CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35179

Project Title

Assessing the Practicality of Asteroid Deflection Strategies Using Simulation

Abstract

Objectives/Goals

In the absence of human intervention, an asteroid impact with Earth is inevitable. In an attempt to predict and prevent possible impacts, scientists are currently detecting and monitoring near-Earth objects (NEOs) and have proposed numerous strategies for deflecting NEOs 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

The Apophis asteroid was chosen for this project because it is a good example of a potential threat to Earth. The three selected deflection methods were the kinetic impact of a space vehicle with the asteroid, solar ablation, and standoff nuclear blast. The trajectory of Apophis was modified to collide with Earth, and each of the three deflection methods was mathematically modeled and its effect on the asteroid was simulated.

Results

The kinetic impact method, which has a technology readiness level (TRL) of nine, was found to be successful when the impact occurred head-on or from behind with at least 5.7 orbits (five years) prior to impact. The ablation method was found to be more effective than kinetic impact but has a TRL of two. The standoff nuclear blast method was found to be most effective at deflecting the asteroid, but will likely cause fragmentation of the asteroid.

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

This project used simulation to study asteroid deflection strategies to determine which strategy is the most practical for avoiding a collision with Earth.

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.