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Topic: Deflection / Disruption Modeling & Testing

APPLYING CENTRIFUGAL PROPULSION TO ENABLE ASTEROID DEFLECTION

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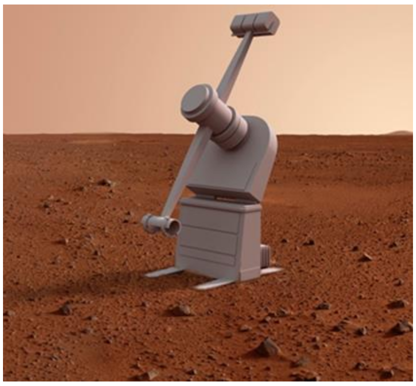
ABSTRACT

To date, asteroid trajectory modification techniques have employed the “big bang” approach. An impulsive deflection is imparted by slamming one or more high-speed kinetic impactor spacecraft into the object or by detonation of a nuclear device in its proximity. This is a “hit it once and hope for the best” approach.



Instead, we propose to land a centrifuge and power supply on a threatening asteroid. We’ll collect asteroid material and spin it away, a bit at a time, using momentum transfer of the recoil to gradually adjust the trajectory from endangering Earth.

This process allows us to sequentially “eject, measure, eject, measure” to gradually deflect the trajectory and fine tune the needed course correction. It offers many operating parameters that can be varied over time, from which an optimized solution can be implemented: location of the landing site, weight of each ejected package, launch speed and direction, cadence and timing of successive ejections, relationship to the asteroid velocity vector, and its spin axis. Once landed on an asteroid, the centrifugal system requires no consumables. Operating entirely on electrical power, it can operate indefinitely.

This approach addresses aspects of Goal 3 of the 2018 U.S. government’s “National Near-Earth (NEO) Object Preparedness Strategy and Action Plan”—*“Develop technologies and designs for NEO deflection and disruption missions.”* The centrifuge approach adds a sustainable and repeatable slow-push tool to the planetary defense toolbox. It mitigates the risk and uncertainty of the single-impulse methods. An artist’s early concept is shown above.

Chelyabinsk and Tunguska-size objects could be deflected to miss Earth within a few weeks of such on-site centrifuge operation. The asteroid Bennu could be deflected in a few years of continuous spinner operation, depending upon the

parameters chosen, sufficient to eliminate a potential collision with Earth in the late 22nd century.

The innovation of a self-contained power and kinetic launch capability without consumables opens new vistas for cost-effective asteroid deflection and other commercial, scientific, government, and international space missions.

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Comments:
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