CCSDS NAVIGATION STANDARDS NORMATIVE ANNEXES

ATMOSPHERIC MODEL REGISTRY

**Policy:**  Expert Review

**Authority:**  CCSDS.MOIMS.NAV

**OID:**  1.3.112.4.X.1

**References:**

* [[ccsds-502.0-B-2]](https://public.ccsds.org/Pubs/502x0b2c1.pdf)
* [[ccsds-503.0-B-1]](https://public.ccsds.org/Pubs/503x0b1c1.pdf)
* [[ccsds-504.0-B-1]](https://public.ccsds.org/Pubs/504x0b1c1.pdf)

**Link:** https://sanaregistry.org/r/atmosphere\_models

Note. It’s probably important to point out/differentiate between atmospheric models and “corrections” to atmospheric models (DCA, JB08, HASDM, etc).

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Description and Reference** | **Nomenclature** | **Default Units/Type** |
| USSA-XX | **US Standard Atmosphere:** The U.S. Committee on Extension to the Standard Atmosphere (COESA) has two models. The Standard Atmosphere has been published twice (1962 and 1976) in an attempt to provide a standard reference model. It is an ideal, steady-state model of the Earth’s atmosphere at a latitude of 45N during moderate solar activity. (Vallado (2013:568)  U.S. Standard Atmosphere. 1976. Washington, DC: U.S. Government Printing Office. |  |  |
| MSIS-86 | **Mass Spectrometer Incoherent radar Scatter** (MSIS—Hedin, et al. 1977) models derive from the DTM models. This is the 1986 version. (Vallado (2013:571).  References:  Hedin, A. E., et al. 1977. A Global Thermospheric Model Based on Mass Spectrometer and Incoherent Scatter Data. MSIS-1 and 2, N2 Density and temperature, Composition. Journal of Geophysical Research. Vol. 82: 2139-2156.  Hedin, A. E. 1987. MSIS-86 Thermospheric Model. Journal of Geophysical Research. Vol. 92: 4649-4662.  Picone, J. M., A. E. Hedin, and D. P. Drob. 2002. NRLMSISE-00 empirical model of the atmosphere: Statistical comparisons and scientific issues Journal of Geophysical Research. Vol. 107, No. A12: 1468 |  |  |
| MSIS-90 | **Mass Spectrometer Incoherent radar Scatter** (MSIS—Hedin, et al. 1977) models derive from the DTM models. This is the 1990 version. (Vallado (2013:571).  References:  Hedin, A. E., et al. 1977. A Global Thermospheric Model Based on Mass Spectrometer and Incoherent Scatter Data. MSIS-1 and 2, N2 Density and temperature, Composition. Journal of Geophysical Research. Vol. 82: 2139-2156.  Hedin, A. E. 1987. MSIS-86 Thermospheric Model. Journal of Geophysical Research. Vol. 92: 4649-4662.  Picone, J. M., A. E. Hedin, and D. P. Drob. 2002. NRLMSISE-00 empirical model of the atmosphere: Statistical comparisons and scientific issues Journal of Geophysical Research. Vol. 107, No. A12: 1468 |  |  |
| NRLMSIS00E | **Mass Spectrometer Incoherent radar Scatter** (MSIS—Hedin, et al. 1977) models derive from the DTM models. This is the 2000 version. (Vallado (2013:571).  References:  Hedin, A. E., et al. 1977. A Global Thermospheric Model Based on Mass Spectrometer and Incoherent Scatter Data. MSIS-1 and 2, N2 Density and temperature, Composition. Journal of Geophysical Research. Vol. 82: 2139-2156.  Hedin, A. E. 1987. MSIS-86 Thermospheric Model. Journal of Geophysical Research. Vol. 92: 4649-4662.  Picone, J. M., A. E. Hedin, and D. P. Drob. 2002. NRLMSISE-00 empirical model of the atmosphere: Statistical comparisons and scientific issues Journal of Geophysical Research. Vol. 107, No. A12: 1468 |  |  |
| JXX | **Jacchia** models – 1970, 1971, 1977. Vallado (2013:569)  Jacchia, L. G. 1965. Static Diffusion Models of the Upper Atmosphere with Empirical Temperature Profiles. Smithsonian Contributions to Astrophysics. Vol. 8. pp. 215-257.  Jacchia, L. G. 1970. New Static Models for the Thermosphere and Exosphere with Empirical Temperature Profiles. SAO Special Report No. 313. Cambridge, MA: Smithsonian Institution Astrophysical Observatory.  Jacchia, L. G. 1971. Revised Static Models for the Thermosphere and Exosphere with Empirical Temperature Profiles. SAO Special Report No. 332. Cambridge, MA: Smithsonian Institution Astrophysical Observatory.  Jacchia, L. G. 1977 Thermospheric Temperature, Density, and Composition: New Models. SAO Special Report 375. Cambridge, MA.  Jacchia, L. G. 1981 Empirical Models of the Thermosphere and Requirements for Improvements. Advances in Space Research. Pp 81-86. |  |  |
| JR71 | **Jacchia-Roberts:** In 1971, Roberts analytically evaluated the 1970 Jacchia models. Roberts uses partial fractions to integrate values between 90 km and 125 km. For altitudes above 125 km, he introduces a different asymptotic function than the one Jacchia introduced to achieve an integrable form. With this substitution, Roberts closely approximates Jacchia’s results above 125 km. The Jacchia-Roberts atmosphere contains analytical expressions for determining exospheric temperature as a function of position, time, solar activity, and geomagnetic activity. With a computed temperature, we get density from empirically determined temperature profiles or from the diffusion equation. (Vallado (2013:571)  Roberts, Charles E., Jr. 1971. An Analytic Model for Upper Atmosphere Densities Based upon Jacchia’s 1970 Models. Celestial Mechanics. 4(314): 368-377. |  |  |
| CIRA-XX | **COSPAR International Reference Atmosphere model:** The Committee on Space Research (COSPAR) of the International Council of Scientific Unions periodically determines an atmospheric model. The current version is the COSPAR International Reference Atmosphere (CIRA-90) model. The first model was produced in 1965 (CIRA-65), which was basically a new model for altitudes from 30–300 km, based on Champion (1963) and the Harris-Priester (1962) model from 120–800 km. CIRA-72 included mean values from 25–500 km. The model is a semi-theoretical technique, but it does have some free variables. Data comes mainly from measurements of satellite drag and ground-based measurements. (Vallado(2013:568) |  |  |
| DTM-XX | **DTM** model: The model is based on air-glow temperatures. Barlier uses spherical harmonics to incorporate data on satellite drag from over two complete solar cycles, and significant observational data based on the Thuillier et al. (1977) model of global exospheric temperature. Various releases, 1978, 1194, 2003, 2012, 2013. (Vallado (2013:571)  Barlier, F., et al. 1978. A Thermospheric Model based on Satellite Drag Data. Annales de Geophysics. 34(1): 9-24. |  |  |
| GITM | **General Circulation Models. Global Ionosphere Thermosphere Model (GITM).**  References:  Ridley, A. J., Y. Deng, and G. Toth. 2006. The Global Ionosphere-Thermosphere Model (GITM). Journal of Atmospheric Solar Terrestrial Physics. 68:839-864.  Roble, R. G., and E. C. Ridley, A thermosphere-ionosphere-mesosphere-electrodynamics general circulation model (TIME-GCM): equinox solar cycle minimum simulations (30-500 km), Geophys. Res. Lett., 21, 417-420, 1994. |  |  |
| TIECGM | **Thermosphere Ionosphere Electrodynamic General Circulation Model (TIEGCM)**.  References:  Ridley, A. J., Y. Deng, and G. Toth. 2006. The Global Ionosphere-Thermosphere Model (GITM). Journal of Atmospheric Solar Terrestrial Physics. 68:839-864.  Roble, R. G., and E. C. Ridley, A thermosphere-ionosphere-mesosphere-electrodynamics general circulation model (TIME-GCM): equinox solar cycle minimum simulations (30-500 km), Geophys. Res. Lett., 21, 417-420, 1994. |  |  |
| HP | **Harris/Priester** model: Essentially a static model, includes several tables account for the densities observed in the solar cycle. Interpolation then determines the density at a particular time. Vallado (2013:568)  Harris, I., and W. Priester. 1962. Time-dependent structure of the upper atmosphere. Journal of Atmospheric Science. 19:4. Pg 286-301. |  |  |
| GOST | **GOST density model**: This model (Yurasov, 1999, Voiskovskii, 1973, Volkov, 1984, Jablonski [Boelitz], 1992, and Amelina et al. 1996) is an analytical method to obtain atmospheric density in an aspherical upper atmosphere from observations of Russian Cosmos satellites. The model emerges empirically from observations of the Cosmos satellites’ orbital motion. It includes the dependence of the density on solar flux and geomagnetic activity as well as the diurnal and semi-annual density variations. This model is valid for satellites at altitudes of 120–1500 km. The current version is GOST 25645.166-2004. (Vallado (2013:572).  GOST. 2004. Earth's Upper Atmosphere Density Model for Ballistics Support of Flights of Artificial Earth Satellites. GOST R 25645.166-2004, Moscow, Publishing House of the Standards. (English translation accomplished by Vasiliy S. Yurasov in 2006 and edited by Paul J. Cefola in 2007). |  |  |
| MET-XX | **Marshall Engineering Thermosphere** model: Suggs R. J., and R.M. Suggs. 2017.  Reference:  Marshall Engineering Thermosphere Model, Version MET-2007. NASA Report TM-2017-218238. Marshall Space Flight Center. Huntsville, Alabama. |  |  |
| GRAM-XX | Global Reference Atmospheric Model, 2016 is the latest version. |  |  |
|  | Corrections to models: |  |  |
| JB08 | **Jacchia-Bowman atmosphere model:** AFSPC derived a technique based on Jacchia 1970 called JB08 (Vallado(2013:572).  Reference: Bowman, B. et al. 2006. A New Empirical Thermospheric Density Model JB2006 Using New Solar Indices. Paper AIAA-2006-6166 presented at the AIAA/AAS Astrodynamics Specialist Conference. Keystone, CO. |  |  |
| JAC\_HASDM | **Jacchia atmosphere model with** **High Accuracy Satellite Drag Model corrections:** This is the Jacchia 1970 model with overlayed Dynamic Calibration of the Atmosphere corrections to predicted atmospheric density. The approach yields scientific information about the variations in the density and the statistics of these variations. The work was  pioneered by Nazarenko (DCA) in the early 1980’s (Gorochov and Nazarenko, 1982) and researched by Draper Laboratory (many documents including Cefola and Nazarenko, 1999, Granholm, 2000, Bergstrom, 2002, Yurasov et al. 2005, and Wilkins et al. 2006).  Reference:  Gorochov, Y. P. and Nazarenko, A. I. 1982. Methodical Points in Building Models of the Fluctuation of the Atmosphere Parameters. Astronomicheskii Sovet Akademii Nauk SSSR, Vol. 80. A copy was obtained by the MIT Lincoln Laboratory Library in January 2004 from the CISTI Document Delivery Service and translated by MIT Aeronautics and Astronautics Department graduate student Kalina Galabova in February 2004. |  |  |

GRAVITY MODEL REGISTRY

**Policy:**  Expert Review

**Authority:**  CCSDS.MOIMS.NAV

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**References:**

* [[ccsds-502.0-B-2]](https://public.ccsds.org/Pubs/502x0b2c1.pdf)
* [[ccsds-503.0-B-1]](https://public.ccsds.org/Pubs/503x0b1c1.pdf)
* [[ccsds-504.0-B-1]](https://public.ccsds.org/Pubs/504x0b1c1.pdf)

**Link:** https://sanaregistry.org/r/gravity\_models

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| **Name** | **Description and Reference** | **Nomenclature** | **Default Units/Type** |
| WGS-84 | The World Geodetic survey was a US Defense Department effort to provide a consistent gravity field for use in determination of orbits, etc. Major release in 1984 (180x180). Others include 1960, 1966, 1972.  Defense Mapping Agency. 1987. Department of Defense World Geodetic System 1984 DMA. DMA-TR 8350.2. Washington, DC: Headquarters, Defense Mapping Agency. | World Geodetic Survey |  |
| GGM-01 | Since 2002, the Grace satellites have provided significant measurements of the Earth’s gravity filed using twin spacecraft in low Earth orbit. The gravity fields are derived solely from satellite measurements (Grace ½ and follow-on 1/2).  B. D. Tapley, S. Bettadpur, M. M. Watkins and Ch. Reigber. 2004. The Gravity Recovery and Climate Experiment: Mission Overview and Early Results. Geophysical Research Letters. 31, L09607. | Grace Gravity Model |  |
|  |  |  |  |
| JGM-X | Releases 2 and 3 (both 70x70). Represents collaboration between NASA/Goddard and the University of Texas at Austin (Nerem et al. 1994). The JGM models updated NASA’s *Goddard Earth Model* (GEM-T3) and have improvements using *International Earth Rotation Service* (IERS) constants, analysis of long-wavelength data, and TOPEX altimetry data. (Vallado 2013:601).  Nerem, R. S. et al. 1994. Gravity Model Developments for TOPEX / POSEIDON: Joint Gravity Models 1 and 2. Journal of Geophysical Research. 99 (C12): 24,421-24,447. | Joint Gravity Model |  |
| EGM-XX | Major releases in 1996 (360x360) and 2008 (2190x0).  Lemoine, F. G., et al. 1998. The Development of the Joint NASA GSFC and the National Imagery and Mapping Agency (NIMA) Geopotential Model EGM96. NASA Technical Report TP-1998-206861. July 1998.  Pavlis, Nikolaos K., Simon Holmes, Steve Kenyon, and John Factor. 2012. The development and evaluation of the Earth Gravitational Model 2008 (EGM2008). Journal of Geophysical Research. 117:B4. | Earth Gravity Model |  |
| GEM-XX | Many models created from Satellite tracking data by NASA. GEM-T1 was released in 1987. Others include GEM-T2, GEM-T3, and the original series GEM-1 to GEM-10.  Marsh, J. G., et al. 1989. The GEM-T2 Gravitational Model. NASA Technical Memorandum TM-100746. | Goddard Earth Model |  |
| TEG-4 |  | TEG-4 |  |
| GRIM-5 |  | GRIM-5 |  |

OBJECT TYPE REGISTRY

**Policy:**  Expert Review

**Authority:**  CCSDS.MOIMS.NAV

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* [[ccsds-504.0-B-1]](https://public.ccsds.org/Pubs/504x0b1c1.pdf)

**Link:** https://sanaregistry.org/r/orbital\_covariance\_matrix\_types

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| --- | --- | --- | --- |
| **Name** | **Description and Reference** | **Nomenclature** | **Default Units/Type** |
| PAYLOAD | A payload, which is a space object that is designed to perform specific function in space excluding launch functionality. This includes operational satellites as well as calibration objects.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |
| PAYLOAD MISSION RELATED OBJECT | A payload mission-related object, which is a space object that is released as space debris, which served a purpose for the function of a payload. Common examples include covers for optical instruments or astronaut tools.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |
| PAYLOAD FRAGMENTATION DEBRIS | A payload fragmentation debris, which is a space object that is fragmented or unintentionally released from a payload as space debris for which their genesis can be traced back to a unique event. This class includes objects created when a payload explodes or when it collides with another object.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |
| PAYLOAD DEBRIS | Payload debris, which is a space object that is fragmented or unintentionally released from a payload as space debris for which the genesis is unclear but orbital or physical properties enable a correlation with a source.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |
| ROCKET BODY | Rocket body, which is a space object that is designed to perform launch related functionality. This includes the various orbital stages of launch vehicles, but not payloads that release smaller payloads themselves.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |
| ROCKET MISSION RELATED OBJECT | Rocket mission related object, which is a space object that is intentionally released as space debris that served a purpose for the function of a rocket body. Common examples include shrouds and engines.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |
| ROCKET FRAGMENTATION DEBRIS | Rocket fragmentation debris, which is a space object that is fragmented or unintentionally released from a rocket body as space debris for which their genesis can be traced back to a unique event. This class includes objects created when a launch vehicle explodes.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |
| ROCKET DEBRIS | Rocket debris, which is a space object that is fragmented or unintentionally released from a rocket body as space debris for which the genesis is unclear but orbital or physical properties enable a correlation with a source.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |
| UNINDENTIFIED | Unidentified, where a space object cannot be traced back to a launch, its nature cannot be determined, or it is intentionally unspecified by the message creator.  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (pp. 5-6) |  |  |

SPACE OBJECT OPERATIONAL STATUS REGISTRY

**Policy:**  Expert Review

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* [[ccsds-504.0-B-1]](https://public.ccsds.org/Pubs/504x0b1c1.pdf)

**Link:** <https://sanaregistry.org/r/operational>\_status

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| --- | --- | --- | --- |
| **Name** | **Description and Reference** | **Nomenclature** | **Default Units/Type** |
| OPERATIONAL | An operational spacecraft.. |  |  |
| NONOPERATIONAL | A non-operational spacecraft or debris. |  |  |
| DEGRADED OPERATIONS | A spacecraft whose operations is substantively degraded. |  |  |
| BACKUP STORAGE STANDBY | A spacecraft that is in backup, storage or standby mode. |  |  |
| EXTENDED MISSION | An operational spacecraft whose mission phase has been continued past the planned end-of-mission schedule. |  |  |
| REENTRY MODE | A space object that is below 150 km or will reenter within several orbital revolutions. |  |  |
| DECAYED | A space object whose orbit has now decaysed. |  |  |
| UNKNOWN | A space object whose status is unknown. |  |  |

ORBIT AVERAGING TECHNIQUES REGISTRY

**Policy:**  Expert Review

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* [[ccsds-503.0-B-1]](https://public.ccsds.org/Pubs/503x0b1c1.pdf)
* [[ccsds-504.0-B-1]](https://public.ccsds.org/Pubs/504x0b1c1.pdf)

**Link:** <https://sanaregistry.org/r/orbit_averaging>

Hmmh.

There are two things that apply – what is actually averaged, and the method of the averaging.

1. What is averaged?
   1. ***Single-averaged*** elements result from removing the high-frequency short-periodic motions.
   2. ***Double-averaging*** removes the long-periodic and short-periodic variations to find a mean motion.
2. Type of averaging:
   1. Von Zeipel approach
   2. Classical averaging theory
   3. Lie Averaging
   4. Genralized Method of Averaging
   5. Other

*Every* analytical and semianalytical technique has a different specifc result for each of these averaging approaches.

So the list that’s below is really just a subset of the techniques that you could apply averaging “to”.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Description and Reference** | **Nomenclature** | **Default Units/Type** |
| OSCULATING | … |  |  |
| BROUWER |  |  |  |
| KOZAI |  |  |  |
| Kwok |  |  |  |
| J2 |  |  |  |
| STELA  OREKIT/DSST |  |  |  |
|  |  |  |  |

ORBIT TYPE REGISTRY

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* [[ccsds-503.0-B-1]](https://public.ccsds.org/Pubs/503x0b1c1.pdf)
* [[ccsds-504.0-B-1]](https://public.ccsds.org/Pubs/504x0b1c1.pdf)

**Link:** <https://sanaregistry.org/r/o>rbit\_types

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Description and Reference** | **Nomenclature** | **Default Units/Type** |
| EGO | Extended Geosynchronous Orbit, 37948 < a < 46380 km, e < 0.25, i < 25°  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| ESO | Escape Orbits  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| GHO | GEO-superGEO, Crossing Orbits 31570 < hp < 40002 km, 40002 km < ha  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| GEO | Geosynchronous Earth Orbit, with i > 3°, 35586 < hp < 35986 km, 35586 < ha < 35986 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| GSO | GeoStationary Orbit, with i < 3°, 35586 < hp < 35986 km, 35586 < ha < 35986 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| GTO | Geosynchronous Transfer Orbit, i < 90°, hp < 2000 km, 31570 < ha < 40002 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| HAO | High Altitude Earth Orbit, 40002 km < hp, 40002 km < ha  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| HELIOCENTRIC | Heliocentric orbit |  |  |
| HEO | Highly Eccentric Earth Orbit, hp < 31570 km and ha > 40002 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| IGO | Inclined Geosynchronous Orbit, 37948 < a < 46380 km, e < 0.25, 25° < i < 180°  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| INTERPLANETARY | Interplanetary trajectory |  |  |
| L<N> | Lagrange point, where L<N> is selected from one of the following five options (L1, L2, L3, L4, L5) |  |  |
| LEO | Low Earth Orbit, hp < 2000 km, ha < 2000 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| LMO | LEO-MEO Crossing Orbits, hp < 2000 km, 2000 < ha < 31570 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| LUNAR | Moon orbit |  |  |
| MEO | Medium Earth Orbit, 2000 < hp < 31570 km, 2000 < ha < 31570 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| MGO | MEO-GEO Crossing Orbits, 2000 < hp < 31570 km, 31570 < ha < 40002 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| NSO | Navigation Satellites Orbit 50° < i < 70°, 18100 < hp < 24300 km, 18100 < ha < 24300 km  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |
| OTHER | Orbit type not captured by any other category provided here |  |  |
| UFO | Undefined Orbit  *ESA's Annual Space Environment Report*. GEN-DB-LOG-00271-OPS-SD. Issue 3. Revision 2. Darmstadt, July 2019 (p. 6) |  |  |

CCSDS NAVIGATION STANDARDS NORMATIVE ANNEXES

OBJECT CATALOGUE REGISTRY

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**Link:** https://sanaregistry.org/r/atmosphere\_models

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| --- | --- | --- | --- |
| **Name** | **Description and Reference** | **Nomenclature** | **Default Units/Type** |
| SATCAT | Space object catalog maintained by the 18th Space Control Squadron of the United States Air Force. Data from this catalog may be obtained through an SSA Data Sharing Agreement with U.S. Strategic Command. |  |  |
| RFSA | Space object catalog maintained by the Russian Federation Space Agency |  |  |
| ISON | Space object catalog managed by the International Scientific Optical Network (ISON) for Roscosmos (the Russian space agency) |  |  |
| VYMPEL | Space object catalog managed by the International Scientific Optical Network (ISON) for the Vympel Corporation |  |  |
| COMSPOC | Space object catalog maintained by the Commercial Space Operations Center (ComSpOC), a division of Analytical Graphics, Inc. |  |  |
| LEOLABS | Space object catalog maintained by the LeoLabs, Inc. |  |  |
| OTHER | The space catalog is either from another source, or this field is not applicable to the current message. |  |  |
| DISCOS | Research catalog maintained by the European Space Agency |  |  |