Objectives of a Human Mission to a NEO: Planetary Defense Considerations

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Opinion of the Author. Not a position of the USAF or DOD.
• Advance the state of preparedness to protect planet Earth (its citizens, civilization, property and biosphere) from a future asteroid or comet strike
Planetary Defense: Objectives & Requirements

- Better understand the composition and dynamics of NEO objects in order to:
  - Refine methods of “pushing” the NEO
    - Select appropriate method
    - Model potential methods
  - Conduct better mission planning

Know thy enemy.
What is hard for unmanned?

While a manned mission can also survey the asteroid for shape, surface composition, gravity / EM field model, etc., it is likely to have an advantage in:

• Innovation and adaptation to unknowns & unanticipated phenomena
• Recovery from errors
• Multiple protocols in multiple locations with a faster OODA loop and opportune site selection
• Docking, Drilling, Sample Collection & sub-surface exploration….and…compelling public interest
Human Mission for Planetary Defense “Bare Minimum Requirements”

- Transponder / Reflector emplacement for precise tracking
- Proximity Ops & Docking
- Seismic Survey
- Drilling & Attaching
- Sample Return

Humans allow multiple protocols in multiple locations
Planetary Defense: Objectives & Requirements

Better understand the maturity, ‘workability’ and complications of proposed methods:

- Concentrated light (fouling, off-gassing)
- Kinetic Impact
- Subsurface emplacement of physics packages
- Survival of device packaging
- Station-Keeping / Thrusting (Gravity Tractor)
• **Ideal target would be large & “rich”**
  – Heterogeneous composition
  – Rubble Pile
  – Perhaps binary
• **An actual PHA or a very similar to a high risk PHA**
Awareness of the threat is a component of success:

- Capitalize on public interest and excitement and relevance to a common concern: survival
- Capitalize on publicity to advance the profile and organizational readiness to respond
Planetary Defense Library

- [http://www.nss.org/resources/library/planetarydefense/index.htm](http://www.nss.org/resources/library/planetarydefense/index.htm)

**2010: Defending Planet Earth: Near-Earth Object Surveys and Hazard Mitigation Strategies: Final Report**


**Abstract:** The United States spends approximately $4 million each year searching for near-Earth objects (NEOs). The objective is to detect those that may collide with Earth. The majority of this funding supports the operation of several observatories that scan the sky searching for NEOs. This, however, is insufficient in detecting the majority of NEOs that may present a tangible threat to humanity. A significantly smaller amount of funding supports ways to protect the Earth from such a potential collision or "mitigation." In 2005, a Congressional mandate called for NASA to detect 90 percent of NEOs with diameters of 140 meters or greater by 2020. Defending Planet Earth: Near-Earth Object Surveys and Hazard Mitigation Strategies identifies the need for detection of objects as small as 30 to 50 meters as these can be highly destructive. The book explores four main types of mitigation including: earth defense, "slow push" or "pull" methods, kinetic impacts and