CCSDS NAVIGATION STANDARDS NORMATIVE ANNEXES

ORBIT CENTERS REGISTRY

**Policy:**  Expert Review

**Authority:**  CCSDS.MOIMS.NAV

**OID:**  1.3.112.4.X.7

**References:**

* [[ccsds-502.0-B-2]](https://public.ccsds.org/Pubs/502x0b2c1.pdf)
* [[ccsds-504.0-B-1]](https://public.ccsds.org/Pubs/504x0b1c1.pdf)
* [[ccsds-508.0-B-1]](https://public.ccsds.org/Pubs/508x0b1e2.pdf)

Values are color-coded as follows:

* blue: orbiters, impactors, and landers
* yellow: flybys (Voyager 2 generated most entries)
* red: proposed missions
* green: Lagrange points (Lissajous, halo, and Lyapunov orbits)

| **Orbit Center** | **JPL SSD Name** | **Example of Orbiting Spacecraft** |
| --- | --- | --- |
| **Sun, Planets, and Associated Dynamical Points** |
| SUN | Sun [Sol] | *STEREO A* and *STEREO B* (NASA), *Kepler* (NASA) |
| SOLAR SYSTEM BARYCENTER | Solar System Barycenter [SSB] | *STEREO A* and *STEREO B* (NASA), *Kepler* (NASA) |
| MERCURY | Mercury | *Mariner 10* (NASA) flyby, *MESSENGER* (NASA) flyby and orbit, *BepiColombo* (ESA/JAXA) planned orbit |
| MERCURY BARYCENTER | Mercury Barycenter | *Mariner 10* (NASA) flyby, *MESSENGER* (NASA) flyby and orbit, *BepiColombo* (ESA/JAXA) planned orbit |
| VENUS | Venus | *Venus Express* (ESA) |
| VENUS BARYCENTER | Venus Barycenter | *Venus Express* (ESA) |
| EARTH | Earth [Geocenter] |  |
| EARTH BARYCENTER | n/a |
| SUN-EARTH L1 | L1 [S-E-M Lagrangian] | *Deep Space Climate Observatory* (NOAA), *SOHO* (ESA) |
| SUN-EARTH L2 | L2 [S-E-M Lagrangian] | *Planck* and *Herschel* (ESA) |
| EARTH-MOON L1 | n/a | none |
| EARTH-MOON L2 | n/a | *Chang'e 5-T1* (CNSA) before lunar orbit |
| MARS | Mars | first flyby *Mariner 4* (NASA), first orbiter *Mars 2* (USSR), first lander *Viking 1* (NASA) |
| MARS BARYCENTER | Mars Barycenter | first flyby *Mariner 4* (NASA), first orbiter *Mars 2* (USSR), first lander *Viking 1* (NASA) |
| JUPITER | Jupiter | orbited by *Galileo* (NASA) and *Juno* (NASA) |
| JUPITER BARYCENTER | Jupiter Barycenter | orbited by *Galileo* (NASA) and *Juno* (NASA) |
| SATURN | Saturn | orbited by *Cassini* (NASA) |
| SATURN BARYCENTER | Saturn Barycenter | orbited by *Cassini* (NASA) |
| URANUS | Uranus | *Voyager 2* (NASA) flyby |
| URANUS BARYCENTER | Uranus Barycenter | *Voyager 2* (NASA) flyby |
| NEPTUNE | Neptune | *Voyager 2* (NASA) flyby |
| NEPTUNE BARYCENTER | Neptune Barycenter | *Voyager 2* (NASA) flyby |
| **Planetary Satellites** |
| MOON | Moon [Luna] | *Lunar Reconnaissance Orbiter* (NASA) |
| PHOBOS | Phobos (MI) | three failed missions + proposed missions |
| DEIMOS | Deimos (MII) | proposed missions |
| IO | Io (JI) | *Voyager 1* & *Voyager 2* (NASA) flyby |
| EUROPA | Europa (JII) | *JUICE* (ESA) and Europa Clipper (NASA) planned flyby; *Voyager 1* & *Voyager 2* (NASA) flyby |
| GANYMEDE | Ganymede (JIII) | *JUICE* (ESA) planned orbit; *Voyager 1* (NASA) flyby |
| CALLISTO | Callisto (JIV) | *JUICE* (ESA) planned flyby; *Voyager 1* (NASA) flyby |
| AMALTHEA | Amalthea (JV) | *Voyager 1* & *Voyager 2* (NASA) flyby |
| MIMAS | Mimas (SI) | *Voyager 1* & *Voyager 2* (NASA) flyby |
| ENCELADUS | Enceladus (SII) | *Cassini* (NASA) flyby ; several proposed missions by ESA/NASA/DLR; *Voyager 1* (NASA) flyby |
| TETHYS | Tethys (SIII) | *Voyager 1* & *Voyager 2* (NASA) flyby |
| DIONE | Dione (SIV) | *Voyager 2* (NASA) flyby |
| RHEA | Rhea (SV) | *Voyager 1/2* (NASA) flyby |
| TITAN | Titan (SVI) | *Huygens* (ESA) lander; *Voyager 1* (NASA) flyby |
| HYPERION | Hyperion (SVII) | *Voyager 1/2* (NASA) flyby |
| IAPETUS | Iapetus (SVIII) | *Voyager 2* (NASA) flyby |
| PHOEBE | Phoebe (SIX) | *Cassini* (NASA) flyby |
| JANUS | Janus (SX) | *Voyager 2* (NASA) flyby |
| EPIMETHEUS | Epimetheus (SXI) | *Voyager 2* (NASA) flyby |
| HELENE | Helene (SXII) | *Voyager 2* (NASA) flyby |
| TELESTO | Telesto (SXIII) | *Voyager 2* (NASA) flyby |
| CALYPSO | Calypso (SXIV) | *Voyager 2* (NASA) flyby |
| ATLAS | Atlas (SXV) | *Voyager 2* (NASA) flyby |
| PANDORA | Pandora (SXVII) | *Voyager 2* (NASA) flyby |
| ARIEL | Ariel (UI) | *Voyager 2* (NASA) flyby |
| UMBRIEL | Umbriel (UII) | *Voyager 2* (NASA) flyby |
| TITANIA | Titania (UIII) | *Voyager 2* (NASA) flyby |
| OBERON | Oberon (UIV) | *Voyager 2* (NASA) flyby |
| MIRANDA | Miranda (UV) | *Voyager 2* (NASA) flyby |
| TRITON | Triton (NI) | *Voyager 2* (NASA) flyby |
| LARISSA | Larissa (NVII) | *Voyager 2* (NASA) flyby |
| PROTEUS | Proteus (NVIII) | *Voyager 2* (NASA) flyby |
| CHARON | Charon (PI) | *New Horizons* (NASA) flyby during Pluto flyby |
| **Minor Planets and Asteroids** |
| PLUTO | Pluto (134340) | *New Horizons* (NASA) flyby |
| PLUTO BARYCENTER | Pluto Barycenter | *New Horizons* (NASA) flyby |
| 1 CERES | 1 Ceres | Orbited by *Dawn* (NASA) |
| 4 VESTA | 4 Vesta | Orbited by *Dawn* (NASA) for 2 months |
| 21 LUTETIA | 21 Lutetia | *Rosetta* (ESA) flyby |
| 243 IDA | 243 Ida | *Galileo* (NASA) flyby |
| 253 MATHILDE | 253 Mathilde | *NEAR Shoemaker* (NASA) flyby |
| 433 EROS | 433 Eros (1898 DQ) | *NEAR Shoemaker* (NASA) flyby, orbit and landing |
| 951 GASPRA | 951 Gaspra (1916 S45) | *Galileo* (NASA) flyby |
| 2867 STEINS | 2867 Steins (1969 VC) | *Rosetta* (ESA) flyby |
| 4179 TOUTATIS | 4179 Toutatis (1989 AC) | *Chang'e 2* (CNSA) flyby |
| 5525 ANNEFRANK | 5535 Annefrank (1942 EM) | *Stardust* (NASA) flyby |
| 9969 BRAILLE | 9969 Braille (1992 KD) | *Deep Space 1* (NASA) attempted flyby |
| 132524 APL | 132524 APL (2002 JF56) | *New Horizons* (NASA) flyby |
| 25143 ITOKAWA | 25143 Itokawa (1998 SF36) | *Hayabusa* (JAXA) landing |
| 16 PSYCHE | 16 Psyche | *Psyche* (NASA) planned orbit (2026) |
| 617 PATROCLUS | 617 Patroclus (1906 VY) | *Lucy* (NASA) planned flyby (2033) |
| 3200 PHAETHON | 3200 Phaethon (1983 TB) | *DESTINY+* (JAXA) planned flyby (2024) |
| 3548 EURYBATES | 3548 Eurybates (1973 SO) | *Lucy* (NASA) planned flyby (2027) |
| 11351 LEUCUS | 11351 Leucus (1997 TS25) | *Lucy* (NASA) planned flyby (2028) |
| 15094 POLYMELE | 15094 Polymele (1999 WB2) | *Lucy* (NASA) planned flyby (2027) |
| 21900 ORUS | 21900 Orus (1999 VQ10) | *Lucy* (NASA) planned flyby (2028) |
| 52246 DONALDJOHANSON | 52246 Donaldjohanson (1981 EQ5) | *Lucy* (NASA) planned flyby (2025) |
| 65803 DIDYMOS | 65803 Didymos (1996 GT) | *AIDA* (ESA) proposed impact |
| 101955 BENNU | 101955 Bennu (1999 RQ36) | *OSIRIS-REx* (NASA) planned sample return (en route) |
| 162173 RYUGU | 162173 Ryugu (1999 JU3) | *Hayabusa 2* (JAXA) planned sample return (en route) |
| 486958 2014 MU69 | 486958 (2014 MU69) | *New Horizons* (NASA) planned flyby |
| **Comets** |
| 21P/GIACOBINI-ZINNER | Comet 21P/Giacobini-Zinner [2013] | *ICE* (NASA) flyby |
| 1P/HALLEY | Comet 1P/Halley | flyby by *Vega 1* (USSR), *Vega 2* (USSR), *Suisei* (JAXA), *Sakigake* (JAXA) and *Giotto* (ESA) |
| 26P/GRIGG-SKJELLRUP | Comet 26P/Grigg-Skjellerup [2014] | *Giotto* (ESA) flyby |
| 19P/BORRELLY | Comet 19P/Borrelly | *Deep Space 1* (NASA) flyby |
| 81P/WILD 2 | Comet 81P/Wild 2 | *Stardust* (NASA) flyby and coma sample return |
| 9P/TEMPEL 1 | Comet 9P/Tempel 1 | *Deep Impact* (NASA) flyby and impactor, *Stardust* (NASA) flyby |
| 103P/HARTLEY 2 | Comet 103P/Hartley 2 [2010] | *EPOXI* (NASA) flyby |
| 67P/CHURYUMOV-GERASIMENKO | Comet 67P/Churyumov-Gerasimenko [2010] | *Rosetta* (ESA) orbit and impact, *Philae* (ESA) lander |