CCSDS NAVIGATION STANDARDS NORMATIVE ANNEXES

TIME SYSTEMS REGISTRY

**Policy:**  Expert Review

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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)

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| **Name** | **Description and Reference** | **Nomenclature** | **Default Units/Type** |
| BEIDOU | BeiDou Time (BDT) is a continuous time scale starting at 0h UTC on January 1st, 2006 and is synchronized with UTC within 100 ns< (modulo one second). |  |  |
| ET | Ephemeris Time, (ET), the first dynamical time scale in history; it was defined by the International Astronomical Union in the 1950s and was superseded by Barycentric Dynamical Time in 1984. (See dynamical time.) |  |  |
| GALILEO | Galileo System Time (GST) is a continuous time scale maintained by the Galileo Central Segment and synchronized with TAI with a nominal offset below 50 ns. The GST start epoch is 0h UTC on Sunday, 22 August 1999 (midnight between 21 and 22 August). |  |  |
| GLONASS | GLONASS Time (GLONASST) is generated by the GLONASS Central Synchronizer and the difference between the UTC(SU) and GLONASST should not exceed 1 millisecond plus three hours [http://www.navipedia.net/index.php/Time\_References\_in\_GNSS - cite\_note-2](http://www.navipedia.net/index.php/Time_References_in_GNSS#cite_note-2) (the difference between Moscow Time and Greenwich Mean Time (GMT)), but http://www.navipedia.net/images/math/8/1/a/81a69207104f00baaabd6f84cafd15a0.png is typically better than 1 microsecond. Note: Unlike GPS, Galileo or BeiDou, GLONASS time scale implements leap seconds, like UTC. |  |  |
| GPS | Global Positioning System Time (GPS) is the continuous time scale for all GPS operations. It is maintained to be within one microsecond of UTC (Modulo one second). GPS time lags TAI by nineteen (19) seconds, i.e., GPS Time = TAI - 19 s. |  |  |
| NAVIC | NAVIC (Navigation with Indian Constellation) is an autonomous regional [satellite navigation](https://en.wikipedia.org/wiki/Satellite_navigation) system in the Indian Regional Navigation Satellite System (IRNSS) that will provide accurate real-time positioning and timing services. The system is expected to be fully operational in 2018. |  |  |
| SCLK | Spacecraft Clock (receiver) (requires rules for interpretation in ICD) |  |  |
| TAI | International Atomic Time (TAI) is the practical realization of a uniform time scale based on atomic clocks and agrees with TT, except for a constant offset of 32.184s and the imperfections of existing clocks. The following relationships to other timescales are: TAI = TT - 32.184s  TAI = UTC + #leap\_seconds  TAI provides a physical time scale affected by the Earth's gravitational and rotational potential, and deduced from a weighted average of various international frequency standards. Relative weighting is based on the historical stability of the individual standards. TAI is maintained by the Bureau International des Poids et Mesures (BIPM) and is the basis of other time scales. |  |  |
| TCB | Barycentric Coordinate Time (TCB), where TCB is related to TT through a complex sequence of relativistic transformations. TCB - TDB ≈ 0.489seconds/year \* (year-1977.0) Note: TCB is intended to be the time scale for ephemerides in the solar system. |  |  |
| TCG | Geocentric Coordinate Time is defined in the context of the [general theory of relativity](https://en.wikipedia.org/wiki/General_relativity). It is defined by a 1991 IAU resolution. |  |  |
| TDB | Barycentric Dynamical Time (TDB) is intended to serve as the independent argument of Barycentric ephemerides and equations of motion. It is defined as being linearly related to Barycentric Coordinate Time (TCB) The linear relationship between TDB and TCB is chosen such that the rate of TDB closely matches TT for the time span covered by the JPL Development Ephemerides. TDB is sometimes designated as Barycentric Ephemeris Time (Teph) when used as the time scale of the JPL ephemerides. |  |  |
| TT | Terrestrial Time (TT) is a theoretically ideal time at the Earth geoid. A practical realization is TT = TAI + 32.184 s. TT has also been known as Terrestrial Dynamical Time (TDT) when considered as a coordinate time for geocentric orbits. TT is the successor of pre-relativistic Ephemeris Time (ET). |  |  |
| UT1 | Universal Time (UT1) is the angular measure of Earth rotation inferred from observations. UT1 is the Earth-rotation angle determined by VLBI of selected radio point sources and interpolated by tracking of GPS satellites. UT1 provides a sequentially increasing continuum that is everlasting and widely apparent, and serves as the astronomical basis of civil time of day. The angular rate of modern-day UT1 has been defined to closely follow Newcomb's convention for mean solar time, based on the mean motion of the Sun reduced from 19th-century observations. |  |  |
| UTC | Coordinated Universal Time (UTC) is a broadcast time standard providing both astronomical time of day and atomic-time interval. UTC is kept within +/-0.9 s of UT1 by the introduction of leap seconds and is therefore a legally recognized proxy for Universal Time in most countries. UTC is always offset from TAI by an integer number of seconds, and is thus a carrier of precision frequency and time interval for broadcast standards based on the SI second. Note: Zulu time is synonymous with UTC. |  |  |