



Association of Space Explorers

Committee on Near Earth Objects

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**By
Russell L. Schweickart
Chairman, Association of Space Explorers
Committee on Near-Earth Objects**

The Asteroid Impact Threat: Decisions Upcoming

The asteroid impact threat has likely been constant for the past three billion years. What has accelerated, rather rapidly, is our knowledge of the impact hazard, and in particular the population of near-Earth objects (NEOs), those asteroids and near-Earth comets whose orbits approach or cross that of the Earth.

We currently know of and are tracking about 3,000 NEOs of a size capable of destroying a major city on impact. Within the next 10-15 years we will be tracking the orbits of over 300,000 such objects. Based on current data 97% of these objects will have no chance of impact over the next century. However of the remaining 3% there are likely to be many that will appear threatening enough to seriously consider deflection.

Given that with adequate early warning a NEO deflection campaign can be initiated using existing space technology, the international community will shortly be confronted with the decision of whether action should be taken, when it should be taken, and who should take such action.

The Association of Space Explorers (ASE) and its Panel on Asteroid Threat Mitigation is currently concluding a two year process leading to a recommended decision program on asteroid threat mitigation that will be submitted to the United Nations in 2009. Confronted with the issue and this recommended program we believe that UN member states will soon be looking to the scientific community for their inputs on this matter. This presentation is therefore intended to provide basic information on the NEO threat and our ability to take preventive action.

It should be emphasized that the opening question the political community will ask is whether or not the threat of NEO impacts is a real issue and whether it needs to be dealt with now. The ASE believes the proper answers to these questions are "yes" and "yes," and it is the basis on which we believe this to be true that the presentation and discussion will be based. It is not therefore the recommendations we will be making to the UN which are at issue now, but rather whether being prepared to deal with NEO impact threats is ripe for their consideration.

Essential elements in the logic:

Demographics:

- Within 10-15 years we will have discovered and be tracking ~300,000 NEOs > Tunguska in size (~45 meters diameter and up).
- Based on current experience (10 years of Spaceguard Survey) ~10,000 of these will have a non-zero probability of Earth impact within the next 100 years.
- Of these 10,000, 50-100 (0.5-1%) are likely to appear threatening enough to warrant active monitoring and consideration as candidates for in situ tracking (i.e. deployment of a transponder mission) and/or deflection.

Intervention: (Deflection, sometimes called mitigation)

- Well understood, but unproven deflection techniques exist using current technology.
- A successful deflection campaign requires an active radio transponder at the NEO, in some instances high total impulse deflection means (e.g., kinetic impact or nuclear standoff explosion), and a precision, low total impulse orbit trimming capability (e.g., gravity tractor).
- Basic kinetic impact capability was demonstrated in the July 4, 2005 Deep Impact mission to comet Tempel I.
- A gravity tractor performance analysis and validation has just been completed by the mission analysis team at JPL.
- While a full flight demonstration of this capability should be performed, both for experience and confidence building, a deflection campaign could be initiated at any time based on current knowledge.

International Decision-making:

- In eliminating the threat of an impact for everyone specific populations and nations not initially at risk will have to accept a temporary increase in risk. NEO deflection necessitates risk shifting in the process of risk elimination.
- Size and/or impact energy thresholds and other decision criteria must be established by the international community in order to permit formal warnings and all-clears to be issued and mission planning and execution to be initiated. NEO impact warnings cannot rationally be left to whoever wishes to issue one.
- All nations and peoples are stakeholders in this process and must therefore be included in the consideration and establishment of these criteria.

- Decision criteria for warning, mission planning and execution should be established based on the value of life and property, not on national political self-interest or self-serving capability. The development of such criteria must therefore be accomplished before a specific impact threat, placing a limited set of particular nations at risk, is discovered.

With the capability to take preventive action and the knowledge that specific threats requiring decisions will be discovered within the next 10-15 years, the ASE and its Panel on Asteroid Threat Mitigation have developed and will be submitting to the UN in 2009 a decision program for asteroid threat mitigation (*Asteroid Threats: A Call for Global Response*). UN member states will be called upon to discuss and deliberate on the many issues contained in this recommended decision program. In formulating their national positions UN member states will be calling upon their scientific resources to advise them on the issue. The entry question to the global scientific community from their political representatives will be, "is this an issue which needs to be attended to?"

We believe the answer is "yes." We hope you agree.