

Glossary of Terms

Near-Earth Object (NEO): An asteroid or comet with a perihelion distance less than or equal to 1.3 AU. 99% of NEOs are asteroids.

Ecliptic plane: Plane of the Earth's orbit.

Orbital parameters: 6 parameters that completely define an object's orbit:

Semi-major axis (a): One half of the major axis of the elliptical orbit; also the mean distance from the Sun.

Eccentricity (e): A measure of the ellipticity of the orbit; $e = 0$ for a circular orbit, e is nearly 1 for a highly elliptical orbit.

Inclination (i): Angle between the orbit plane and the ecliptic plane,

Longitude of the ascending node (Ω): Angle in the ecliptic plane between the inertial-frame x-axis and the line through the ascending node.

Argument of perihelion (ω): Angle in the orbit plane between the ascending node and the perihelion point.

True anomaly (v): Angle in the orbit plane between the perihelion point and the position of the orbiting object.

Line of nodes: The line of intersection between the orbit plane and the plane of the ecliptic (the Earth's orbit plane). (Not defined if orbit lies exactly in the plane of the ecliptic.)

Nodal points: The two points at which an orbit crosses through the ecliptic. The potential impact occurs at one of these points.

Ascending node: Point on the orbit where the object "ascends" through the ecliptic plane, passing from below it to above it.

Descending node: Point on the orbit where the object "descends" through the ecliptic plane, passing from above it to below it.

Perihelion: An orbit's closest point to the Sun.

Aphelion: An orbit's farthest point from the Sun.

Perigee: A trajectory's closest point to the Earth.

Period: The time it takes an orbiting body to make one complete revolution around the Sun.

AU: Astronomical Unit, mean distance between the Earth and the Sun (149,597,870.7 km, or 92,955,807.3 miles)

Delta-V: Change in velocity of the object.

ΔVA , ΔVC , ΔVN : Components of the Delta-V vector in the ACN coordinate frame.

ACN coordinate frame: A right-handed coordinate system centered on the object at the time of deflection (D), with perpendicular axes as follows: A is “along-track” (along the object’s heliocentric velocity vector), C is “cross-track” (perpendicular to A, in the object’s orbit plane and directed to the inside of the object’s orbit), and N is “normal” (normal to the object’s orbit plane and in the positive direction using the right-hand rule).

V_{∞} (V-infinity): Velocity of the asteroid relative to the Earth at the potential impact time, with the acceleration due to the Earth’s gravity removed. This can be thought of as the velocity of the asteroid relative to the Earth at a time when it is far enough away that the Earth’s gravity has not affected its trajectory significantly (of course not literally at an infinite distance from the Earth).

R_E : Radius of the Earth, 6378.137 km.

B-Plane: Plane perpendicular to the asymptote of the incoming hyperbolic trajectory of the object relative to the Earth.

B-vector: Position vector of the point where the asymptote of the incoming hyperbolic trajectory intersects the B-plane, relative to the center of the Earth. In the NEO Deflection App, the B-vector is the position vector of the green dot.

B magnitude: Magnitude of the B-vector.

Capture Radius: Radius of the capture circle, equal to the magnitude of the B-vectors for trajectories which graze a sphere with radius equal to 1 Earth radius (Earth oblateness is ignored).

V_{rel} : In the NEO Deflection App, the velocity of the interceptor spacecraft relative to the object at the Time of Deflection D.

C3: A measure of the energy-per-unit-mass of the outgoing spacecraft trajectory relative to the Earth at departure from Earth.

Beta: Momentum multiplier. A multiplicative factor on the momentum transfer of the Kinetic Impactor meant to account for the effects of the ejecta from the impact.

Δ Period: Change in orbital period due to the deflection.

Phase Angle: Illumination angle of the object as the spacecraft arrives (Sun-Object-Spacecraft angle).

Keyhole: A usually narrow region of a pre-impact b-plane in which the gravitational effect of the encounter puts the asteroid on a trajectory which impacts at a later encounter. In other words, if the object passes through a keyhole in one b-plane, it is on course to collide with the Earth at the potentially impacting encounter.