Asteroid Deflection

New Mexico Supercomputing Challenge
Final Report
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Executive Summary

Many celestial bodies orbit relatively near to Earth on a daily basis. Some actually enter our atmosphere but are too small to be of any significance or to create any large impact. However, there are some asteroids, which due to their size and current path do pose some threat to people on Earth.

Our program will compare the possible results of various deflection strategies, thereby predicting which one would be the most effective.

Statement of Problem

On an average of every few hundred thousand years or so, asteroids with a diameter larger than a mile could collide with Earth and cause global disasters.
The probability of a collision causing such damage is very low; however, even less threatening asteroids can cause significant damage.

Therefore various programs have started developing deflection strategies for asteroids that might collide with Earth.

However, since these strategies are still simulating deflection of rather harmless celestial bodies, one might wonder how efficient they would be in case of a major threat. Therefore we decided to develop a program which would simulate the impact these methods would have on asteroids with a high potential for causing damage to Earth.

Description of Method

We first assumed that the asteroid is on a collision course with earth. Programs are already in place to determine the trajectory of asteroids and they can successfully, and somewhat accurately, predict whether an asteroid is going to collide with earth. Initially, we planned to determine the trajectory of asteroids. However, we then decided to focus on asteroids that might pose some threat to earth, rather than those that might not even hit earth. We then assumed that an approximate chemical composition of the asteroid could be determined. This piece of information would be necessary to determine an approximate density for the asteroid. The type of asteroid, as in a rubble pile or solid mass, is also relevant to the problem.

To begin our calculations we would calculate the Torino Value[D1] of the asteroid. To do so we would need to use the Kinetic Energy Equation ($KE=1/2mv^2$). Here the mass would be useful to determine the Torino value.. In finding the velocity of the asteroid, we assumed that this could be measured using the same techniques that determine the trajectory of the asteroid. That is, if time lapsed photos could be taken then the velocity could be determined by comparing the position of the asteroid and the time that passed between these two landmarks. Next, we would determine the type and composition of asteroid, whether it is a rubble pile or solid mass. We would then simulate various deflection scenarios including a nuclear blast on the asteroid and bumping the asteroid with another object which would require the elastic collision equation ($m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v_f$.). We would then determine which deflection strategy best neutralizes the threat of the asteroid.

Results

Our results were inconclusive. Due to circumstances beyond the team's control, further investigation and time would be needed to obtain valid results.

Analysis

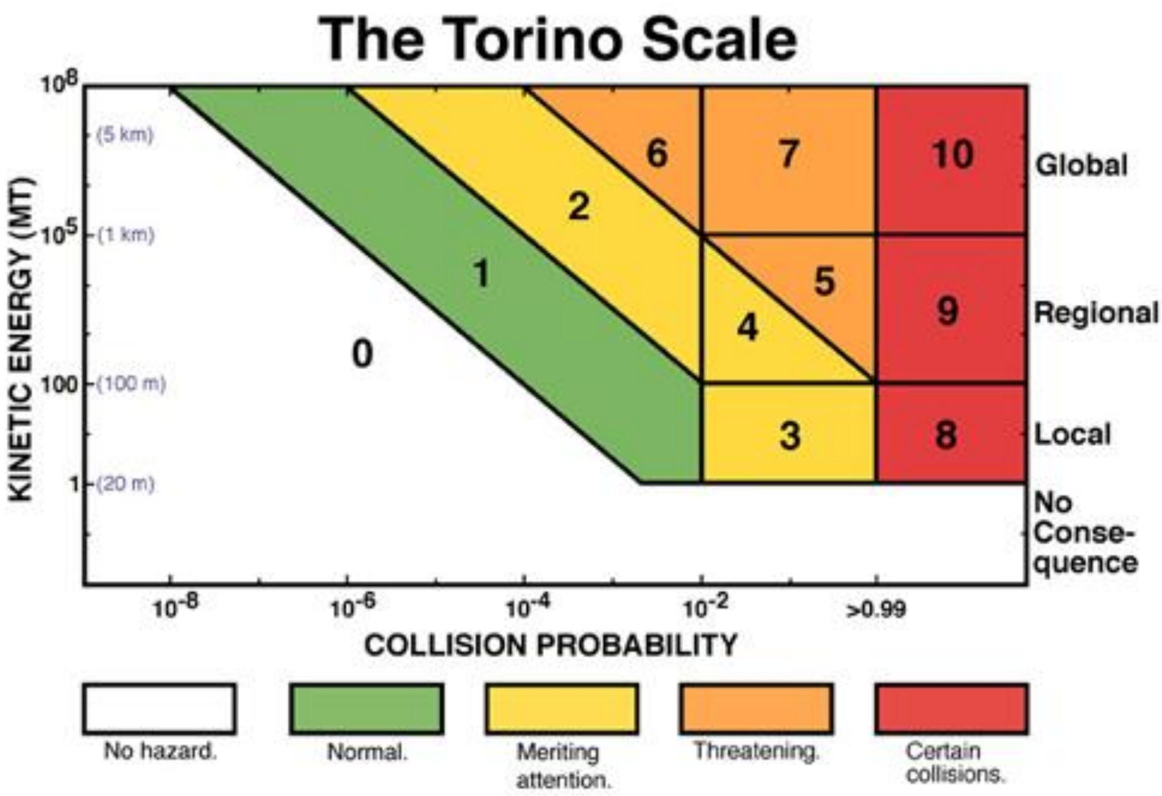
(See Results, page 6)

Achievements

Although the results of our project were inconclusive, the experience proved to educate us about the nature of asteroids, asteroid deflection, and asteroid impacts. It was enjoyable to learn about an area of science that we were interested in yet knew little about. Our project has increased our appreciation for the programs already in place that deal with asteroid deflection. Very few agencies realize the potential that asteroids pose to Earth and the work that has already been done to monitor these objects is instrumental in implementing an effective deflection strategy. As opposed to merely a distant threat, asteroids can pose a serious threat to all of the inhabitants on Earth.

Appendix

D1



Source: http://neo.jpl.nasa.gov/torino_scale.html