The NEOTωIST Mission

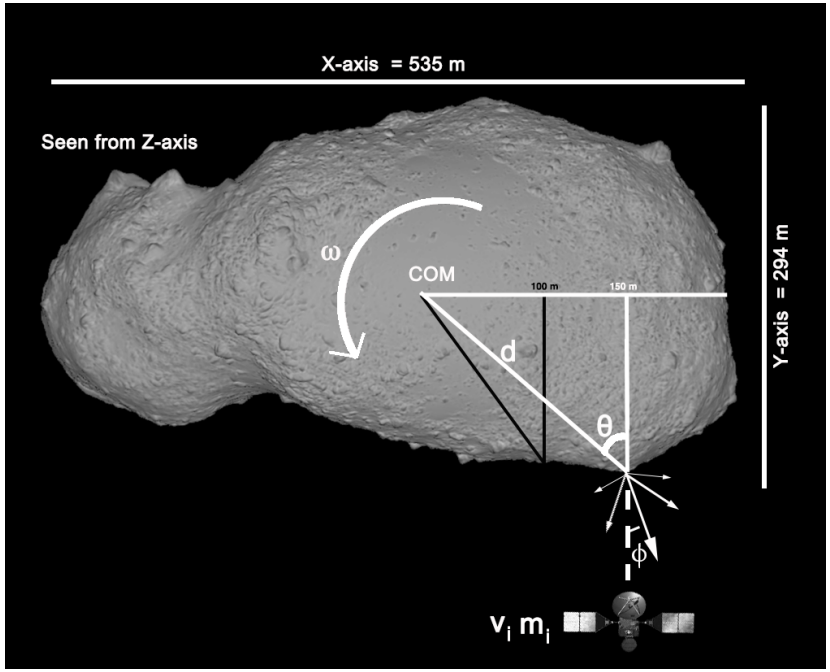
A low-budget kinetic-impactor demonstration mission

Mission concept developed by the NEOShield-2 consortium:

Low-cost: Single-launch kinetic-impactor demonstration mission.

Target: For scientific context a previously visited NEO will be chosen: e.g. Itokawa
(with mission opportunity every 3 years).

Mission: Change the spin period and measure the change from Earth. Itokawa's period would change by > 4 minutes, which can easily be measured from Earth via light-curves measurements.



-Itokawa model credit: Gaskell

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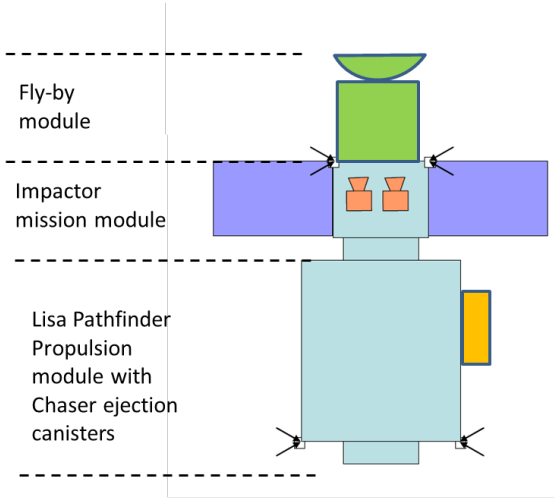
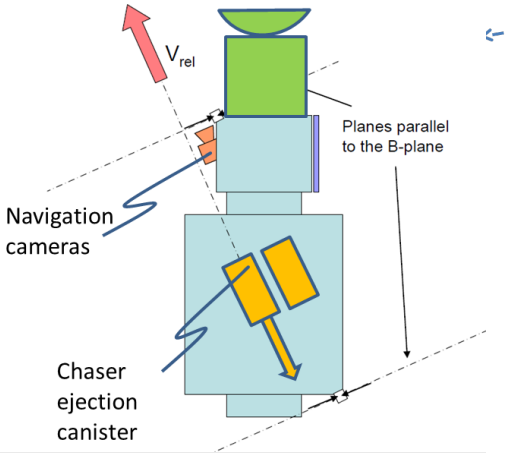
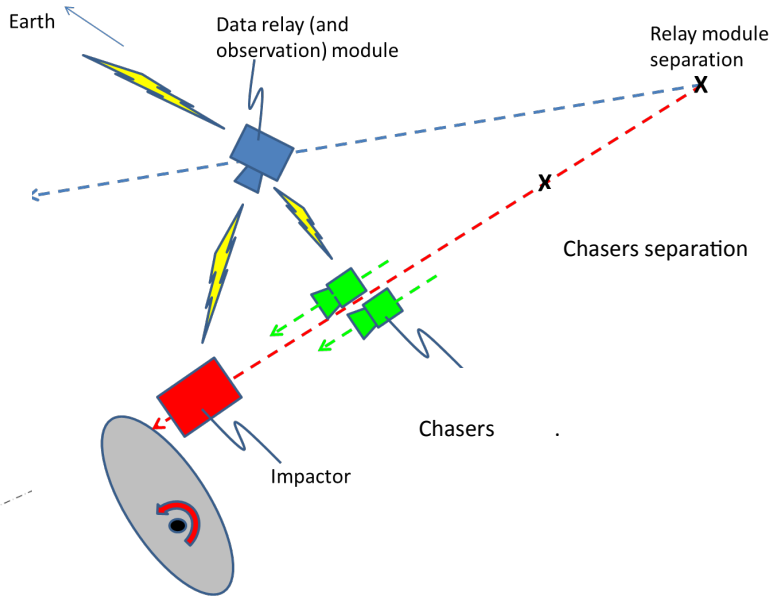
Mission design







Mission types: The mission can be designed in several ways and for different budgets:

1. An impactor spacecraft only.
2. A two-part spacecraft, which separates before impact into an impactor and a flyby spacecraft. The flyby spacecraft would observe the impact and the resulting ejecta cloud and act as a relay station.
3. The two-part spacecraft as above, with additional small sub-spacecraft ejected from the impactor at a late stage to observe the impact close up and the ejecta cloud from inside the ejecta cone. They would use the flyby spacecraft for data relay until they (possibly) also impact the target.

The system division into several subunits **allows for international collaboration opportunities**.

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NEOTωIST Mission Objectives

Objective	Derived functionality
Technology demonstration Kinetic Impactor	Impact target NEO with a spacecraft in hypervelocity regime with sufficient accuracy to ensure momentum transfer
Technology demonstration of an observer spacecraft for impact verification	Demonstrate observation, from a flyby vehicle, of the impact event with sufficient quality to verify that the impact took place as required for deflection
Deflection validation	Measure target NEO rotation before and after impact to prove transfer of (angular) momentum.
Determine β - momentum enhancement factor	Quantify the magnitude of momentum enhancement due to ejecta
Observational data to validate/ improve impact modelling	Measurement of the dynamics and effects of the impact event Note: Observables and accuracy will depend on mission utility/ cost assessment.

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