter. It was the first asteroid to be the target of a sample return mission.



163693 Atira Atira is a binary asteroid, a system of two asteroids orbiting their common barycenter. The primary component with a diameter of approximately 4.8 kilometers is orbited by a minor-planet moon that measures about 1 km. Atira is the namesake and the first numbered body of the Atira asteroids.

2 Asteroid Belt

The asteroid belt is a torus-shaped region in the Sol System, located roughly between the orbits of the planets Jupiter and Mars, that is occupied by a great many solid, irregularly shaped bodies, of many sizes but much smaller than planets, called asteroids or minor planets.

The identified objects are of many sizes and, on average, are about one million kilometers apart. About half the mass of the belt is contained in the four largest asteroids and the total mass is approximately 4% that of the Moon.

The three broad composition classes of asteroids are C-, S-, and M-types:

C-type C-type (chondrite) asteroids are most common. They consist of clay and silicate rocks, and are dark in appearance. They are among the most ancient objects in the Sol System.

S-type S-types ("stony") are made up of silicate materials and nickel-iron.

M-type M-types are metallic (nickel-iron). The asteroids' compositional differences are related to how far from the Sun they formed. Some experienced high temperatures after they formed and partly melted, with iron sinking to the center and forcing basaltic (volcanic) lava to the surface.

2.1 Space Stations

Hades' Garden A deceptively low-tech station run by a Belter group known as Persephone's Scythe. The heart of the Garden is the Cerberus, an old bulk hauler that has been converted to serve as laboratory and living quarters for the small but highly dedicated group of biohackers, guerilla farmers, and occasional eco-terrorists.

Tycho The Belt headquarters of Tycho Manufacturing and Engineering Concern is the largest mobile construction platform in the Sol System. Fifteen thousand workers and their families live within Tycho, building megastructures or massive ships far beyond the reach of a planet.

2.2 Colonized Asteroids

1 Ceres The only dwarf planet in the inner Sol System, and the first asteroid discovered by humanity. Only object in the asteroid belt rounded by its own gravity. Tycho corporation spun up the asteroid in a dramatic feat of engineering, granting it a gravity of 0.3 g. Now the most important port of call in the Belt with population of approximately six million permanent residents

2 Pallas The third largest asteroid in the asteroid Belt, and the second asteroid discovered by humanity. It hosts one of the oldest stations, Pallas Station, in the outer planets, but is also known for a revolt at its colony. The station itself has a long history of a refinement station for the mining operations of the Belt. Due to this legacy, it continues to have its infrastructure maintained and upgraded, making use of its older equipment as overflow capacity.

4 Vesta The second-most-massive asteroid in the asteroid Belt after Ceres and the only known remaining rocky protoplanet of the kind that formed the terrestrial planets. It hosts one of the largest settlements in the outer planets. At some time during the UN-MCR Cold War, Vesta was the site of the Vesta Blockade, a confrontation between the UN and MCR that would delay the Martian terraforming efforts for over a century.

10 Hygiea The fourth largest asteroid in the asteroid Belt and somewhat oblong. It hosts Hygeia Station. Like many places in the Belt, its population suffered from high UN taxes that made survival expensive and kept the population routinely destitute.

2.3 Notable Asteroids

3 Juno One of the two largest stony asteroids, along with 15 Eunomia. It contains about 1% of the total mass of the asteroid Belt. Its orbit has an extreme eccentricity which brings Juno closer to the Sun at perihelion than Vesta and further out at aphelion than Ceres.

5 Astraea The fifth asteroid discovered. Physically unremarkable but notable because after its discovery, thousands of other asteroids would follow. The discovery of Astraea proved to be the starting point for the eventual demotion of the four original asteroids (which were regarded as planets at the time) to their current status.

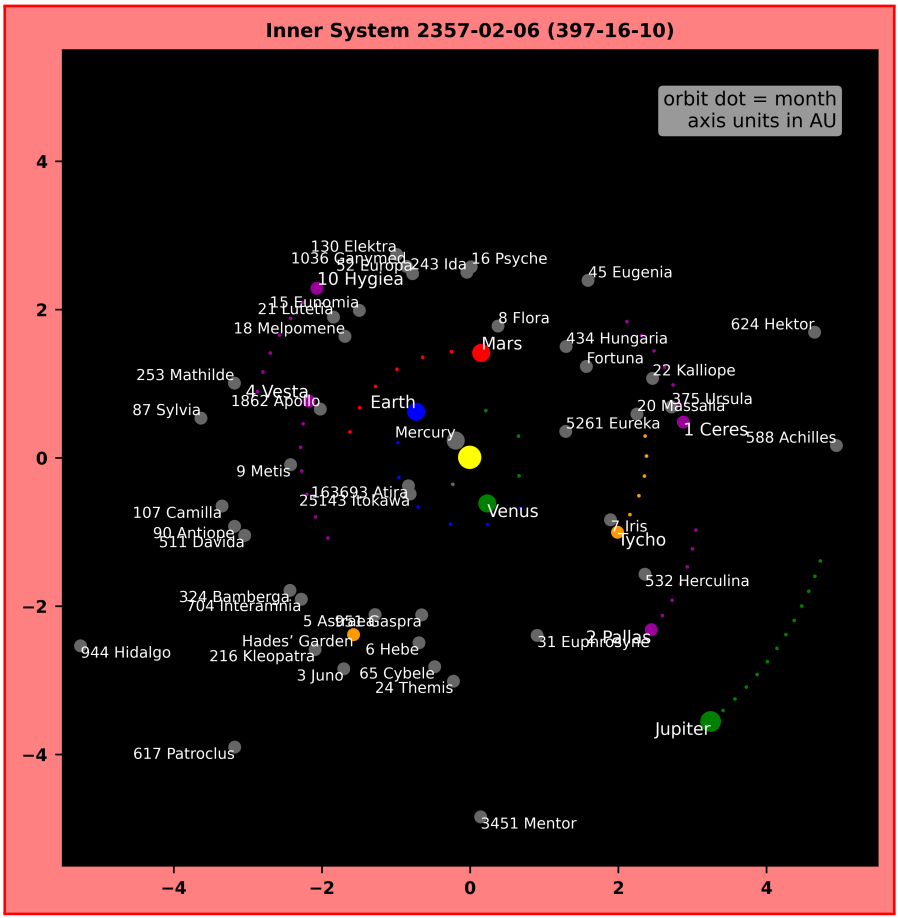
6 Hebe Large main-belt asteroid, containing around 0.5% of the mass of the Belt. This high bulk density means an extremely solid body that has not been impacted by collisions, which is not typical of asteroids of its size. In brightness, Hebe is the fifth-brightest object in the asteroid Belt.

7 Iris Large main-belt asteroid orbiting the Sun between Mars and Jupiter. It is the fourth-brightest object in the asteroid belt. It is classified as an S-type asteroid, meaning that it has a stony composition.

8 Flora Large, bright main-belt asteroid. It is the innermost large asteroid: no asteroid closer to the Sun has a diameter above 25 kilometres or two-elevenths

that of Flora itself, and not until the tiny 149 Medusa was discovered was a single asteroid orbiting at a closer mean distance known.

9 Metis One of the larger main-belt asteroids. It is composed of silicates and metallic nickel-iron, and may be the core remnant of a large asteroid that was destroyed by an ancient collision. Metis contains just under half a percent of the total mass of the asteroid Belt.



15 Eunomia The largest of the stony asteroids with mean diameter of 268 km. Eunomian family is the most prominent family in the intermediate asteroid belt and the 6th-largest family with nearly six thousand known members, or approximately 1.4% of all asteroids in the asteroid Belt.

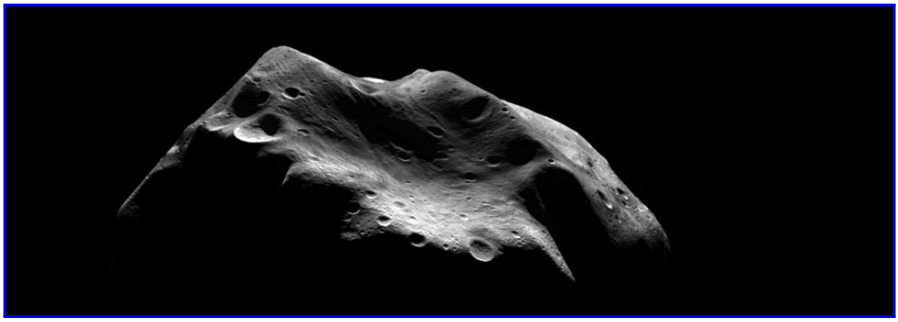
16 Psyche One of the most massive asteroids in the asteroid belt. This object is over 200 km in diameter and contains about 1% of the mass of the entire asteroid belt. It is thought to be the exposed iron core of a protoplanet, and is the most massive metallic M-type asteroid.

18 Melpomene Large, bright main-belt asteroid named after Melpomenē, the Muse of tragedy in Greek mythology. It is classified as an S-type asteroid and is composed of silicates and metals.

19 Fortuna Fortuna is one of the largest main-belt asteroids. It has a composition similar to Ceres: a darkly colored surface that is heavily space-weathered with the composition of primitive organic compounds, including tholins.

20 Massalia Stony asteroid and the parent body of the Massalia family located in the inner region of the asteroid belt, approximately 145 kilometers in diameter. The family is fairly young, estimated to have been created by an impact 150 to 200 million years ago.

21 Lutetia A large asteroid in the asteroid belt of an unusual spectral type. It measures about 100 kilometers in diameter and is heavily cratered, with the largest impact crater reaching 45 km in diameter. The surface is geologically heterogeneous and is intersected by a system of grooves and scarps. One of the few planetesimals in the Belt.



22 Kalliope Kalliope is a large M-type asteroid. Kalliope has one known natural satellite, called Linus. It is quite large – about 28 km in diameter – and would be a sizeable asteroid by itself. It orbits about 1100 km from the center of Kalliope, equivalent to about 13.2 Kalliope radii.

24 Themis The largest member of the Themistian family with surface completely covered in ice. There is also organic compounds in the form of tholins, high-molecular weight organics found in the outer Sol System, distinguished by a brown or reddish color in optical spectra.

31 Euphrosyne Euphrosyne is the 12th-largest asteroid in the asteroid belt, and one of the half-dozen or so most massive. It has a high orbital inclination and eccentricity having nodes near perihelion and aphelion, Its perihelion lies at the northernmost point of its orbit.

45 Eugenia Famed as one of the first asteroids to be found to have a moon orbiting it, and the first one to been discovered by an Earth-based telescope. Eugenia I Petit-Prince is the larger (diameter of 13 km), outer moon. A second, smaller (diameter of 6 km) satellite orbits closer to Eugenia.

52 Europa The 6th-largest asteroid in the asteroid belt, having an average diameter of around 315 km. It is not round but is shaped like an ellipsoid of approximately 380×330×250 km. Europa is a very dark carbonaceous C-type, and is the second largest of this group.

65 Cybele One of the largest asteroids in the Sol System and is located in the outer asteroid belt. It gives its name to the Cybele group of asteroids that orbit outward from the Sun from the 2:1 orbital resonance with Jupiter. The last outpost of an extended asteroid belt.

87 Sylvia The 8th-largest asteroid in the asteroid belt. It is the parent body of the Sylvia family and member of Cybele group located beyond the core of the belt. Sylvia was the first asteroid known to possess more than one moon. They have been named (87) Sylvia I Romulus and (87) Sylvia II Remus.

90 Antiope A double asteroid in the outer asteroid belt. It was found to consist of two almost-equally-sized bodies orbiting each other. At average diameters of about 88 km and 84 km, both components are among the 500 largest asteroids.

107 Camilla One of the largest asteroids from the outermost edge of the asteroid belt, approximately 220 kilometers. It is a member of the Sylvia family and located within the Cybele group. The X-type asteroid is a rare trinary asteroid with two minor-planet moons.

130 Elektra Elektra is a large (about 260 x 200 x 164 kilometers) outer main-belt asteroid and quadruple system with three minor-planet moons. Their sizes are about 6.0, 2.0 and 1,6 kilometres. Given their similar spectra, these satellites are thought to be fragments of Elektra that were created from a disruptive impact.

216 Kleopatra A metallic, ham-bone-shaped asteroid and trinary system orbiting in the central region of the asteroid belt, approximately 138 kilometers in diameter. It is believed that Kleopatra's shape, rotation, and moons are due to an oblique impact perhaps 100 million years ago.

243 Ida An asteroid in the Koronis family of the asteroid belt. It was the second asteroid visited by a spacecraft and the first found to have a natural satellite. Ida's moon Dactyl is only 1.4 kilometres in diameter, about 1/20 the size of Ida.

253 Mathilde An asteroid with a relatively elliptical orbit that requires more than four years to circle the Sun. Nonetheless, the orbit lies entirely between the orbits of Mars and Jupiter; it does not cross the planetary orbits. This tumbling asteroid has an unusually slow rate of rotation, requiring 17.4 days to complete a 360° revolution about its axis. It is a primitive C-type asteroid, which means the surface has a high proportion of carbon; giving it a dark surface that reflects only 4% of the light that falls on it.

324 Bamberga One of the largest asteroids in the asteroid belt. Bamberga is the tenth-brightest main-belt asteroid. Its high eccentricity (for comparison 36% higher than that of Pluto), though, means that at most oppositions other asteroids reach higher magnitudes.

375 Ursula A dark asteroid and parent body of the Ursula family from the outer regions of the asteroid belt. It is one of the largest asteroids with a diameter of approximately 200 kilometers. In the Tholen classification, Ursula is a carbonaceous C-type asteroid.

434 Hungaria Hungaria is a relatively small asteroid orbiting in the inner asteroid belt. It is an E-type (high-albedo) asteroid, It is the namesake of the Hungaria asteroids, which orbit the Sun on the inside of the 1:4 Kirkwood gap, standing out of the core of the asteroid belt.

511 Davida One of the ten most-massive asteroids, and the 7th-largest asteroid. It is 298 km in diameter and comprises an estimated 1.5% of the total mass of the Asteroid Belt. It is a C-type asteroid, which means that it is dark in colouring with a carbonaceous chondrite composition.

532 Herculina One of the larger members of the main asteroid belt with size of 260×220×215 km. It is not spherical, but a blocky shape not unlike a battered cuboid - or, as the original analysis described it, it "resembles a toaster". It has multiple largish craters, but no major variation in albedo.

588 Achilles Large Jupiter trojan from the Greek camp. Archillies was the first Jupiter trojan to be discovered. The dark D-type asteroid measures 133 kilometers in diameter which makes it one of the 10 largest Jupiter trojans.

617 Patroclus A binary Jupiter trojan is is a slow rotator due to the 103-hour orbital period of its two components. Patroclus (110 kilometer in diameter) and slightly smaller Menoetius orbit around each other at a distance of roughly 700 km It was the second trojan to be discovered and the only member of the Trojan camp named after a Greek character.

624 Hektor The largest Jupiter trojan and the namesake of the Hektor family, with a highly elongated shape equivalent in volume to a sphere of approximately 225 to 250 kilometers diameter. It has one small 12-kilometer sized satellite, Skamandrios.

704 Interamnia Large F-type asteroid with a diameter of 350 kilometres. It is the fifth-most-massive asteroid with a mass estimated to be 1.2% of the mass of the Asteroid Belt. Interamnia may represent a transitional body between small solar system bodies and dwarf planets.

951 Gaspra A small S-type asteroid that orbits very close to the inner edge of the asteroid belt. Gaspra's surface lacks unambiguous craters of a size comparable to its radius. A probable reason is that the collision that produced the Flora family and Gaspra was relatively recent on an astronomical timescale.

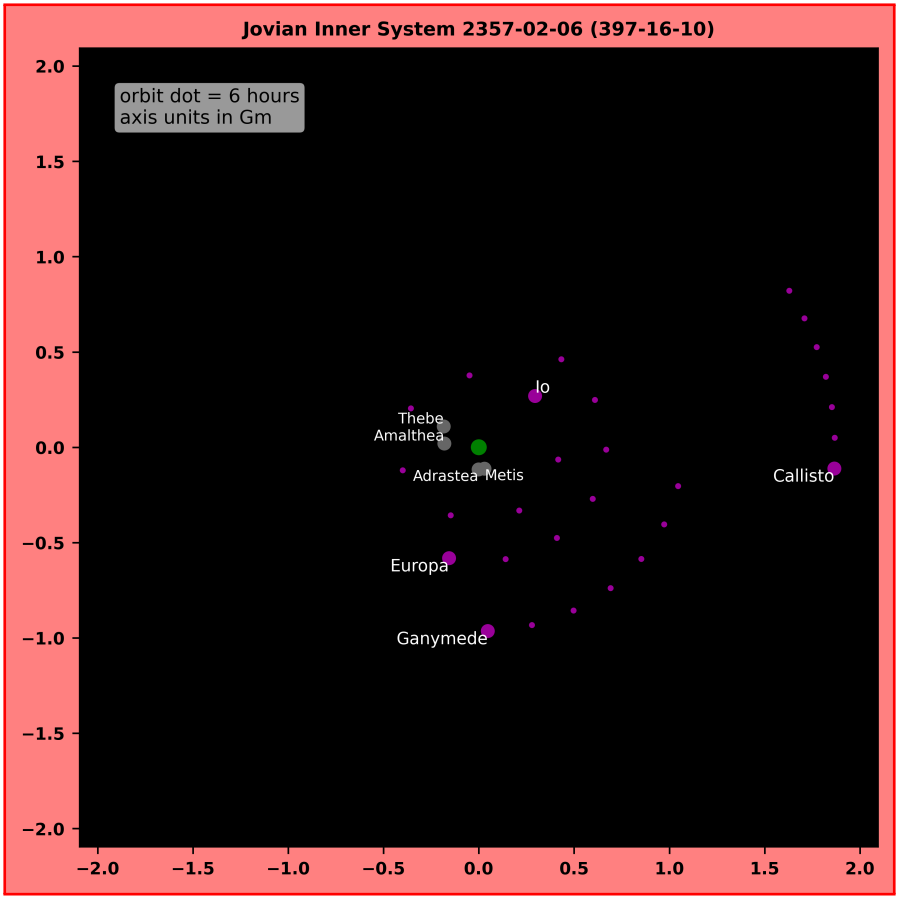
3451 Mentor Mentor is a large Jupiter trojan from the Trojan camp, approximately 120 kilometers in diameter. The uncommon Jovian X-type asteroid is one of the largest Jupiter trojans and orbits the Sun at a distance of 4.8–5.5 AU once every 11 years and 8 months.

5261 Eureka Eureka is a trojan trailing Mars at the L5 point. The asteroid is located deep within a stable Lagrangian zone of Mars, which is considered indicative of a primordial origin — meaning the asteroid has most likely been in this orbit for much of the history of the Sol System. It has one natural satellite orbiting 2.1 km from Eureka.

3 Jovian System

Named for the gas giant it surrounds, the Jovian System has drawn the largest population in the Outer Planets to Jupiter's moons. There are dozens of settlements and orbiting space stations around it and its moons.

The Jovian System is responsible for growing and distributing most of the food in the Outers and the Belt. Most extrasolar astronomy was done in the Jovian System before the Uranian System was colonized. It is a vital piece of humanity's survival in the furthest reaches of the Sol System, and of the Belt's economy.

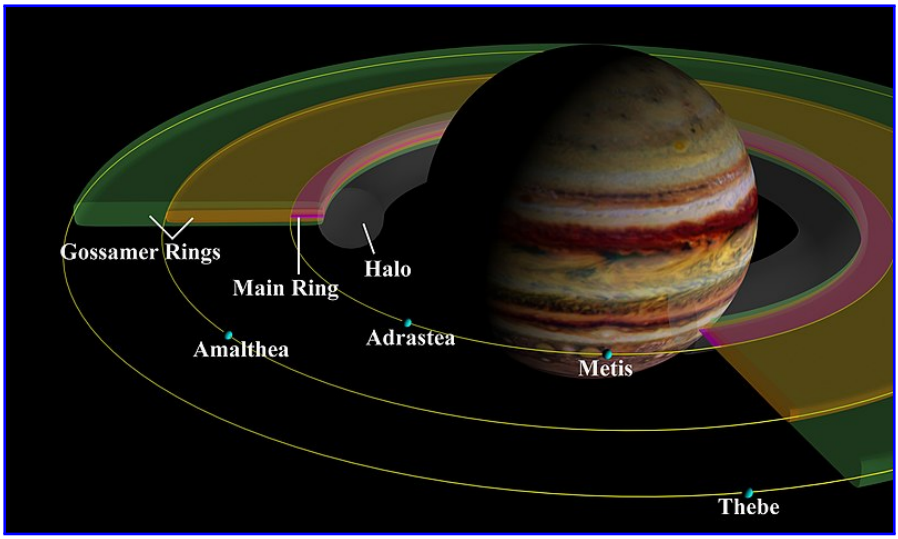


Jupiter is primarily composed of hydrogen with a quarter of its mass being helium, though helium comprises only about a tenth of the number of molecules.

3.1 Ring System

The planet Jupiter has a system of rings known as the rings of Jupiter or the Jovian ring system. It was the third ring system to be discovered in the Sol System, after those of Saturn and Uranus.

The Jovian ring system is faint and consists mainly of dust. It has four main components: a thick inner torus of particles known as the "halo ring"; a relatively bright, exceptionally thin "main ring"; and two wide, thick and faint outer "gossamer rings", named for the moons of whose material they are composed: Amalthea and Thebe.



The main and halo rings consist of dust ejected from the moons Metis, Adrastea, and other unobserved parent bodies as the result of high-velocity impacts. In visible and near-infrared light, the rings have a reddish color, except the halo ring, which is neutral or blue in color.

3.1.1 Snow Line

The term snow line represents the present distance at which water ice can be stable (even under direct sunlight). This distance in the Sol System is approximately 5 AU, practically same as the Jupiter's orbit.

It also explains why the Jovian rings are so faint compared to the Saturnian rings: There is no ice.

3.2 Inner Moons

Inner moons are unpopulated primarily due to their proximity to Jupiter and location in its harsh radiation belt — even aboveground structures on moons further from the planet require heavy shielding.

Metis Metis is the innermost moon of Jupiter. It is tidally locked to Jupiter, and its shape is strongly asymmetrical, with one of the diameters being almost twice as large as the smallest one. It is one of the two moons known to orbit Jupiter in less than the length of Jupiter's day, the other being Adrastea. It orbits within the main ring of Jupiter, and is a major contributor of material to the rings. The surface of Metis is heavily cratered, dark, and appears to be reddish in color.

Adrastea Adrastea is the second by distance, and the smallest of the four inner moons of Jupiter. It also orbits Jupiter in less than the length of planet's day. It orbits at the edge of Jupiter's Main Ring and, like Metis, is the main contributor of material to the rings. Adrastea has an irregular shape.

Amalthea Amalthea has the third closest orbit around Jupiter among known moons. It is in a close orbit around Jupiter and is within the outer edge of the Amalthea Gossamer Ring which is formed from dust ejected from its surface. Jupiter would appear 46.5 degrees in diameter from its surface. Amalthea is the largest of the inner satellites of Jupiter and is irregularly shaped and reddish in color. Its surface features include large craters and ridges.

Thebe Thebe is the fourth of Jupiter's moons by distance from the planet. The second largest of the inner satellites of Jupiter, Thebe orbits within the outer edge of the Thebe gossamer ring that is formed from dust ejected from its surface. It is irregularly shaped and reddish in colour Its surface features include large craters and high mountains — some of them are comparable to the size of the moon itself.

3.3 Galilean Moons

The Galilean moons are the four largest moons of Jupiter. They were first seen by Galileo Galilei in 1609 and were the first objects found to orbit a planet other than the Earth.

Io One of Jupiter's larger moons, Io is an extremely hostile and unforgiving environment for colonists. Its atmosphere of sulfur dixoide and hot spots of volcanic and tectonic activity make Io a very dangerous environment for humanity. Io's volcanos produce vents of heat in excess of 2,000° K, and

the moon itself creates an intense electrical field when its nickel and iron core passes through Jupiter's magnetic field, producing in excess of 1 trillion watts. Power stations dotted around the surface converting heat transfer and atmospheric electrical charge into usable energy have made Io one of the primary storable energy production facilities in the Outers.

Europa One of the most populated of Jupiter's moons, Europa has some similarities to Ganymede — they both have stable tectonics and aboveground dome greenhouses, and were amongst the first moons to be colonized. Earthers, Belters, and Martians all store eggs and sperm on Europa and Ganymede, as well as Luna and Earth. However, while Ganymede has significantly increased its investment in agricultural and medical technology over the decades, Europa has fallen behind. Now, the moon's primary advantage is its thick surface layer of ice, which allows its settlements to supply themselves with water and oxygen without outside help.

Ganymede Ganymede Station is the bread basket and the main birthing center for the Outers and the Belt, and a center of civilization in the far reaches of the Sol System. It is the safest station in the Jovian system, where people come to give birth, avoiding the defects that can come with carrying to term in low or zero g. As the only moon with any magnetosphere, it's the only place where dome-grown crops stand a chance in Jupiter's harsh radiation belt, even with heavy shielding on the domes and habitats.

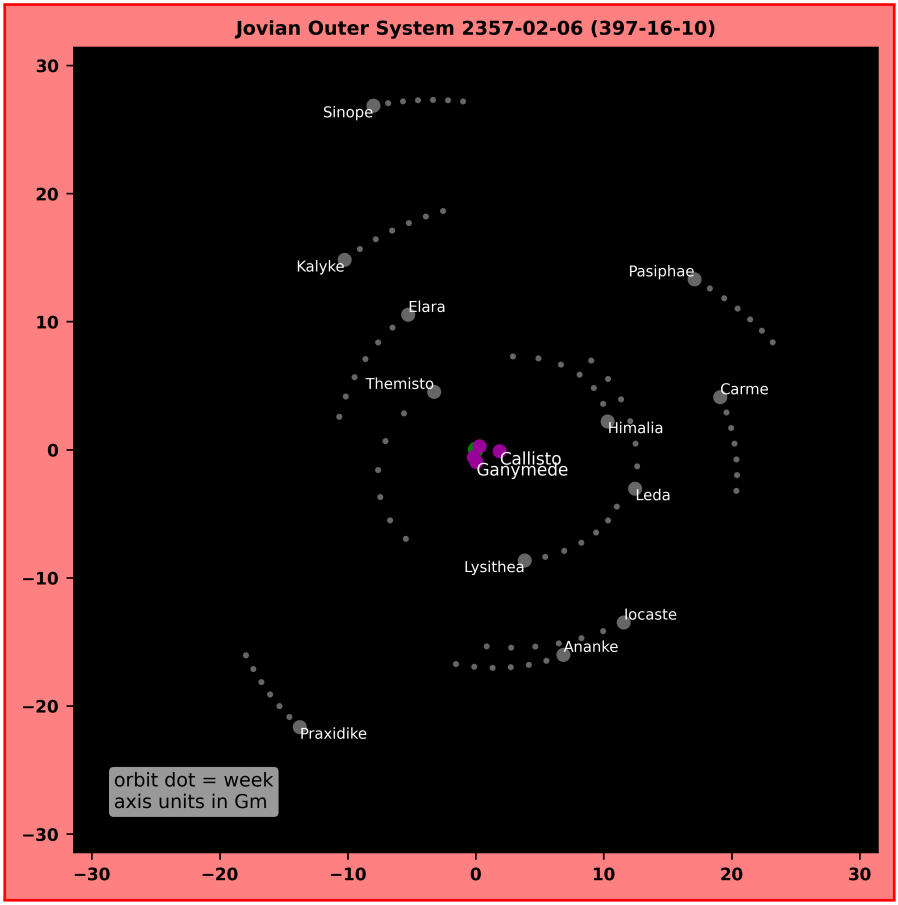
Ganymede is also unique in its intricate system of orbital mirror stations that shine concentrated sunlight down onto the dome greenhouses that produce vegetables, fruits, and even some meat. The moon's ice, on the surface and reaching into the depths of the moon, provides all the water necessary for life.

Callisto Callisto is the second-largest moon of Jupiter and the third-largest in the Sol System. Its orbit requires it to be tidally locked – one side constantly faces Jupiter. This large moon's tectonic stability and significant deposits of rare minerals made it an ideal location for Mars' shipyards, the largest in the Outers. Most of the MCRN's fleet has been built orbiting Callisto, where the shipyards are capable of building hulls up to 700 meters in length.

Callisto is one of the only moons of Jupiter where radioactive minerals are close enough to the surface for easy extraction, however it hasn't created a strong economy. Mining and shipbuilding are the only sources of revenue, and revenue that comes only from Mars.

3.4 Outer Moons

These Jovian outer moons are all too small to support a colony, but they are, or have been, used as scientific and mining outposts. Note that some of them have retrograde orbits: clockwise instead of standard counterclockwise rotation within the Sol System.



Themisto Themisto's orbit is unusual: unlike most of Jupiter's moons, which orbit in distinct groups, Themisto orbits alone. The moon is located midway between the Galilean moons and the first group of prograde irregular moons, called the Himalia group. It is about 9 kilometers in diameter.

Leda Leda is a prograde irregular satellite of Jupiter. It belongs to the Himalia group, five moons orbiting between 11 and 13 Gm from Jupiter at an

inclination of about 28°. Its orbit is continuously changing due to solar and planetary perturbations.

Himalia Himalia is the largest irregular satellite of Jupiter, with a diameter of 140 km. It is the fifth largest Jovian satellite, after the four Galilean moons. Himalia's rotational period is 7 h 47 m. There is an abandoned supply waystation for early mining operations.

Elara Elara is a prograde irregular satellite of Jupiter. It is the eighth-largest moon of Jupiter. It has a mean radius of just 43 kilometres, thus it is 2% of the size of Europa. However, it is half the size of Himalia, so it is the second-biggest moon in the Himalia group. It reflects very little light.

Lysithea Lysithea is a prograde irregular satellite of Jupiter. It belongs to the Himalia group, five moons orbiting between 11 and 13 Gm from Jupiter at an inclination of about 28°. Its orbit is continuously changing due to solar and planetary perturbations.

Iocaste Iocaste is a retrograde irregular satellite of Jupiter. It orbits Jupiter at an average distance of 20.723 million kilometers in 609.427 days, at an inclination of 147° to the ecliptic with an eccentricity of 0.2874. Iocaste belongs to the Ananke group, believed to be the remnants of a break-up of a captured heliocentric asteroid. The satellite is about 5 kilometres in diameter and appears grey.

Praxidike Praxidike is a retrograde irregular satellite of Jupiter. It orbits Jupiter at an average distance of 20,824,000 km in 613.904 days, at an inclination of 144° to the ecliptic, in a retrograde direction and with an eccentricity of 0.1840. Praxidike belongs to the Ananke group, believed to be the remnants of a break-up of a captured heliocentric asteroid. With a diameter of 7 km, Praxidike is the second largest member of the group after Ananke itself.

Ananke Ananke is a retrograde irregular moon of Jupiter. It gives its name to the Ananke group, retrograde irregular moons which orbit Jupiter between 19.3 and 22.7 Gm, at inclinations of roughly 150°. Ananke orbits Jupiter on a high-eccentricity and high-inclination retrograde orbit.

Kalyke Kalyke is a retrograde irregular satellite of Jupiter. Kalyke's albedo is measured at 2.9%, corresponding to a diameter of 6.9 kilometres. It belongs to the Carme group, made up of irregular retrograde moons orbiting Jupiter at a distance ranging between 23 and 24 Gm and at an inclination of about 165°.

Pasiphae Pasiphae is a retrograde irregular satellite of Jupiter. Pasiphae orbits Jupiter on a high eccentricity and high inclination retrograde orbit. It gives

its name to the Pasiphae group, irregular retrograde moons orbiting Jupiter at distances ranging between 22.8 and 24.1 million km, and with inclinations ranging between 144.5° and 158.3°. Pasiphae is also known to be in a secular resonance with Jupiter. With diameter of 60 km Pasiphae is the largest retrograde and third largest irregular satellite after Himalia and Elara.

Carme Carme is a retrograde irregular satellite of Jupiter. It gives its name to the Carme group, made up of irregular retrograde moons orbiting Jupiter at a distance ranging between 23 and 24 Gm and at an inclination of about 165°. Its orbital elements are continuously changing due to solar and planetary perturbations. It has diameter of 47 km.

Sinope Sinope is a retrograde irregular satellite of Jupiter. Sinope orbits Jupiter on a high-eccentricity and high-inclination retrograde orbit. Its orbit is continuously changing due to solar and planetary perturbations. Sinope belongs to the Pasiphae group of retrograde irregular moons. It is also known to be in a secular resonance with Jupiter, similar to Pasiphae.

Distances within the Jovian system are vast, and while the travel times aren't as long as in interplanetary journeys, they are still quite significant.

Jovian Travel Times in Hours (0.3 g) 2357-02-06 (397-16-10)

	Ganym.	Themisto	Leda	Himalia	Elara	Lysithea	Ananke	Pasiphae	Carme	Sinope
Ganym.	0	26.3	36.5	33.9	39.9	35.7	41.7	49.1	45.5	55.1
Themisto	26.3	0	43.1	38.0	35.2	41.6	49.0	49.5	48.5	49.1
Leda	36.5	43.1	0	26.9	49.4	39.0	38.9	42.8	32.2	61.6
Himalia	33.9	38.0	26.9	0	46.5	38.5	44.1	40.0	31.3	56.9
Elara	39.9	35.2	49.4	46.5	0	53.4	56.8	48.8	52.7	43.5
Lysithea	35.7	41.6	39.0	38.5	53.4	0	33.6	55.5	47.8	63.7
Ananke	41.7	49.0	38.9	44.1	56.8	33.6	0	57.8	49.8	69.0
Pasiphae	49.1	49.5	42.8	40.0	48.8	55.5	57.8	0	33.8	55.0
Carme	45.5	48.5	32.2	31.3	52.7	47.8	49.8	33.8	0	60.9
Sinope	55.1	49.1	61.6	56.9	43.5	63.7	69.0	55.0	60.9	0

Jovian Travel Times in Hours (0.5 g) 2357-02-06 (397-16-10)

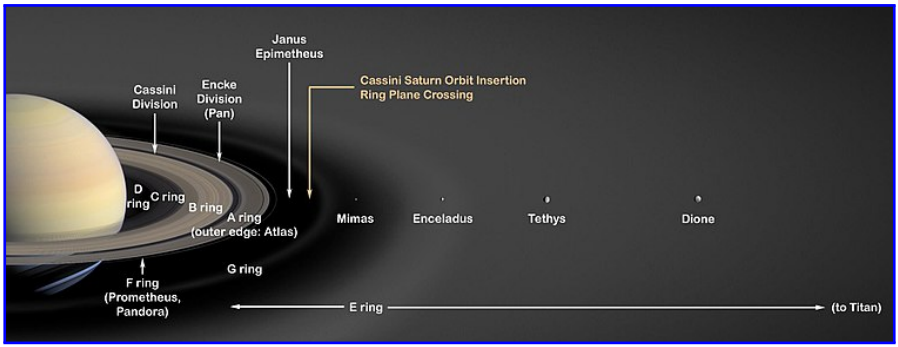
	Ganym.	Themisto	Leda	Himalia	Elara	Lysithea	Ananke	Pasiphae	Carme	Sinope
Ganym.	0	20.4	28.3	26.3	30.9	27.6	32.3	38.0	35.2	42.7
Themisto	20.4	0	33.4	29.4	27.3	32.2	38.0	38.3	37.6	38.1
Leda	28.3	33.4	0	20.9	38.3	30.2	30.2	33.1	24.9	47.8
Himalia	26.3	29.4	20.9	0	36.0	29.8	34.2	31.0	24.2	44.1
Elara	30.9	27.3	38.3	36.0	0	41.3	44.0	37.8	40.8	33.7
Lysithea	27.6	32.2	30.2	29.8	41.3	0	26.0	43.0	37.0	49.3
Ananke	32.3	38.0	30.2	34.2	44.0	26.0	0	44.8	38.5	53.5
Pasiphae	38.0	38.3	33.1	31.0	37.8	43.0	44.8	0	26.2	42.6
Carme	35.2	37.6	24.9	24.2	40.8	37.0	38.5	26.2	0	47.2
Sinope	42.7	38.1	47.8	44.1	33.7	49.3	53.5	42.6	47.2	0

4 Cronian System

Surrounding the second largest gas giant in the Sol System, the Saturnian System has — or had — one large orbiting station functioning as a way point for exploration and resource harvesting inside Saturn's rings, and a few settled moons. Pan, Atlas, Prometheus, Pandora, Epimetheus, Janus, Mimas, Enceladus, Tethys, Telesto, Calypso, Dione, and Helene all exist within the rings of Saturn and are too small to support any long-term habitat. Hyperion has not yet been developed.

4.1 Ring System

The rings of Saturn are the most extensive ring system of any planet in the Sol System. They consist of countless small particles, ranging in size from micrometers to meters, that orbit about Saturn. The ring particles are made almost entirely of water ice, with a trace component of rocky material.



The rings have numerous gaps where particle density drops sharply: two opened by known moons embedded within them, and many others at locations of known destabilizing orbital resonances with the moons of Saturn.

D Ring Very faint innermost ring.

C Ring Wide but faint ring located inward of the B Ring.

B Ring The largest, brightest, and most massive of the rings.

A ring The outermost of the large, bright rings.

F Ring Very thin ring near the outer edge of the A ring.

E Ring Wide ring composed of microscopic particles.

4.2 Inner Moons

Shepherd satellites are small moons that orbit within, or just beyond, a planet's ring system. They have the effect of sculpting the rings: giving them sharp edges, and creating gaps between them. Saturn's shepherd moons are Pan, Daphnis, Atlas, Prometheus and Pandora. These moons together with co-orbitals formed as a result of accretion of the friable ring material on preexisting denser cores. The cores with sizes from one-third to one-half the present-day moons are themselves collisional shards formed when a parental satellite of the rings disintegrated.

Janus and Epimetheus are called co-orbital moons. They are of roughly equal size, with Janus being slightly larger. Janus and Epimetheus have orbits with only a few kilometers difference in semi-major axis, close enough that they would collide if they attempted to pass each other. Instead of colliding, however, their gravitational interaction causes them to swap orbits every four years.

Trojan moons are a unique feature only known from the Saturnian system. A trojan body orbits at either the leading L4 or trailing L5 Lagrange point of a much larger object, such as a large moon or planet. Tethys has two trojan moons, Telesto and Calypso, and Dione also has two, Helene and Polydeuces.

Prometheus Prometheus is extremely elongated, measuring approximately 136 km × 79 km × 59 km. It has several ridges and valleys and a number of impact craters of about 20 km diameter are visible, but it is less cratered than nearby Pandora, Epimetheus, and Janus.

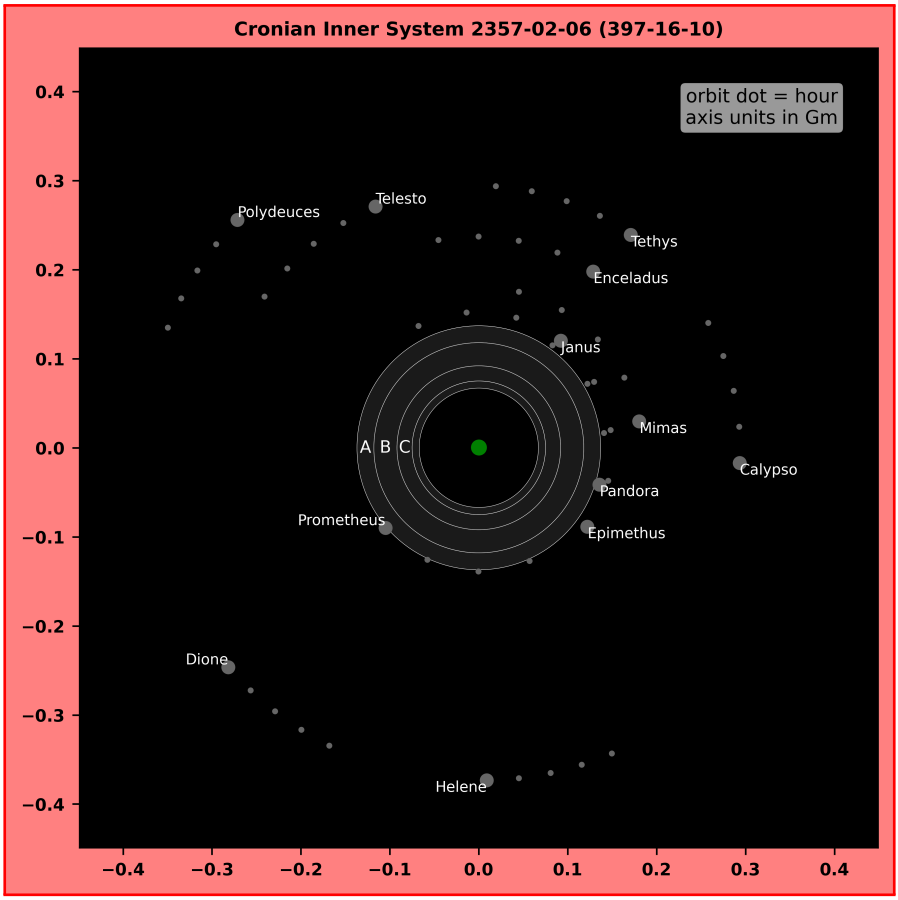
Prometheus is the site of a small mining and ice-processing station.

Pandora Pandora is more heavily cratered than nearby Prometheus, and has at least two large craters 30 kilometres in diameter. The majority of craters on Pandora are shallow as a result of being filled with debris. Ridges and grooves are also present on moon's surface. The orbit of Pandora appears to be chaotic, as a consequence of a series of four 118:121 mean-motion resonances with Prometheus.

Epimethus Epimetheus occupies essentially the same orbit as the moon Janus. There are several Epimethean craters larger than 30 km in diameter, as well as both large and small ridges and grooves. The extensive cratering indicates that Epimetheus must be quite old. Janus and Epimetheus may have formed from a disruption of a single parent to form co-orbital satellites, but if this is the case the disruption must have happened early in the history of the satellite system.

Janus Janus's orbit is co-orbital with that of Epimetheus. Janus is extensively cratered with several craters larger than 30 km, but has few linear features. Janus's surface appears to be older than Prometheus's but younger than Pandora's.

Mimas With a diameter of 396 kilometres, Mimas is the smallest astronomical body that is known to still be rounded in shape because of self-gravitation. The low density indicates that it is composed mostly of water ice with only a small amount of rock. Due to the tidal forces acting on it, Mimas is noticeably prolate; its longest axis is about 10% longer than the shortest. Mimas's most distinctive feature is a giant impact crater 130 km across, named Herschel, with diameter almost a third of Mimas's own diameter. The Mimantean surface is saturated with smaller impact craters, but no others are anywhere near the size of Herschel.



Enceladus Enceladus is about 500 kilometers in diameter. It is mostly covered by fresh, clean ice, making it one of the most reflective bodies of the Sol

System. Geyser observations, along with the finding of escaping internal heat and very few impact craters in the south polar region, show that Enceladus is currently geologically active. Its resonance with Dione excites its orbital eccentricity, which is damped by tidal forces, tidally heating its interior and driving the geological activity. Plumes from Enceladus, which are similar in composition to comets, have been shown to be the source of the material in Saturn's E ring.

Tethys Tethys is a mid-sized moon of Saturn about 1,060 km across. It has the lowest density of all the major moons in the Sol System, indicating that it is made of water ice with just a small fraction of rock. The surface of Tethys is very bright and neutral in color. Tethys is heavily cratered and cut by a number of large faults/graben. The largest impact crater, Odysseus, is about 400 km in diameter, whereas the largest graben, Ithaca Chasma, is more than 2000 km long. Tethys has two small co-orbital moons, **Telesto** and **Calypso** orbiting near Tethys's trojan points L4 and L5 respectively.

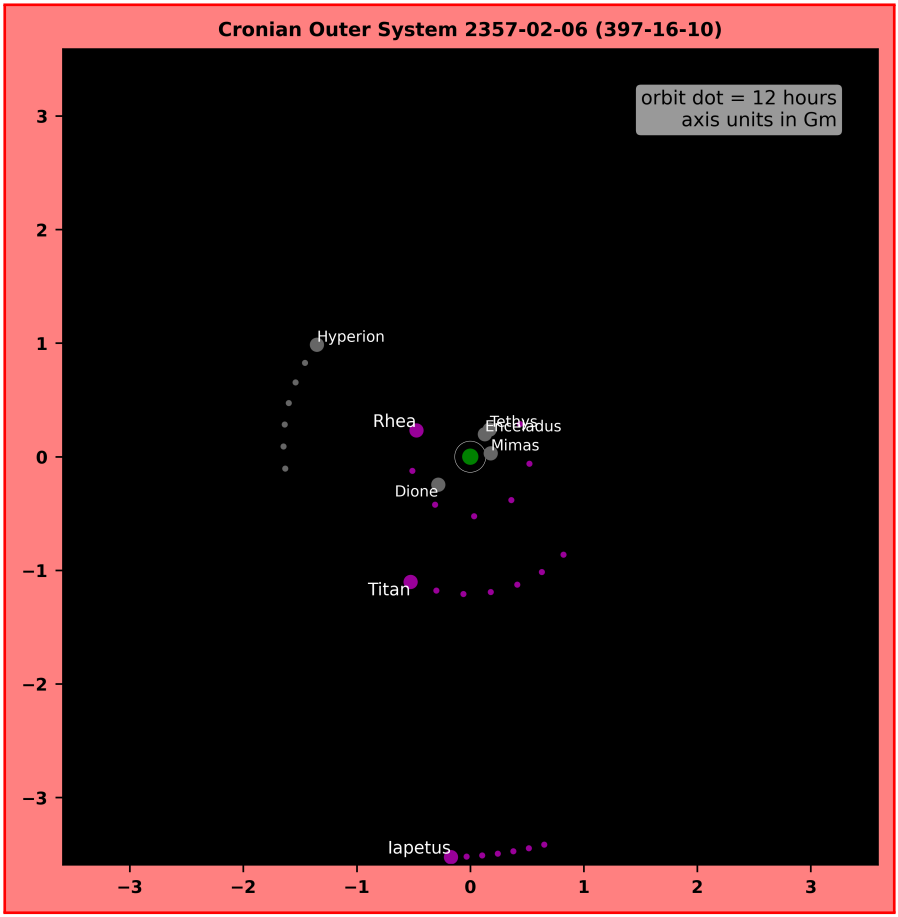
Dione At 1122 km in diameter, Dione is the 15th largest moon in the Sol System. About two thirds of Dione's mass is water ice, and the remaining is a dense core. Dione orbits Saturn with a semimajor axis about 2% less than that of the Moon. However, reflecting Saturn's greater mass, Dione's orbital period is one tenth that of the Moon. Dione is currently in a 1:2 mean-motion orbital resonance with moon Enceladus, completing one orbit of Saturn for every two orbits completed by Enceladus. Dione has two small co-orbital, or trojan, moons, **Helene** and **Polydeuces**. They are located within Dione's Lagrangian points L4 and L5 respectively. Helene is by far the largest trojan moon, while Polydeuces is the smallest and has the most chaotic orbit.

4.3 Outer Moons

These moons all orbit beyond the E Ring. The circle around the Saturn in the outer system map is outer edge of the A ring.

Rhea One of the frontiers of human civilization, Rhea is only just large enough for a colony, and primarily composed of water, ice, and rock. The only thing the moon has to offer the rest of the system is Helium-3 deposits, and some small mineral mining operations. Rhea's several small underground habitats provide all the living space required for its population, mostly comprised of miners and workers in the Helium-3 refineries. Most of their food must be imported from Titan, increasing costs, and mineral and Helium-3 exports do not bring much money into the local economy.

Phoebe In the early days of Phoebe's colonization, the story was that a science station was established there by Mars in collaboration with the Protogen corporation to study early Sol System formation and Oort cloud objects. Study of the moon suggested, from its unique, eccentric, retrograde orbit and unusual albedo, that it might have been a captured comet or Kuiper Belt object. Now, it's nothing more than dust.



Titan The most populous moon in the system has a thick cloud cover that generates strange and beautiful solar wind displays as the moon moves in and out of Saturn's powerful magnetic field. Titan is also the most chemically active body in the Sol System, aside from Earth. Both the atmosphere and icy surface of the moon are filled with organic compounds

not found anywhere else. Easy access to ice suitable for oxygen and water production and a lack of available sunlight have put Titan on the forefront of sunlight-free food production.

Titan is home to more than three dozen dome resorts that offer pampering and exclusive vacations. Each dome is a large resort that occupies a significant amount of space, and due to the environment are all connected by skyways and tunnels.

Teardrop shaped Coulton Station under the Titanian ice used to be a prestige research destination. There were encouraging signs that life might be present, even if it hadn't been captured for study yet. Then the protomolecule changed the game. While the patents they developed have kept the station funded, the interest in their findings has diminished to a handful of fellow academics.

Hyperion Hyperion is Titan's nearest neighbor in the Saturn system. The two moons are locked in a 4:3 mean-motion resonance with each other, meaning that while Titan makes four revolutions around Saturn, Hyperion makes exactly three. With an average diameter of about 270 km, Hyperion is smaller and lighter than Mimas. It has an extremely irregular shape, and a very odd, tan-colored icy surface resembling a sponge. It was the first non-round moon to be discovered.

Iapetus The moon is primarily known for its leading and trailing hemispheres being radically different. The albedo of most of the leading hemisphere is as dark as lampblack, while the trailing hemisphere's albedo is as bright as Europa. The 'dark' side of Iapetus is covered in minerals ready for harvesting right there on the surface. The colonists have built special mechs that make regular runs to sweep the surface for these materials for export and sale off-moon.

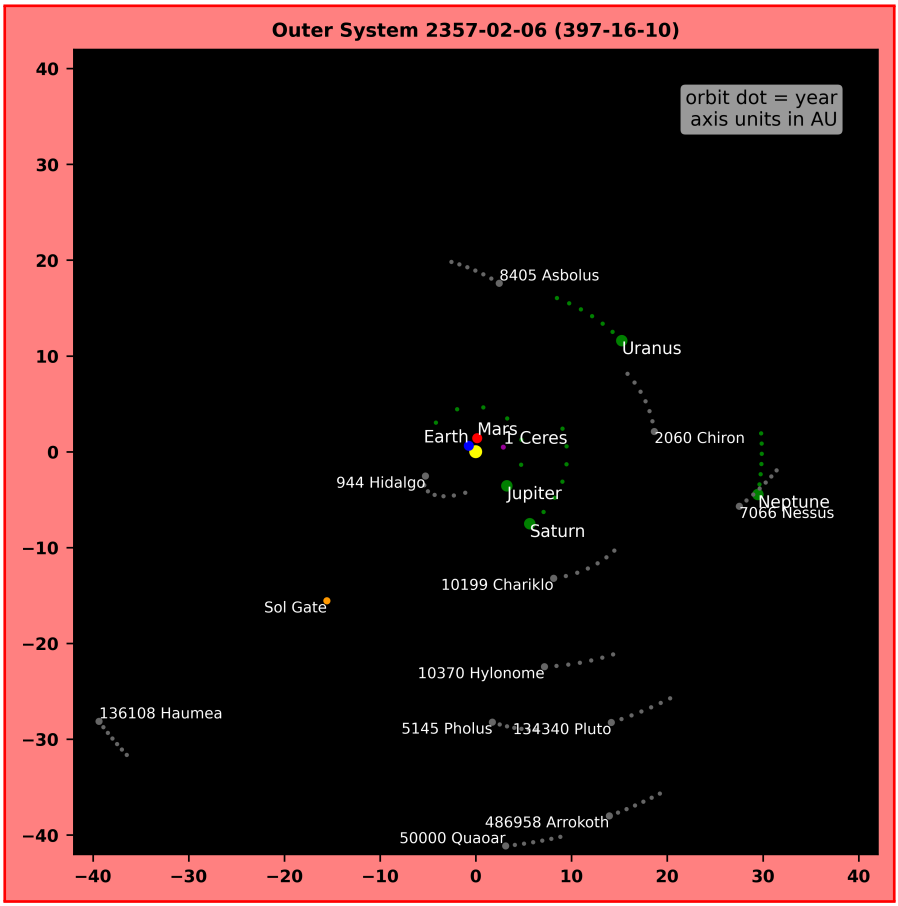
Travel times within the Cronian system are quite short, usually just few hours.

Cronian Travel Times in Hours (0.3 g) 2357-02-06 (397-16-10)

	Prometh.	Janus	Mimas	Encelad.	Tethys	Dione	Rhea	Titan	Hyperion	Iapetus
Prometh.	0	5.5	5.7	6.3	6.7	5.0	7.2	10.7	13.1	19.1
Janus	5.5	0	3.6	3.0	3.9	7.4	7.8	12.0	13.3	19.7
Mimas	5.7	3.6	0	4.3	4.7	7.5	8.5	11.9	13.8	19.5
Encelad.	6.3	3.0	4.3	0	2.5	8.0	8.0	12.4	13.3	19.9
Tethys	6.7	3.9	4.7	2.5	0	8.4	8.2	12.6	13.3	20.0
Dione	5.0	7.4	7.5	8.0	8.4	0	7.4	9.7	13.1	18.7
Rhea	7.2	7.8	8.5	8.0	8.2	7.4	0	11.8	11.0	20.0
Titan	10.7	12.0	11.9	12.4	12.6	9.7	11.8	0	15.4	16.4
Hyperion	13.1	13.3	13.8	13.3	13.3	13.1	11.0	15.4	0	22.2
Iapetus	19.1	19.7	19.5	19.9	20.0	18.7	20.0	16.4	22.2	0

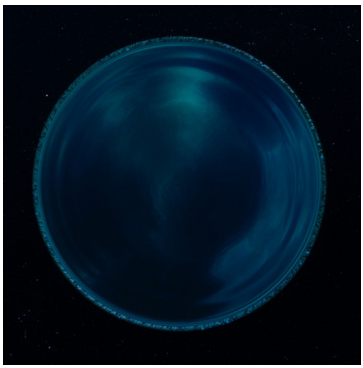
5 Outer System

The outer system map shows positions of notable objects beyond the orbit of Jupiter. These include some centaurs and the nearest Kuiper Belt objects. Earth, Mars and Ceres are included for the reference. Future orbit positions are displayed at one year intervals.



Travel beyond the Saturn orbit used to be quite rare. There is a small colony in the Uranian moon Titania. Neptunian moon Triton has an astronomy lab and mining research station. No human has ever ventured to Kuiper Belt, but several automated probes have charted it.

5.1 The Sol Gate



The Sol Gate, also known as Sol Ring or simply "the Ring", is a ring-shaped megastructure with a rough diameter of 1000 km; it is in a stationary position roughly 2 AU outside the orbit of Uranus. It was created by the protomolecule out of the remnants of Eros Station, having departed Venus after incubating in Eros' impact crater for some time.

The Ring is a wormhole gate, existing as a part of an ancient network built by an alien civilization many billions of years ago. It connects the Sol System to this intragalactic network and to some 1,372 other systems in the galaxy — many of them with habitable planets — thus bringing humanity the newfound abilities of interstellar travel and colonization. The Ring is among the most highly contested structures in the Sol System given its immense strategic and economic potential.

5.2 Centaurs

Centaurs are small solar system bodies with either a perihelion or a semi-major axis between those of the outer planets. They generally have unstable orbits because they cross or have crossed the orbits of one or more of the giant planets; almost all their orbits have dynamic lifetimes of only a few million years. Centaurs typically behave with characteristics of both asteroids and comets.

944 Hidalgo The first member of centaurs ever to be discovered. The dark D-type object has a rotation period of 10.1 hours and an elongated shape with mean diameter of 52 kilometers. Its cometary-like orbit takes it to the inner edge of the Asteroid Belt and as far out as to the orbit of Saturn.

2060 Chiron Although Chiron was initially called an asteroid and classified only as a minor planet, it was later found to exhibit behavior typical of a comet. Now it is classified as both a minor planet and a comet. Chiron's orbit is highly eccentric (0.37), with perihelion just inside the orbit of Saturn and aphelion just outside the perihelion of Uranus. Its diameter is 200 kilometers.

5145 Pholus An eccentric centaur in the outer Sol System, 180 kilometers in diameter, that crosses the orbit of both Saturn and Neptune. The very reddish object has an elongated shape and a rotation period of 9.98 hours. It was the second centaur to be discovered.

7066 Nessus A centaur on an eccentric orbit, located beyond Saturn in the outer Sol System. The dark and reddish minor planet is elongated and measures 60 kilometers in diameter. It has a relatively long orbital half-life of about 4.9 million years.

8405 Asbolus A centaur orbiting in the outer Sol System between the orbits of Jupiter and Neptune. It measures 80 kilometers in diameter and has a fresh impact crater on its surface, less than 10 million years old.

10199 Chariklo The largest centaur with a diameter of 232 km. It orbits the Sun between Saturn and Uranus, grazing the orbit of Uranus. Chariklo has two ice rings (named Oiapoque and Chuí) with radii 396 and 405 km and widths of about 7 km and 3.5 km respectively.

5.3 Kuiper Belt

The Kuiper belt is a circumstellar disc in the outer Sol System, extending from the orbit of Neptune at 30 AU to approximately 50 AU from the Sun. It is similar to the asteroid belt, but is far larger — 20 times as wide and 20 – 200 times as massive. Like the asteroid belt, it consists mainly of small bodies or remnants from when the Sol System formed. While many asteroids are composed primarily of rock and metal, most Kuiper belt objects are composed largely of frozen volatiles, such as methane, ammonia, and water.

50000 Quaoar Quaoar measures approximately 1,110 km in diameter, about the size of Saturn's moon Dione or half the size of Pluto. Signs of water ice on the surface of Quaoar have been found, which suggests that cryovolcanism may be occurring on Quaoar. A small amount of methane is present on its surface, which can only be retained by the largest Kuiper belt objects.

134340 Pluto Pluto is the ninth-largest and tenth-most-massive known object to directly orbit the Sun. It is the largest known trans-Neptunian object by volume, by a small margin, but is slightly less massive than Eris. Like other Kuiper belt objects, Pluto is made primarily of ice and rock and is much smaller than the inner planets. Pluto has only one sixth the mass of Earth's moon, and one third its volume.

136108 Haumea Haumea is the third-largest known trans-Neptunian object, after Eris and Pluto, and approximately the size of Uranus's moon Titania.

486958 Arrokoth Arrokoth is a contact binary 36 km long, composed of two planetesimals 21 and 15 km across, that are joined along their major axes. With an orbital period of about 298 years and a low orbital inclination and eccentricity, Arrokoth is classified as a cold classical Kuiper belt object.

6 Distances

One of the few true constants in the universe remains the speed of light. Whether communications are sent as radio waves or on the laser of a tightbeam, they travel 300,000 kilometers per second. Often a message can be slowed while the receiver waits for redundant copies of lost packets of data to arrive, or for a message to work its way to the top of the queue at a tightbeam relay station and get passed along on the next stage of its journey. Worse, a distance of 15 light minutes between Earth and Ceres doesn't mean it takes 15 minutes to establish a connection: it means it takes 15 minutes for the first part of the message to travel the distance ("How are you?"), then another 15 minutes for the reply to return ("I'm fine, thanks."). Conversations of alternating messages can take hours or days to complete. Because of this, most transmitted conversations are sent as recorded messages rather than attempting a live conversation, unless the light-speed delay is only a few seconds.

System Communication Delays in Minutes 2357-02-06 (397-16-10)

	Earth	Mars	Tycho	Ceres	Pallas	Vesta	Hygiea	Jupiter	Saturn	Ring
Earth	0	10	27	30	36	12	18	50	91	183
Mars	10	0	27	25	37	20	20	52	93	192
Tycho	27	27	0	14	13	39	45	25	66	190
Ceres	30	25	14	0	24	43	45	35	75	203
Pallas	36	37	13	24	0	46	54	20	59	186
Vesta	12	20	39	43	46	0	13	60	100	176
Hygiea	18	20	45	45	54	13	0	69	109	186
Jupiter	50	52	25	35	20	60	69	0	41	186
Saturn	91	93	66	75	59	100	109	41	0	191
Ring	183	192	190	203	186	176	186	186	191	0

Jovian system outer moons are quite far away and communication delays between them are significant.

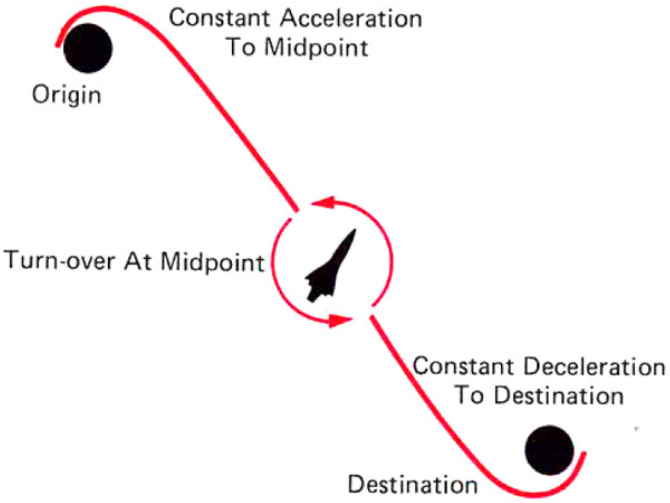
Jovian Communication Delays in Seconds 2357-02-06 (397-16-10)

	Ganym.	Themisto	Leda	Himalia	Elara	Lysithea	Ananke	Pasiphae	Carme	Sinope
Ganym.	0	22	42	37	51	41	55	77	66	97
Themisto	22	0	59	46	39	55	76	78	75	77
Leda	42	59	0	23	78	48	48	58	33	121
Himalia	37	46	23	0	69	47	62	51	31	103
Elara	51	39	78	69	0	91	103	76	88	60
Lysithea	41	55	48	47	91	0	36	98	73	129
Ananke	55	76	48	62	103	36	0	106	79	152
Pasiphae	77	78	58	51	76	98	106	0	36	96
Carme	66	75	33	31	88	73	79	36	0	118
Sinope	97	77	121	103	60	129	152	96	118	0

Delay between Earth and Luna is about 1.3 seconds. Likewise, in Saturn's inner system, delays are always within 2 seconds. Delay between outmost Iapetus and inner Saturn system is less than 15 seconds.

Travel Times

Because the Epstein Drive removed Δv limitations to space travel, ships no longer needed to execute Hohmann transfers to maneuver between bodies. To transfer, ships can simply burn prograde at a constant rate, then flip around and decelerate by burning retrograde. This maneuver is called a Brachistochrone trajectory, from the Greek meaning "shortest time." A course using this maneuver tends to be curved as it uses the sun's gravity to increase the ship's acceleration.



The time it takes to execute a flight path along a Brachistochrone trajectory depends on two factors: the distance between the two points, and the acceleration of the ship. The greater the acceleration, the less time it takes to travel, but the multiple g-forces created by these "hard burns" are extremely stressful on the human body. Crash couches and pharmaceutical cocktails like "the juice" alleviate some, but not all, of the damage inflicted by the hardest burns.

Following tables show the time to travel the average distance between the two locations at an average acceleration of 0.3 g and 0.5 g, presented as total required travel time under acceleration without any of the necessary breaks taken into consideration. The first acceleration of 0.3 g is a belter standard and the second one of 0.5 g is still tolerable.

Note that the actual travel times will be somewhat longer. Spaceport bureaucracy and other travel regulations usually need at least one hour at both ends of the journey.

System Travel Times in Days (0.3 g) 2357-02-06 (397-16-10)

	Earth	Mars	Tycho	Ceres	Pallas	Vesta	Hygiea	Jupiter	Saturn	Ring
Earth	0	5.8	9.4	10.0	10.9	6.4	7.8	12.9	17.3	24.5
Mars	5.8	0	9.4	9.1	10.9	8.1	8.1	13.1	17.5	25.1
Tycho	9.4	9.4	0	6.9	6.6	11.3	12.1	9.1	14.7	24.9
Ceres	10.0	9.1	6.9	0	8.9	11.8	12.1	10.8	15.6	25.8
Pallas	10.9	10.9	6.6	8.9	0	12.3	13.3	8.1	13.9	24.7
Vesta	6.4	8.1	11.3	11.8	12.3	0	6.5	14.1	18.1	24.0
Hygiea	7.8	8.1	12.1	12.1	13.3	6.5	0	15.0	18.9	24.7
Jupiter	12.9	13.1	9.1	10.8	8.1	14.1	15.0	0	11.6	24.7
Saturn	17.3	17.5	14.7	15.6	13.9	18.1	18.9	11.6	0	25.0
Ring	24.5	25.1	24.9	25.8	24.7	24.0	24.7	24.7	25.0	0

System Travel Times in Days (0.5 g) 2357-02-06 (397-16-10)

	Earth	Mars	Tycho	Ceres	Pallas	Vesta	Hygiea	Jupiter	Saturn	Ring
Earth	0	4.5	7.3	7.7	8.4	4.9	6.0	10.0	13.4	18.9
Mars	4.5	0	7.3	7.1	8.5	6.3	6.3	10.1	13.5	19.4
Tycho	7.3	7.3	0	5.3	5.1	8.7	9.4	7.1	11.4	19.3
Ceres	7.7	7.1	5.3	0	6.9	9.2	9.4	8.3	12.1	20.0
Pallas	8.4	8.5	5.1	6.9	0	9.5	10.3	6.3	10.8	19.1
Vesta	4.9	6.3	8.7	9.2	9.5	0	5.0	10.9	14.0	18.6
Hygiea	6.0	6.3	9.4	9.4	10.3	5.0	0	11.6	14.7	19.1
Jupiter	10.0	10.1	7.1	8.3	6.3	10.9	11.6	0	9.0	19.1
Saturn	13.4	13.5	11.4	12.1	10.8	14.0	14.7	9.0	0	19.4
Ring	18.9	19.4	19.3	20.0	19.1	18.6	19.1	19.1	19.4	0

The last table starts and ends the journey with an acceleration boost of 6 g. This requires use of the juice and is usually used only by the navy under exceptional circumstances. The central part of the journey uses 0.5 g acceleration and flip at the middle.

System Travel Times in Days (0.5 g + 6 g x 4h) 2357-02-06 (397-16-10)

	Earth	Mars	Tycho	Ceres	Pallas	Vesta	Hygiea	Jupiter	Saturn	Ring
Earth	0	2.2	4.6	5.0	5.6	2.6	3.5	7.0	10.2	15.7
Mars	2.2	0	4.6	4.4	5.6	3.7	3.7	7.2	10.4	16.2
Tycho	4.6	4.6	0	2.9	2.7	5.9	6.5	4.4	8.4	16.0
Ceres	5.0	4.4	2.9	0	4.2	6.3	6.5	5.5	9.0	16.7
Pallas	5.6	5.6	2.7	4.2	0	6.6	7.3	3.7	7.8	15.8
Vesta	2.6	3.7	5.9	6.3	6.6	0	2.7	7.9	10.9	15.3
Hygiea	3.5	3.7	6.5	6.5	7.3	2.7	0	8.6	11.5	15.8
Jupiter	7.0	7.2	4.4	5.5	3.7	7.9	8.6	0	6.1	15.8
Saturn	10.2	10.4	8.4	9.0	7.8	10.9	11.5	6.1	0	16.1
Ring	15.7	16.2	16.0	16.7	15.8	15.3	15.8	15.8	16.1	0

Index