CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Ethan M. Uetrecht

Project Number
S1718

Project Title
Assessing the Practicality of NEO Deflection Strategies Using Simulation, Year 2

Abstract

Objectives/Goals
In the absence of human intervention, a collision between a near-Earth object (NEO) and Earth is inevitable. In an attempt to predict and prevent possible collisions, scientists are currently detecting and monitoring NEOs and have proposed numerous strategies for deflecting them should they become a real threat. The purpose of this project is to determine the practicality of three selected deflection methods by simulating their overall effectiveness.

Methods/Materials
Two example NEOs were chosen for this project: the asteroid Apophis and the comet Tempel-Tuttle. Three selected deflection methods were examined: kinetic impact, solar ablation, and standoff nuclear blast. The trajectories of both Apophis and Tempel-Tuttle were modified to collide with Earth, and each of the three deflection methods was mathematically modeled and their effects on the NEOs were simulated.

Results
The kinetic impact method, which has a technology readiness level (TRL) of nine, was found to be successful in deflecting the asteroid but not the comet. The ablation method, which has a TRL of two, was found to be more effective than kinetic impact at deflecting the asteroid but was not able to deflect the comet. The standoff nuclear blast method, which has a TRL of six, was found to be most effective at deflecting the asteroid and was also successful at deflecting the comet.

Conclusions/Discussion
While each of these methods can be successful depending on the situation, no single method seems to be the best choice for all possible situations. This analysis contributes to understanding which method is appropriate in a given situation.

Summary Statement
The practicality of different NEO deflection methods was studied using simulation; it was found that the most practical method is dependent on the given situation.

Help Received
Mr. David Uetrecht mentored me and helped me write the Matlab simulation codes. My teacher, Mr. Peter Starodub, guided me through the research process.