

Asteroid Return Mission Feasibility Study

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What?

- Identify a very small Near Earth Asteroid (NEA) with a mass of $\sim 10,000$ kg (corresponding to a diameter of ~ 2 m)
- Use a high-power Solar Electric Propulsion (SEP) System to rendezvous with this object, capture it, and return it to the International Space Station (ISS)



When?

- Launch before the end of the decade using a single evolved expendable launch vehicle (EELV) with a total flight time of ~ 5 years

Why?

- Assess resource potential of NEAs for exploration and commercial use
- Use the ISS as a geology lab
- Use the ISS as a test bed for learning how to handle/process asteroid material in space



Is It Feasible to Capture and Return a NEA to the ISS?

Key Feasibility Issues:

- Is it possible to find a sufficiently small, scientifically interesting NEA in an accessible orbit?
- How would you capture, secure, and transport a 10,000-kg asteroid?
- How would you safely approach and dock with the ISS while transporting a 10,000-kg asteroid?
- What would you do with a 10,000-kg asteroid at the ISS?



The asteroid would be curated at ISS where numerous possible scientific and resource utilization experiments would be conducted. Sampling and packaging would be done by astronauts on EVA, analogous to lunar sampling during Apollo. This would provide valuable experience with tools and techniques, prior to the human

Yes! It Appears to be Feasible to Rendezvous with, Capture, and Return an Entire NEA to the ISS

Reasonable projections suggest that several dozen candidate NEAs of the right size and orbit could be found through the use of new telescopes by the end of the decade from which a suitable target could be selected.

Low-thrust trajectory analyses suggest that the mission could be performed from a single EELV with a total flight time of approximately 5 years and a SEP power level of 40 kW.

A concept for capturing, securing, and despinning the asteroid has been identified.

Multiple approaches for docking the SEP vehicle and its asteroid cargo with the ISS have been identified.

Safely handling the asteroid at the ISS would require care and planning, but is definitely feasible.

Planetary protection issues were not addressed in this study.

The Panoramic Survey Telescope & Rapid Response System

