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**Committee on the Peaceful
Uses of Outer Space
Scientific and Technical Subcommittee
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Vienna, 9-20 February 2009
Agenda item 11
Near-Earth Objects**

**Draft Recommendations for Near-Earth Objects Threat
Mitigation**

At its fifty-first session, in 2008, the Committee on the Peaceful Uses of Outer Space noted with satisfaction the work carried out by the Working Group on Near-Earth Objects of its Scientific and Technical Subcommittee and by the Action Team on Near-Earth Objects and endorsed the amended workplan for 2009-2011, under which it was expected, inter alia, to continue to review policies and procedures related to the handling of the NEO threat at the international level and consider drafting international procedures for handling the NEO threat.¹

The Action Team on Near-Objects² convened two open meetings on 16 and 17 February 2009, on the margins of the forty-sixth session of the Subcommittee, in order to discuss and review the report of the International Panel on Asteroid Threat Mitigation of the Association of Space Explorers entitled "Asteroid threats: a call for a global response".³ On the basis of the discussions from the meetings, the Action Team has prepared this conference room paper with draft recommendations for NEO threat mitigation for further discussions in the Working Group on Near-Earth Objects.

¹ *Official Records of the General Assembly, Sixty-third Session, Supplement No.20 (A/63/20)*, para. 153.

² The Action Team on Near-Earth Objects was established in response to recommendation 14 of UNISPACE III and was given the terms of reference that include, inter alia, identifying any gaps in the ongoing work where additional coordination is required and/or where other countries or organizations could make contributions, as well as propose steps for the improvement of international coordination in collaboration with specialized bodies.

³ <http://www.space-explorers.org/committees/NEO/docs/ATACGR.pdf>.



Draft Recommendations for Near-Earth Objects Threat Mitigation

1. Background

The Committee on the Peaceful Uses of Outer Space established United Nations Action Team 14 on Near Earth Objects (NEOs) in 1999 in response to a recommendation from UNISPACE III with a mandate to: review the content, structure and organization of ongoing efforts in the field of NEOs; identify any gaps in the ongoing work where additional coordination is required and/or where other countries or organizations could make contributions; propose steps for the improvement of international coordination in collaboration with specialized bodies. For the purpose of this document and the work of the Committee, a near Earth object (NEO) is defined as an asteroid or comet whose orbit brings it close to the Earth, usually defined as within 45 million kilometres of Earth's orbit; this includes an object that will come close to the Earth at some point in its future orbital evolution.

Since the establishment of Action Team 14 it has become a common understanding amongst the international community that Earth's geological and biological history has been punctuated by evidence of repeated and devastating impacts from space, and that NEOs continue to pose an impact risk to humankind. The global nature of the NEO impact hazard, which can occur anywhere on Earth, has also been recognized. The consequences of NEO impact events, although less frequent than more familiar geological and meteorological hazards, can be much more severe than those resulting from phenomena such as earthquakes or extreme weather events. Perhaps uniquely amongst natural hazards, there is the potential to anticipate and prevent NEO impact events through timely actions, and it is the combination of potentially catastrophic scale, the predictability of events, and the opportunity to intervene which obligates the international community to establish a coordinated response to the NEO threat.

In 2007, the Working Group on NEOs was established (by the Scientific and Technical Subcommittee of the Committee) in the expectation that international procedures to mitigate the threat of NEOs would be proposed by the Working Group for consideration by the Committee on the Peaceful Uses of Outer Space (COPUOS). At this time, the Association of Space Explorers (ASE) assembled a Panel on Asteroid Threat Mitigation (PATM), enlisting renowned non-governmental, multi-disciplinary experts in science, diplomacy, law, and disaster management from around the world, with the aim of submitting its recommendations (for a decision-making programme for a global response to asteroid threats) to COPOUS for consideration as part of the work plan of the Working Group on NEOs.

NEO mitigation measures can be divided in two categories: those that detect and track potentially hazardous NEOs; and countermeasures that seek to deflect the potentially hazardous NEO to prevent an impact, and/or those that seek to limit the consequences on the ground (including response to the aftermath of an impact event).

2. Rationale

Within the next decade, advanced telescopes will greatly increase our ability to find more and smaller NEOs, and hence increase the NEO discovery rate. Based on

current statistics of the NEO population, these enhanced search programmes will discover a significant number of potentially threatening NEOs, thereby increasing the likelihood that a decision will be required by the international community as to whether or not to take action to prevent an impact. There is usually a substantial lead time required to execute an asteroid deflection operation, and consequently the international community may have to act before it is certain that an impact will occur. The longer that necessary decisions to undertake responsive actions are delayed, the more limited the relevant options become, and the larger the risk that an option finally chosen may have undesirable consequences. In the absence of an agreed-upon decision-making process, it is recognized that the international community may lose the opportunity to act against a NEO in time, leaving evacuation and disaster management as the only response to a pending impact. The prompt adoption of an international programme of coordinated activities and set of preparatory measures for action is therefore considered a prudent and necessary step in anticipation of such a potential impact event. To be effective, such a response must involve established deflection criteria and campaign plans which can be implemented rapidly, without the need for extended debate.

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 series of outline recommendations relating to a decision making programme for a global response to asteroid threats have been developed by the ASE Panel on Asteroid Threat Mitigation (PATM). The Committee on the Peaceful Uses of Outer Space acknowledges the benefit of such a series of high level recommendations, having wide acceptance among the global space and disaster response community. The Working Group on Near Earth Objects has therefore derived such a set of international measures for handling the NEO threat, based on those outline recommendations developed by the ASE PATM, and taking into consideration the United Nations treaties and principles in outer space.

3. Application

Member States and international organisations should take measures, through national, or other applicable mechanisms, to support the implementation of these recommendations, to the greatest extent feasible. Building on existing relationships, institutions and activities, this support should include the availability of a commensurate level of resources to address the specific potential threat posed by NEOs.

These recommendations are applicable to regional organisations, governments, non-government organisations, institutions, and relevant United Nations entities with responsibility for the coordination of space activities, the security of the citizen, and disaster management functions.

It is recognised that exceptions to the implementation of individual recommendations or elements thereof may be justified, for example, by the provisions of the United Nations treaties and principles.

4. NEO Mitigation Measures

A. Information, Analysis, and Warning

Capacities should be established by, or on behalf of, the international community, with the capability to:

- (a) Act as a global portal, serving as the focal point for information on the NEO population;
- (b) Provide the official clearinghouse function for all NEO observations;
- (c) Assess impact analysis results, and communicate these to those entities identified by Member States to be responsible for receipt of notification of an impact threat which exceeds a particular criterion threshold;
- (d) Recommend policies regarding criteria and thresholds for notification of an emerging impact threat;
- (e) Assist in impact consequence analysis and mitigation response planning.

The important and unique roles played by the Minor Planet Center in the coordination, archiving, and the identification of targets for follow-up NEO observations, and nodes such as NASA JPL's SENTRY and the University of Pisa's NEODyS in conducting impact risk analyses, are widely recognized by the international community. Member States should ensure that these facilities are supported at an appropriate level to enable them to continue to perform their critical functions.

Emerging aspirations and capability in space situational awareness offer the opportunity to take leadership in the support of the Information, Analysis and Warning functions identified above, and establish the potential to develop mechanisms for confidence building and transparency within the international community.

Capacities should be established by Member States to be responsible for:

- (a) Receipt of notification of an impact threat which exceeds a particular criterion threshold and,
- (b) To take appropriate action at a national/regional level in response to this impact threat.

B. Mission Planning and Operations

An inter-agency body should be established by space-faring nations, whose responsibilities should include:

- (a) Recommendation of generic decision and event timelines for NEOs that have the potential to impact the Earth;
- (b) Determination of specific decision and event timelines for NEOs which exceed a particular criterion threshold;
- (c) Recommendation of a generic process for deflection campaign operational responsibility;

(d) Determination of a specific process for deflection campaign operational responsibility for NEOs which exceed a particular criterion threshold;

(e) Recommendation of policies regarding criteria and thresholds to initiate a deflection campaign;

(f) Assessment of alternative deflection concepts based on feasibility and technical maturity;

(g) Development of specific information required to support mission planning efforts.

C. Oversight

The United Nations should designate one of its existing bodies to identify an entity to be responsible for monitoring and oversight of the management of the NEO impact risk. In particular it should ensure that the following functions are performed:

(a) Consideration of recommended criteria and thresholds for action (e.g. notification of a significant impact risk, initiation of observation and/or deflection campaign);

(b) Consideration of decision and event timelines for NEOs identified for preliminary deflection campaign analysis;

(c) Consideration of the recommended process for deflection campaign operational responsibility;

(d) Identification, in cooperation with Member States, of methods to engage designated national/international disaster response entities and exploit existing functions and infrastructures;

(e) Development and maintenance of a detailed protocol for the consideration of impact threat scenarios and agreement on the criteria and thresholds which will guide the choice and implementation of an appropriate response by the international community to a specific impact threat, from initial identification of a potential for impact, through to including the criteria requiring action by the international community to mount a deflection mission;

(f) Communication of the protocol to the international community via the United Nations' relevant organizations;

(g) Coordination of the relevant actors involved in the implementation of the protocol.
