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# ASTEROID THREATS: A CALL FOR GLOBAL RESPONSE

A report on the need to develop an international decision-making program for global response to Near Earth Object threats. Submitted for consideration and subsequent action by the United Nations, its goal is to assist the international community in preventing loss of life and property resulting from an asteroid impact on Earth.

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**Association of Space Explorers International Panel on Asteroid Threat Mitigation**

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## Executive Summary

Earth's geological and biological history is punctuated by evidence of repeated and devastating impacts from space. Sixty-five million years ago, an asteroid impact caused the extinction of the dinosaurs along with some 70% of Earth's living species. A more typical recent impact was the 1908 Tunguska Event, a 3-5 megaton explosion which destroyed 2,000 square kilometers of Siberian forest.

A future asteroid collision could have disastrous effects on our interconnected human society. The blast, fires, and atmospheric dust produced could cause the collapse of regional agriculture, leading to widespread famine. Ocean impacts like the Eltanin event (2.5 million years ago) produce tsunamis which devastate continental coastlines. Asteroid 99942 Apophis, which has a 1-in-45,000 chance of striking Earth in 2036, would generate a 500-megaton (MT) blast and inflict enormous damage.

Devastating impacts are clearly infrequent events compared to a human lifetime: Tunguska, thought to be caused by the impact of a 45-meter-wide asteroid, is an event that occurs on average two or three times every thousand years. However, when Near Earth Object (NEO) impacts occur they can cause terrible destruction, dwarfing that caused by more familiar natural disasters.

Advances in observing technology will lead to the detection of over 500,000 NEOs over the next 15 years. Of those several dozen will pose an uncomfortably high risk of striking Earth and inflicting local or regional devastation.

### The Need for a Global Response

Faced with such a threat, we are far from helpless. Astronomers today can detect a high proportion of Near Earth Objects and predict potential collisions with the Earth. Evacuation and mitigation plans can be prepared to cope with an unavoidable impact. For the first time in our planet's 4.5-billion-year history, the technical capacities exist to prevent such cosmic collisions with Earth. The keys to a successful outcome in all cases are preparation, planning, and timely decision-making.

Efforts to deflect a NEO will temporarily put different populations and regions at risk in the process of eliminating the risk to all. Questions arise regarding the authorization and responsibility to act, liability, and financial implications. These considerations make it inevitable that the international community, through the United Nations and its appropriate organs, will be called upon to make decisions on whether or not to deflect a NEO, and how to direct a proposed deflection campaign. Because of the substantial lead time required for a deflection, decisions will have to be taken before it is certain that an impact will occur. Such decisions may have to be made as much as ten times more often than the occurrence of actual impacts.

Existing space technology makes possible the successful deflection of the vast majority of hazardous NEOs. However, once a threatening object is discovered, maximizing the time to make use of that technology will be equally important. Failure to put in place an adequate and effective decision-making mechanism increases the risk that the international community will temporize in the face of such a threat. Such a delay will reduce the time available for mounting a

deflection campaign. Therefore, timely adoption of a decision-making program is essential to enabling effective action.

Within 10-15 years, the United Nations, through its appropriate organs, will face decisions about whether and how to act to prevent a threatened impact. To counter a threat of global dimension, information-sharing and communications capabilities must be harnessed to identify and warn society of hazardous NEOs. To prevent an actual impact, an international decision-making program, including necessary institutional requirements, must be agreed upon and implemented within the framework of the United Nations.

This report, prepared by the Association of Space Explorers and its International Panel on Asteroid Threat Mitigation, proposes the following program for action:

### **Proposed Program for Action**

Because NEO impacts represent a global, long-term threat to the collective welfare of humanity, an international program and set of preparatory measures for action should be established. Once in place, these measures should enable the global community to identify a specific impact threat and decide on effective prevention or disaster responses.

A global, coordinated response by the United Nations to the NEO impact hazard should ensure that three logical, necessary functions are performed:

1. Information Gathering, Analysis, and Warning

An Information, Analysis, and Warning Network should be established. This network would operate a global system of ground- and/or space-based telescopes to detect and track potentially hazardous NEOs. The network, using existing or new research institutions, should analyze NEO orbits to identify potential impacts. The network should also establish criteria for issuing NEO impact warnings.

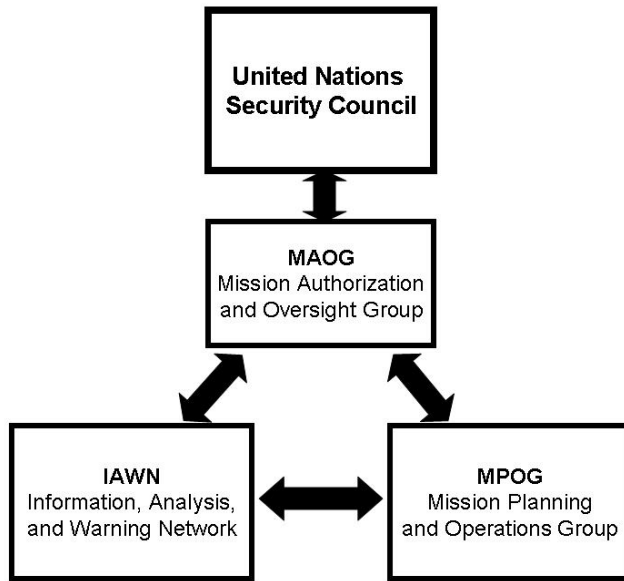
2. Mission Planning and Operations

A Mission Planning and Operations "Group," drawing on the expertise of the spacefaring nations, should be established and mandated to outline the most likely options for NEO deflection missions. This group should assess the current, global capacity to deflect a hazardous NEO by gathering necessary NEO information, identifying required technologies, and surveying the NEO-related capabilities of interested space agencies. In response to a specific warning, the group should use these mission plans to prepare for a deflection campaign to prevent the threatened impact.

3. Mission Authorization and Oversight Group

The United Nations should exercise oversight of the above functions through an intergovernmental Mission Authorization and Oversight "Group." This group would develop the policies and guidelines that represent the international will to respond to the global impact hazard. The Mission Authorization and Oversight Group should establish impact risk thresholds and criteria to determine when to execute a NEO deflection campaign. The Mission Authorization and Oversight Group would submit recommendations to the United Nations Security Council for appropriate action.

The Association of Space Explorers and its international Panel on Asteroid Threat Mitigation are confident that with a program for concerted action in place, the international community can prevent most future impacts. The Association of Space Explorers and its international Panel are firmly convinced that if the international community fails to adopt an effective, internationally mandated program, society will likely suffer the effects of some future cosmic disaster—intensified by the knowledge that loss of life, economic devastation, and long-lasting societal disruption could have been prevented. Scientific knowledge and existing international institutions, if harnessed today, offer society the means to avoid such a catastrophe. We cannot afford to shirk that responsibility.

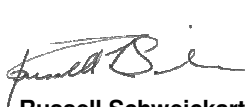
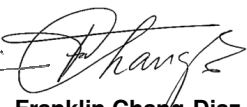





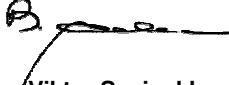


**Figure 1. NEO Decision-making Functions**

Association of Space Explorers International Panel on Asteroid Threat Mitigation

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