



# TraCSS-SPEC-003: TraCSS Satellite Catalog (TraCSS Cat) Specification

## 1. Introduction

This specification documents the standard structure, semantics, and data governance policies for the TraCSS Satellite Catalog (TraCSS Cat). This catalog integrates data from multiple sources-including the Department of Defense (DoD), NASA-derived estimates, and information voluntarily submitted by spacecraft owner/operators (O/Os) and national governments.

TraCSS Cat is intended to support global spaceflight safety, transparency, and coordination by ensuring that accurate, standardized, and interoperable satellite data is available to a broad set of users under an open data paradigm, subject to applicable restrictions and licensing. The TraCSS Cat contains useful information about satellites that spacecraft operators can use to improve their situational awareness. Many of the fields in the TraCSS Cat are used by the TraCSS system as part of the conjunction analysis process. Because of this, it is highly encouraged that TraCSS users submit accurate information about their satellites and submit updates when there are significant changes. Each of the necessary parameters have redundant backup sources of data through the DoD, or NASA, but spacecraft operators often have the most accurate information about their own satellites. One of the most important parameters coming out of the TraCSS system is the probability of collision parameter from the Conjunction Data Messages (CDMs). This calculation is sensitive to hard body radius (HBR), so spacecraft operators who submit accurate HBR and other parameters into the system can make a positive impact on spaceflight safety.

## 2. Purpose

This specification establishes the canonical data format and element definitions used in the TraCSS Cat. It outlines:

- The meaning and source of each data field,
- Default data governance (including edit permissions and redactions),
- Licensing and dissemination policies, and
- Expectations for data contributions by TraCSS registered users.

## 3. Data Format Overview

Each record in the TraCSS Cat represents a distinct space object. Records are published in a structured format (JSON) and contain metadata that allows traceability of

source and edit permissions.

Each field is associated with a source authority, redaction policy, and edit workflow, which are detailed in the corresponding data dictionary (Section 6).

## 4. Data Governance and Licensing

Per the TraCSS Data Policy (March 2025), most TraCSS Cat data is released under the [Creative Commons 0 Public Domain Dedication \(CC0 1.0\)](#). This includes:

- Satellite name and identification,
- Orbit parameters,
- Launch and licensing metadata,
- Functional and regulatory attributes.

Registered users are required to keep their satellite information current and are responsible for validating accuracy. All spacecraft attribute data submitted to TraCSS is considered open data unless explicitly designated otherwise.

## 5. Data Update and Validation Workflow

- **DoD/Automated Sources:** TraCSS Cat auto-ingests data from DoD and NASA. This data is updated regularly and changes must be coordinated with the TraCSS Operations Team.
- **O/O Contributions:** Satellite operators must submit and update spacecraft attribute data, including planned and actual orbit details, licensing information, and functional metadata.
- **Validation:** All submissions are subject to TraCSS internal validation checks. Edits to sensitive or foundational identifiers (e.g., NORAD ID) require approval from the TraCSS Operations Team.

**Note:** There are two endpoints for updating TraCSS Cat. Additionally, it's possible to update TraCSS Cat with OCMs.

## 6. Data Dictionary

A comprehensive data dictionary is included in the next section (to follow). Each entry includes:

- Field Name
- Description
- Unit of Measurement
- Value Range /Allowed Values
- Default Source
- Alternative Source(s)
- Edit/Update Authority
- Edit/Update Method

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updatable by O/O	Update Method
<b>Satellite Name</b>	The common name of the satellite, often used in public and operational contexts.	Text	satelliteName	Free-form string (e.g., "GPS IIR-1")	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Alternate name(s)</b>	Any alternate names used to refer to the satellite, for example the foreign name of a satellite	Text	alternateName	Free-form strings (e.g., "COSPAR 2021-032A")	O/O	N/A	Yes	Presentation Layer / API
<b>NORAD ID</b>	NORAD (North American Aerospace Defense Command) identifier for tracking space objects. If a NORAD ID has not yet been assigned, TraCSS will assign a temporary ID.	Integer	noradId	5-digit number (e.g., 25544 for ISS)	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>International designator</b>	The International Designator for the object in a YYYY-NNNP{PP}, where: YYYY = Year of launch. NNN = Three-digit serial number of launch in year YYYY (with leading zeros). P{PP} = At least one capital letter for the identification of the part brought into space by the launch.	Text	internationalDesignator	YYYY-NNN# format (e.g., "2021-032A")	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Owner/ operator organization</b>	Automatically populated when satellite is added by an organizational user.	Text	organization	Free-form strings (e.g. "SpaceX")	O/O	N/A	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updatable by O/O	Update Method
<b>Country of launch license</b>	Country that licensed the satellite launch	Text	countryOfLaunchLicense	ISO 3166 standard Alpha-2: Two-letter codes (e.g., US for the United States).	O/O	National Government (only through Ops Team)	No (O/O change requires Ops Team)	N/A
<b>Country of Headquarters</b>	Country of the headquarters of the satellite owner	Text	countryOfHeadquarters	ISO 3166 standard Alpha-2: Two-letter codes (e.g., US for the United States).	O/O	National Government (only through Ops Team)	No (O/O change requires Ops Team)	N/A
<b>Country providing communications license</b>	Country that licensed the satellite to operate (communications)	Text	countryProvidingCommunicationLicense	ISO 3166 standard Alpha-2: Two-letter codes (e.g., US for the United States).	O/O	National Government (only through Ops Team)	No (O/O change requires Ops Team)	N/A
<b>Country provide remote sensing/novel activities license</b>	Country that licensed the satellite for remote sensing (or novel activities) [If applicable]	Text	countryProvidingRemoteSensing	ISO 3166 standard Alpha-2: Two-letter codes (e.g., US for the United States).	O/O	National Government (only through Ops Team)	No (O/O change requires Ops Team)	N/A
<b>Country of UN Registry</b>	Country that registered the spacecraft with the United Nations [If known / available]	Text	countryOfUNRegistry	ISO 3166 standard Alpha-2: Two-letter codes (e.g., US for the United States).	O/O	National Government (only through Ops Team)	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updateable by O/O	Update Method
<b>Countries of Affiliation</b>	The information defaults to DoD SatCat. If any of the other 5 Country fields are populated, then the set of all countries will appear here in comma separated form. This shows which countries can see the satellite data	Text	countriesOfAffiliation	Comma delimited two-letter country codes (e.g. "US, FR" for United States and France)	DoD	O/O	No (O/O change requires Ops Team)	N/A
<b>Constellation</b>	Constellation as recognized by individual owner/operators.	Text	constellation	Predefined names (e.g., "Starlink", "Iridium")	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Launch Provider</b>	Name of the organization providing the launch	Text	launchProvider	Organization names (e.g., "SpaceX", "Roscosmos")	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Launch Vehicle</b>	Name of the vehicle providing the launch	Text	launchVehicle	Rocket names (e.g., "Falcon 9", "Soyuz-2.1b")	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Launch Location</b>	The launch site from where the satellite was deployed. Spaceport used for launch, including spaceport name and country. TraCSS satellite file is validated against the <a href="#">UN global launch locations</a> and expected to be an exact match (excluding commas) or "OTHER".	Text	launchLocation	Spaceport names (e.g., "Cape Canaveral", "Baikonur")	O/O	DoD	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Update by O/O	Update Method
<b>Launch Date</b>	The launch date and details of the satellite or object. If not yet launched, the current schedule or best estimate. After launch, the date will be updated to reflect the actual launch date.	UTC datetime	launchDate	ISO 8601 format (e.g., "2025-04-09T03:32:52Z")	O/O	DoD	No (O/O change requires Ops Team)	N/A
<b>Deployment date</b>	If the deployment date is different than the launch date, the deployment date should be given. If not yet deployed, provide the current schedule or best estimate. After deployment, the date should be updated to reflect the actual deployment date.	UTC datetime	deploymentDate	ISO 8601 format	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Additional Deployments</b>	Whether there will be additional deployments from the satellite.	Text	additionalDeployments	Yes/No	O/O	N/A	Yes	Presentation Layer / API
<b>Additional Deployments Information</b>	If there was or there will be additional deployments from the satellite additional information can also be provided explaining the narrative.	Text	additionalDeploymentsInformation	Free-form text	O/O	N/A	Yes	Presentation Layer / API
<b>Launch Name</b>	If part of a rideshare, use the rideshare name. For all others, use the primary payload name and/or name of the launch, if any.	Text	launchName	Mission identifiers (e.g., "Transporter-5")	O/O	N/A	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updatable by O/O	Update Method
<b>General Function</b>	The general function of the spacecraft provided by O/O	Text	generalFunction	Categories (“spacecraft engaged in investigation of spaceflight techniques and technology”, “spacecraft engaged in research and exploration of the upper atmosphere or outer space”, “spacecraft engaged in practical applications and uses of space technology such as weather or communications”, “spent boosters; spent maneuvering stage; shrouds and other non-functional objects”, “reusable space transportation systems”)	O/O	N/A	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Update by O/O	Update Method
<b>Object Type</b>	Type of space object	Text	objectType	Categories ("Payload", "Debris", "Rocket Body", "Unknown", "Other"). Null values will be assigned to "Unknown"	O/O	DoD	No (O/O change requires Ops Team)	N/A
<b>Decay Date</b>	The actual date when the object re-enters Earth's atmosphere.	UTC datetime without offset	decayDate	ISO 8601 date format	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Estimated Time on Orbit</b>	What is the expected operational lifespan of the spacecraft? This can be the value estimated at launch.	Years	estimatedTimeOnOrbit	≥0 (e.g., 5.5 years)	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Orbit - Period</b>	The actual time (in minutes) it takes for the satellite to complete one orbit. Defined as part of the mean orbital element set used in TLEs	Minutes	orbitPeriod	84–144 min (LEO) to 1,440 min (GEO)	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Orbit - Inclination</b>	The angle (in degrees) between the satellite's orbit and the Earth's equator. Defined as part of the mean orbital element set used in TLEs	Degrees	orbitInclination	0°–180° (0°=equatorial, 90°=polar)	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Orbit - Apogee</b>	The highest altitude (in kilometers) the satellite reaches in its orbit. Defined as part of the mean orbital element set used in TLEs	Kilometers	orbitApogee	200–42,164 km (LEO to GEO)	DoD	N/A	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updateable by O/O	Update Method
<b>Orbit - Perigee</b>	The lowest altitude (in kilometers) the satellite reaches in its orbit. Defined as part of the mean orbital element set used in TLEs	Kilometers	orbitPerigee	200–42,164 km	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Planned Orbit - Period</b>	Planned nodal period (in minutes) prior to launch. Defined as part of the mean orbital element set used in TLEs	Minutes	plannedOrbitPeriod	Same as actual orbit	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Planned Orbit - Inclination</b>	Planned nodal inclination (deg) prior to launch. Defined as part of the mean orbital element set used in TLEs	Degrees	plannedOrbitInclination	Same as actual orbit	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Planned Orbit - Apogee</b>	Planned nodal apogee (km) prior to launch. Defined as part of the mean orbital element set used in TLEs	Kilometers	plannedOrbitApogee	Same as actual orbit	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Planned Orbit - Perigee</b>	Planned nodal period perigee (km) prior to launch. Defined as part of the mean orbital element set used in TLEs	Kilometers	plannedOrbitPerigee	Same as actual orbit	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>RCS Size</b>	A qualitative classification of the object's radar cross-section	Text	rcsSize	Categories: "Small" (<1 m <sup>2</sup> ), "Medium" (1–10 m <sup>2</sup> ), "Large" (>10 m <sup>2</sup> )	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Launch Piece</b>	The piece designation from a launch (e.g., A, B, C) to differentiate objects from the same launch.	Text	launchPiece	Deployment identifiers (e.g., "A" for first deployable)	DoD	N/A	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updatable by O/O	Update Method
<b>Operational Status</b>	Status indicating if the objects current operational status. Available options defined by SANA registry: <a href="https://sanaregistry.org/r/operational_status/">https://sanaregistry.org/r/operational_status/</a>	Text	operationalStatus	Categories ("BACKUP_STORAGE_STANDBY", "DECAYED", "DEGRADED_OPERATIONS", "EXTENDED_MISSION", "NONOPERATIONAL", "OPERATIONAL_MANEUVERABLE", "OPERATIONAL_NONMANEUVERABLE", "REENTRY_MODE", "UNKNOWN")	O/O	N/A	Yes	Presentation Layer / API / OCM
<b>Orbital Regime</b>	The orbital regime of the object. This value determines the screening volume size used in conjunction assessment.	Text	orbitalRegime	Categories (GEO, HEO, MEO, Deep Space, LEO1-4, Other) Orbit Regime Definitions: Deep Space: Perigee > 37500 km. GEO: 27000 < Perigee ≤ 37500 and Eccentricity < 0.25 HEO: Perigee ≤ 37500 and	DoD Derived	N/A	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updatable by O/O	Update Method
				Eccentricity > 0.25 MEO: 2000 < Perigee ≤ 27000 and Eccentricity < 0.25 LEO 4: 1200 km < Perigee ≤ 2000 km and Eccentricity < 0.25 LEO 3: 750 km < Perigee ≤ 1200 km and Eccentricity < 0.25 LEO 2: 500 km < Perigee ≤ 750 km and Eccentricity < 0.25 LEO 1: Perigee ≤ 500 km and Eccentricity < 0.25 Other: Any object that does not have data to support categorization into an orbit regime gets assigned "Other" and will have the same screening				

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updatable by O/O	Update Method
				volumes as Deep Space				
<b>OCM Orbit Regime</b>	Alternative orbit regime that is expressly used to determine screening volumes for screening O/O OCM submissions	Text	ocmOrbitRegime	Categories (Near Earth, Deep Space, Other) Orbit Regime Definitions: Near Earth: Period < 225 minutes Deep Space: Period > 225 min. Other: Any object that does not have data to support categorization into an orbit regime gets assigned "Other" and will have the same screening volumes as Deep Space				
<b>Orbit category</b>	Include in registration, if relevant; Automatically updated by OCM. According to: <a href="https://sanaregistry.org/r/orbit_categories/">https://sanaregistry.org/r/orbit_categories/</a>	Text	orbitCategory	Categories ("GEO", "GSO", "GTO", "HELIOCENTRIC", "HEO", "INTERPLANETARY", "LEO",	O/O	N/A	Yes	Presentation Layer / API / OCM

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updatable by O/O	Update Method
	<p>&lt;P1&gt;_&lt;P2&gt;_&lt;N&gt; must be some combination of: SUN_EARTH_[1-5] or EARTH_MOON_[1-5]</p> <p>TraCSS does not support safety services for satellites not orbiting the Earth/Moon/Sun at this time.</p>			"<P1>_<P2>_<N>", "LUNAR", "MEO", "OTHER", "PLANETARY")				
<b>Wet mass (optionally binned value)</b>	Wet mass of the spacecraft. This value is used for fragmentation model input. Operators may choose to round their values or provide binned values. The values provided by O/O will be displayed as is without further binning.	Kilograms	wetMass	≥0 (e.g., 1,200 kg), either exact value or at least one significant digit.	O/O	NASA	Yes	Presentation Layer / API / OCM
<b>Hard body radius</b>	The hard body radius should be calculated using a standard method. If the Hard Body Radius changes over the lifespan of the spacecraft (due to a deployment, for example), this value should be updated.	Meters	hardBodyRadius	≥0 (e.g., 0.5 m for CubeSats)	O/O	NASA, DoD	Yes	Presentation Layer / API / OCM
<b>Hard body radius calculation method</b>	The method used to calculate hard body radius	Text	hardBodyRadiusCalculationMethod	Any (e.g. Circumscribing Sphere)	O/O	N/A	Yes	Presentation Layer/API/OCM
<b>Conjunction mitigation capabilities</b>	Which types of conjunction mitigation capabilities does the organization have the	Text	conjunctionMitigationCapabilities	Categories ("chemical propulsion",	O/O	N/A	Yes	Presentation Layer / API

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updateable by O/O	Update Method
	ability to implement for this spacecraft?			"electric propulsion", "differential drag", "object reorientation", "none")				
<b>Expected operational mission lifetime</b>	What is the expected operational lifespan of the spacecraft? This can be the value estimated at launch.	Years	expectedOperationalMissionLifetime	$\geq 0$ (e.g., 15 years for GEO satellites)	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>Estimated total time on orbit</b>	What is the total expected time in orbit (including time in orbit after operations have ceased)? i.e. The period of time from launch until the object expected to deorbit?	Years	estimatedTotalTimeOnOrbit	$\geq 0$ (includes post-mission drift)	O/O	N/A	No (O/O change requires Ops Team)	N/A
<b>1st Derivative of the Mean Motion</b>	First derivative of mean motion, indicating orbital decay. Example: 0.9273E-04.	Revolutions/day	firstDerivativeOfMeanMotion	$\pm 1e-8$ to $\pm 1e-3$ (TLE format: scaled by $2/3\pi$ )	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>2nd Derivative of the Mean Motion</b>	Second derivative of mean motion, often blank. Example: (empty).	Revolutions/day	secondDerivativeOfMeanMotion	$\pm 1e-16$ to $\pm 1e-11$ (TLE format: scaled by $6/\pi$ )	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>B* Drag Term</b>	BSTAR drag term, used for atmospheric drag modeling.	Unitless	bStarDragTerm	0–1 (atmospheric drag coefficient), e.g. 0.90517E-03	DoD	N/A	No (O/O change requires Ops Team)	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updatable by O/O	Update Method
<b>Right Ascension of Ascending Node (RAAN)</b>	Right Ascension of the Ascending Node (RAAN) in degrees. Defined as part of the mean orbital element set used in TLEs	Degrees	raan	0°–360° (TLE field: degrees, converted to radians in models), e.g. 0.3249228E+03 (≈ 324.92°).	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Eccentricity (decimal point assumed)</b>	A measure of how elliptical the orbit is. Defined as part of the mean orbital element set used in TLEs	Unitless	eccentricity	Decimal 0–1 (0 = circular, closer to 1 = more elongated, e.g. 0.28588E-02 ≈ 0.00286, nearly circular)	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Argument of Perigee</b>	Argument of perigee, indicating where the perigee occurs in the orbit. Defined as part of the mean orbital element set used in TLEs	Degrees	argumentOfPerigee	0°–360°, e.g. 0.2641518E+03 (≈ 264.15°).	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Mean Anomaly</b>	Position of the object in its orbit at the epoch (degrees). Defined as part of the mean orbital element set used in TLEs	Degrees	meanAnomaly	0°–360°, e.g. 0.956139E+02 (≈ 95.61°).	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Mean Motion (revolutions/day)</b>	Number of orbits completed per day. Defined as part of the mean orbital element set used in TLEs	Revolutions/day	meanMotion	0.99–17.0 (LEO: ~15.5 rev/day), e.g. 0.1492603281E+02 (≈ 14.93 rev/day).	DoD	N/A	No (O/O change requires Ops Team)	N/A
<b>Revolution Number at Epoch</b>	Total number of revolutions (orbits) completed at epoch.	Integer	revolutionNumberAtEpoch	≥0 (total orbits completed at TLE epoch), e.g. 43432	DoD	N/A	No (O/O change requires	N/A

Data Element	Description	Unit of Measurement	API Name	Value Range / Allowed Distinct Values	Default Source	Alternative Source(s)	Updateable by O/O	Update Method
							Ops Team)	
<b>Data Source</b>	JSON or key value pair to associate each element with the source of data for that element	Text	dataSource	e.g. "Launch Date": "O/O", "Period": "DoD", etc	Internal	N/A	N/A	N/A
<b>Last Update Timestamp</b>	The last update timestamp for the record in UTC format	UTC Timestamp	lastUpdatedTimestamp	e.g. 2025-04-09T03:32:52Z	Internal	N/A	N/A	N/A
<b>Create Timestamp</b>	Timestamp when the record for the satellite was created	UTC Timestamp	createTimestamp	2025-04-09T03:32:52Z	Internal	N/A	N/A	N/A
<b>Last Updated By</b>	The name of the entity last updated the record	Text	lastUpdatedBy		Internal	N/A	N/A	N/A
<b>Created By</b>	The name of the entity that created the record	Text	createdBy		Internal	N/A	N/A	N/A

## 7. Access and Use

The public elements of the TraCSS Cat are openly available via the TraCSS website. Users may:

- Query and download the catalog freely.
- Integrate with other SSA services or internal data pipelines.
- Share derived products without restriction.

Users must be registered in TraCSS with the appropriate access level.