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A NEW BUSINESS PLAN FOR PLANETARY DEFENSE

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ABSTRACT

The planetary defense enterprise is becoming a victim of its own success. As a result of the Spaceguard Survey, it is now exceptionally unlikely that a significantly large (crater-forming) asteroid will be discovered on a collision course in the next century. Globally catastrophic asteroid impacts within the time scale of societal interest have been effectively ruled out, and it is overwhelmingly likely that the survey will conclude by successfully reducing the statistical risk from undiscovered NEOs to a near-negligible level. It is virtually certain (probability >99%) that there will never be a need for defensive asteroid deflection in the 21st century.

The remaining statistical asteroid impact risk will be dominated by airbursts for two reasons: 1) The vast majority of potential crater-forming objects will have been discovered, whereas the vast majority of smaller objects capable of producing a dangerous airburst will remain undiscovered, and 2) The destructive power of an airburst is greater than was previously recognized, because the explosion is directed downward and not an isotropic, massless point source.

As the current survey progresses, it will become increasingly more important, in a relative sense, to provide resources to discover small short-warning objects and develop a civil-defense-based mitigation plan. Moreover, the population of airburst-scale objects is sufficiently large that continued surveys to discover short-warming objects is a sustainable activity.

As planetary defense is diminished as justification for developing asteroid deflection technologies, other potential reasons are emerging, and new ones may be conceived. For example, a recent report by the Keck Institute for Space Studies (KISS) investigated the feasibility of “identifying, robotically capturing, and returning an entire Near-Earth Asteroid (NEA) to the vicinity of the Earth by the middle of the next decade.” The primary justification for this project would be to provide a destination for astronaut crews to cis-lunar space, and resources to enable further human exploration.

There may be other reasons to consider deflecting small asteroids into Earth orbit. It is conceivable that LEO could eventually become unusable for most satellites due to cascading space debris, or an act of war. Harder, more massive satellites may become necessary in the future, and the KISS study suggests a 28-1 mass amplification factor is possible (28 times the mass of a launch into LEO could be delivered).

Another potential goal of asteroid deflection would be to exploit NEOs to use in transfer orbits to provide shielding for astronauts between Earth and Mars. As the catalog of small NEOs increases, there will be an increasing number that--with an achievable impulse applied at a prescribed time well in advance of the mission--could provide such a pathway.

Generalizing the concept of planetary defense, there may come a time in which desperate measures are required to maintain a habitable planet in the face of catastrophic global warming. Applying the same probabilistic risk assessment principles to both climate change and asteroid impact suggests that catastrophic global warming is many orders of magnitude more likely (Boslough, 2010). If climate sensitivity is at the upper end of the published uncertainty range, it is highly likely that geoengineering will be required, and this may include deflection of asteroids to exploit their mass to shade the earth. As preposterous as this concept may appear, it is becoming more likely at the same time that the assessed asteroid impact risk is shrinking.

Finally, if new surveys and observational capabilities are built, there will be so many new discoveries and that large quantity of information might be useful for making inferences about the origin and history of NEOs. Such an explosion of data may create a new field of asteroid informatics, or “NEOmics.” As a side effect, we will be discovering many more objects like 2008 TC3 that will harmlessly, but spectacularly, explode in the upper atmosphere. This will create an opportunity for research, and even a new form of adventure tourism. The latter could possibly help defray the cost of the research.

References

Boslough M. 2010. Appendix D: Minority Opinion. Defending Planet Earth: Near-Earth Object Surveys and Hazard Mitigation Strategies, National Research Council.

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