SLOVENSKI STANDARD
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Vesolje - Nadzorovanje zavedanja položaja v vesolju - 01. del: Glosar izrazov v zvezi z objekti v bližini Zemlje ter nadzorovanjem in sledenjem v vesolju

Space - Space Situational Awareness Monitoring - Part 01: Glossary of Near Earth objects and space surveillance and tracking terms

Raumfahrt - Überwachung der Weltraumlageerfassung - Teil 01: Glossar für erdnahe objekt-, überwachungs- und verfolgungsbezogene Nachrichten

Espace - Surveillance de la représentation situationnelle de l'espace - Partie 01 : Glossaire des termes liés aux objets géocroiseurs, et à la surveillance de l'espace et au suivi des objets en orbite

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European foreword

This document (prEN 16604-30-01:2020) has been prepared by Technical Committee CEN-CENELEC/JTC 5 “Space”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

0 Introduction

0.1 Document structure

Clause 1 describes the scope and purpose of this standard.

Clause 2 describes the normative references used; in this case, none.

Clause 3 contains the list of acronyms and units conventions used in this document.

Clause 4 contains the glossary proposed for standardization.

Clause 5 contains complementary terminology defined by official sources.

Bibliography contains the references used to support this document.

0.2 Verbal conventions

There is no verbal convention defined for this document.

1 Scope

1.1 Purpose

The purpose of this document is to define the terminology to be used in the areas of near-Earth object (NEO) research and the field of Space Surveillance and Tracking of man-made objects (SST).

1.2 Applicability

The NEO and SST Glossary of Terms is applicable to all SSA activities, especially those overlapping the fields of near-Earth objects (NEO) and Space Surveillance and Tracking (SST). The terms included in the glossary are mainly, but not exclusively, relevant to both the NEO and SST fields.

The NEO and SST Glossary of Terms can and should be used as an extra source of information when interpreting CEN/CENELEC SSA standards, and the use of terminology in those standards is consistent with this document.

2 Normative references

There are no normative references in this document.

3 Acronyms and units

3.1 List of acronyms

Table 1 — list of acronyms

H	Absolute magnitude
IAU	International Astronomical Union
IEO	Inner-Earth Object
LEO	Low Earth Orbit
LOV	Line Of Variation
MOID	Minimum Orbit Intersection Distance
NEA	Near-Earth Asteroid
NEO	Near-Earth Object
PHO	Potentially Hazardous Object
PS	Palermo Scale
RCS	Radar cross-section
RSO	Resident Space Object
RU	Range unit/s
SRP	Solar Radiation Pressure
SST	Space Surveillance Tracking
TNO	Transneptunian Object
TS	Torino Scale
UCT	Uncorrelated Tracks

3.2 Unit conventions

This document generally uses units that are part of the International System of Units (SI) as well as non-SI, base or derived units that are accepted for use within the SI. The units used in this document are summarized in the following table.

Table 2 — Unit conventions

deg	decimal degrees
arcsec	seconds of arc or 3600th part of 1 deg (1/3600 deg)
au	astronomical unit, average Sun – Earth distance ~149,597,870,700 m
m	metre
km	kilometre
s	SI seconds

4 Defined Glossary

4.1 Absolute magnitude (H)

In asteroid science, the absolute magnitude (H) is used to define the brightness of an asteroid. The absolute magnitude is defined as the magnitude in the Johnson V band, with the asteroid at 1 au distance from the Sun, as seen from 1 au distance at phase angle 0 (the phase angle being the angle sun-asteroid-observer). The absolute magnitude can be converted into a rough size estimate if the albedo (percentage of reflected light from the surface) is known. The formula to convert absolute magnitude H to size D in km, with p being the albedo is:

$$D = \frac{1329}{\sqrt{p}} 10^{-0.2H} \text{ km}$$

For instance, a typical value for p would be P = 0,14, i.e. 14 % of the incoming light will be reflected by the object. Using H = 22 as example, the object size would be of about D ~0,14 km or 140 m.

In the SST field, part of the community defines the absolute magnitude of an object orbiting the Earth as the magnitude when: the Sun-to-target distance is 1 au, the target-to-observer distance is 40000 km (equivalent to a GEO object at 15,6 deg elevation above the local horizon), and a phase angle (Sun-to-target-to-observer angle) of 0 deg.

4.2 Along-track uncertainty

The largest component of orbital state uncertainties can be typically observed in the along-track (also called in-track) direction. The dispersion is caused by uncertainties in the semi-major axis, planet flybys, or in case of LEO objects the uncertainty of atmospheric density. In order to represent the dispersion in one component in a more efficient way, methods like line-of-variation are used in the NEO community.

4.3 Apparent magnitude (m)

The brightness of a space object as seen by an observer on Earth. Typically used for SST and NEO observations when photometric data are required, as the distance between the observer and target is usually not known.

4.4 Association

Assigning radar observations to a space object. Similar to correlation for optical observations, but for radars correlation is a term used in signal processing.

4.5 Astrometry

In the context of telescopic observations of small solar system objects, it is the process and techniques used to extract an accurate measurement of the sky-plane position of an object at a given time from an astronomical image obtained with a telescope. This is usually done in a relative way, determining the position of the moving object in relation to stars of known (catalogued) position visible in the same field of view. The accuracy of such measurements depends on a variety of factors, including the quality of the object detection, the accuracy of the stellar positions in the reference stellar catalogue, the optical properties of the camera and telescope system used to obtain the image, the accuracy of the time stamp of the image.

In general, any positional or speed measurement of a moving object can be considered an astrometric measurement. For example, range and radial velocity measurements obtained via radar are often called “radar astrometry”, and treated in a way that is similar to sky-plane positions determined from ground-based telescopic astrometry.

4.6 Attribution

Used in the NEO field. In the SST field, 'correlation' is used. It describes the linking of observations belonging to a known object (see also 4.4)

4.7 Cometary non-gravitational accelerations

In the NEO field, any object actively outgassing and releasing material into space is subject to a corresponding transfer of momentum in the direction opposite to the emission. Such effect is often extremely evident on cometary bodies, and it can perceivably alter their dynamics even on short timescales. Due to the complex nature of cometary outgassing, driven by surface features on the comet nucleus, these accelerations can be oriented in any spatial direction, and can change with time in both orientation and intensity, due to the varying activity profile of the object.

4.8 Correlation

Used in the SST field. Roughly equivalent to 'attribution' in NEO and 'association' for radars. Assigning optical observations/tracklets to a space object (track-to-object correlation) or determining that multiple tracks belong to the same (potentially unknown) object (track-to-track correlation).

4.9 Detector

Instrument or device whose range of performance can cover single or multiple parts of the electromagnetic spectre. In the NEO field, the detector may be also called sensor, and it is usually the light-sensitive device (CCD or CMOS) within the camera of a telescope.

4.10 Follow-up

Used in the NEO field. In the SST field, identical to 'tracking'. The specific effort to obtain observations of an interesting object at times subsequent to its discovery, with the goal of improving the knowledge of its orbit and the predictability of its future motion. Follow-up telescopes are generally distinct from survey telescopes, and operate with a closer supervision of an observer, which selects the targets in need of follow-up. Survey telescopes may also observe known objects, thus providing follow-up observations, although these observations are often not the goal of the project.

4.11 Hazard mitigation

Combination of activities that can be put into action in case a believable impact threat is detected by impact monitoring calculation, in order to remove or reduce the entity of damage that will be caused by the impact. They include active measures, such as an attempt to deflect the incoming object, and ground-based measure such as local evacuation or civil protection measures. The goal of such mitigation effort can be directed both to preserve human lives, and to reduce or contain the damage to infrastructures, assets and the environment.

4.12 Impact monitoring

Set of activities and computations that take the input observational data on each NEO and derive a formal assessment of the impact threat posed by the object. The typical output of an impact monitoring computation is a (possibly empty) set of future dates when an impact with Earth (or with other bodies) cannot be excluded given the available data, together with an estimate of the probability of such event. Additional estimators, such as dynamical parameters of the encounter, the released energy in case of impact, or the possible impact locations, are also often computed.

4.13 Initial orbit determination

Determining a celestial object's orbit based solely on observations and with no a-priori knowledge of its orbit.

4.14 Observation system or observing system

The system formed by a telescope and camera or a radar transmitter and receiver antennae, and any associated data reduction systems needed to generate astrometric/photometric data.

4.15 Potential impactor

Any NEO that has a computed non-zero impact probability within the time period analysed will be called ‘potential impactor’.

4.16 Precovery

Used commonly in the NEO field. Precovery is the process of finding an object in archived images, for the purpose of calculating a more accurate orbit. The name is based on 'pre-discovery recovery', recovery being the process of making new observations of a previously-observed object after a period of non-observation.

Data mining as used in this document describes the process of analysing the data available within different astronomical databases with the goal of getting additional information on asteroids not yet previously available. One concrete example would be the search for recently discovered asteroids in image data taken before the actual discovery (this task is called 'precovery work').

When an object is of particular interest (as with asteroids with a probability of impacting Earth), a search for precovery images is made. Using the preliminary orbit calculation to predict where the object might appear on old archival images, those images are searched to see if it had been in fact photographed already. If so, the observed arc is usually extended and a more precise orbital calculation can be made. This technique has been used since the mid-1990s.

4.17 Preliminary orbit determination

See 4.12, initial orbit determination