

Space Mission Planning Advisory Group (SMPAG)

Status Report of Activity

Action item: 5.1	Title: Recommended Criteria & Thresholds for Action for Potential NEO Impact Threat	Activity Lead NASA (with IAWN)
<p>Description:</p> <p>The purpose of this task is to develop agreement among the member states and between the IAWN and SMPAG on what real-world scenarios represent a credible impact threat, as defined by specific criteria, and therefore deserve increased attention and action beyond the normal course of daily activities.</p> <p>Objective:</p> <p>Collaborate with the IAWN Steering Committee to develop a set of criteria, based on observable parameters and characteristics of a NEO impact risk, to be used to establish thresholds for action.</p> <p>Background:</p> <p>To date, NASA and the United States’ Federal Emergency Management Agency (FEMA) have held two simulated asteroid impact exercises. In the most recent exercise [from 2014], a small asteroid originally estimated to be ~140-300 meters in size was discovered ~7 years before its predicted impact. This advance notice enabled the development and execution of a space mission campaign to deflect the object away from an Earth impact trajectory – relevant to both IAWN and SMPAG activities. As the scenario unfolded, the exercise team provided updates; i.e., state of knowledge of the approaching asteroid, design and results of the deflection mission, possible regions on Earth that would be affected by the predicted impact event, etc. Two scales have emerged to categorize NEO impact hazards: the Torino Scale and a similar but, more complex Palermo scale. It has also been recommended that a more simplified impact hazard scale be developed for use when communicating level of impact threat to the public. The intent of this effort is to establish threshold criteria to use for triggering appropriate actions by the planetary defense community and supporting government entities.</p> <p>Task description:</p> <p>The criteria may be graduated based on orbit-related parameters that determine probabilities for impact and estimated physical characteristics of the object of interest, among other things. The crossing of a threshold would trigger a specific set of actions by IAWN, SMPAG and other identified entities to begin work on preparations and recommendations for an actual, real-world, mitigation campaign. The thresholds might also be graduated, and actions could involve, on the part of IAWN, increased focus on observations of the object of interest and tasking additional assets to assist with observations, while SMPAG could begin working with specific space-capable entities to define a viable set of mitigation campaign activities to adequately address the real-world scenario.</p>		

Output:

A Summary Report that includes threshold criteria to address potential real-world scenarios in the event of an imminent asteroid impact. These threshold criteria will likely be derived from the Sentry Risk Table as well as the Palermo and Torino hazard scales. In accordance with threshold criteria, IAWN and SMPAG should develop:

- A strategic plan that links emergency management, domestic and international policy, national security, and scientific missions and provides actionable guidance for investment decision-making, analysis and operational planning;
- Communication protocols describing actions that will be taking place and agencies responsible for those actions; and
- A communication plan for describing deflection options, the risk of failure, and the possibility of false alarms to the public.

Recommended Threshold Criteria for Action:

After data collected and analysed has been adequately verified and validated, given the circumstances of the actual, real-world scenario:

- 1) IAWN shall warn of predicted impacts exceeding a probability of 1% for all objects characterized to be greater than 10 meters in size, or roughly equivalent to absolute magnitude of 28 if only brightness data can be collected.

Rationale: Impact probabilities greater than 1 per cent are rare yet warrant awareness of possible effects. Most objects greater than 10 meters in size could have some effects (air blast and pieces) that could reach the Earth's surface. IAWN is compelled to warn populations if bodies will have effects that reach the ground. Setting threshold at 1 per cent is a compromise between not being overly alarmist and not warning too late for necessary action to be initiated. It is a probability figure that individuals and governments can comprehend. An alert such as this demonstrates that the IAWN is functioning. Further, it ensures the flow of communications from IAWN to the public and the United Nations.

- 2) Terrestrial preparedness planning should begin when warned of a possible impact:
 - Predicted to be within 20 years,
 - Probability of impact is assessed to be greater than 10%, and
 - Object is characterized to be greater than 20 meters in size, or roughly equivalent to absolute magnitude of 27 if only brightness data can be collected.

Rationale: Effective terrestrial preparedness involves determination of the "risk corridor" for impact of an object. This is made possible with the increased 10% impact probabilities within 20 years, which is not too long to begin planning, especially in cases for larger objects. This provides population centres on the Earth information to begin plans for emergency preparedness if needed. The surprising effects of the Chelyabinsk event in 2013 from an object ~18 meters in size led to the establishment of a relatively low limit (20 meters) in this threshold criteria.

- 3) SMPAG should start mission option(s) planning when warned of a possible impact:
- Predicted to be within 50 years,
 - Probability is assessed to be greater than 1%, and
 - Object is characterized to be greater than 50 meters in size, or roughly equivalent to absolute magnitude of 26 if only brightness data can be collected

***Rationale:** Several decades warning, if available, provides sufficient lead time to mount in-space characterization missions to enable more effective mitigation techniques. If more than 1 per cent probability of impact by a 50-meter sized object is assessed, IAWN will inform SMPAG immediately following verification of the orbit. Part of a characterization mission plan would likely be to deploy a radio transponder with the object to enable more precise tracking of the orbit.*

Schedule:

2015 SMPAG: Define initial conditions, study scenarios, and task schedule

2016 SMPAG: Present preliminary study results

2017 SMPAG: Submit final report

Status:

[give current status if Status Report]

Opening date: 10 April 2015	Status Report date: 17 Feb 2016	Closure date: April 2017
Report reference: [to be assigned by Steering Committee]	Access: [public/restricted, to be decided by SC]	