

Workshop on Communicating About Asteroid Impact Warnings and Mitigation Plans

Workshop Report Prepared for the International Asteroid Warning Network

September 2014

Executive summary

In September 2014, Secure World Foundation hosted a two-day workshop on communication about near-Earth object (NEO) hazards and impact mitigation. The workshop was organized at the request and for the benefit of the International Asteroid Warning Network (IAWN), an international group of organizations involved in detecting, tracking, and characterizing NEOs. IAWN was organized in response to a United Nations (UN) recommendation and operates independently of the UN.

The workshop brought together a diverse group of experts from the NEO science, risk communication, policy, and emergency management communities to provide communication guidance and advice to managers and directors of IAWN member programs and institutions.

Prepared for IAWN, this workshop report captures key findings and recommendations derived from the workshop. Through brief presentations and case studies, guided discussion and breakout-group work, participants identified the following findings:

- The fundamental principles of risk communication are well defined and widely embraced. IAWN can draw on these principles in developing its communication strategy and plans.
- Cultivating and maintaining public trust, issuing notifications and warnings in a timely fashion, maintaining transparency in communications, understanding its various audiences, and planning for a range of scenarios are important to effectively communicate NEO impact hazards and risks.
- IAWN needs to operate as a global, round-the-clock communications network in order to become a trusted and credible source of information.
- Quantitative and probabilistic scales are of limited value when communicating with non-expert audiences. Qualitative measures of characterizing impact hazards and risks and describing potential impact effects may be more effective communication tools.
- Responsibility for managing NEO impact risks may lie at the national, state or local level. IAWN could play a role in promoting the development of national protocols to respond to IAWN messages.
- Employing a common language to communicate about asteroid impact hazards across the different IAWN institutions could help IAWN build its identity and credibility. Establishing mechanisms for routine communication could help increase NEO awareness.
- IAWN currently has a sparse and scattered online presence. Without a unified online presence, it will be difficult for the network to establish its identity as a trusted and reliable source of information. As IAWN does not have a dedicated website, it is difficult for interested parties to determine what IAWN is and does.

Given these findings, workshop participants formulated the following recommendations:

- IAWN should establish a five-year plan with near and mid-term actions for becoming the global trusted and credible NEO information, notification, and warning network. This plan should consider the fundamental principles of risk communication.
- IAWN should employ a full-time communications officer to oversee the development and execution of its five-year plan.
- IAWN should sponsor briefings and workshops for reporters to improve NEO education within the mass media community.
- IAWN should develop and employ a new, non-probabilistic scale for characterizing asteroid impact hazards and impact effects. The Broomfield Hazard Scale is proposed for IAWN's consideration as an impact effects scale.
- IAWN should create a website as soon as possible. An IAWN member organization should register the URL www.iawn.int immediately.
- IAWN should employ a full-time Webmaster to create and maintain its website.

I. Introduction

Only in the past two decades have scientists acquired an in-depth knowledge of the near-Earth object (NEO) population and the potential for close approaches and future impacts. The Chelyabinsk atmospheric impact event of February 2013, coinciding with the close approach of 2012 DA14, focused public attention on NEO impact hazards and risks and provided the global NEO community with an opportunity to inform decision makers, journalists, and individuals about their current understanding of the NEO population.

In the meantime, recent studies and reports have highlighted the need for the global NEO community to focus on communication strategy and planning, especially in regard to Earth impact predictions and warnings. Among these, the U.S. National Research Council's Committee to Review Near-Earth Object Surveys and Hazard Mitigation Strategies observed:

The statistical risk to human life and property associated with impacts of [asteroids] is real, but it falls outside the everyday experience of most of humanity. This risk must therefore be communicated effectively to the community at large in the context of other natural disasters, particularly those that the local community is likely to encounter. Scientists must carefully assess and explain the hazard so that appropriate public policy measures, commensurate with the level of risk, can be put into action. There must be an assessment of the statistical risk from [asteroids] that is reasonable and acceptable to the general public.¹

The International Asteroid Warning Network (IAWN) is an international group of organizations involved in detecting, tracking, and characterizing NEOs. IAWN was organized in response to a United Nations (UN) recommendation and operates independently of the UN. IAWN's primary focus is the discovery of potentially hazardous NEOs (asteroids and comets) and the identification of those objects requiring action. IAWN is intended to function as an internationally recognized clearinghouse for the receipt, acknowledgement, and processing of all NEO observations, and as a global portal for accurate and validated information on the NEO population.

At its first meeting on 13-14 January 2014, in Cambridge, Massachusetts, the IAWN Steering Committee agreed to organize a communication workshop to help develop and refine messages regarding NEO impact hazards and to advise IAWN members on how to develop and implement effective international NEO communications. The IAWN Steering Committee recognized the need to involve experts in science communication, risk communication, public policy analysis, and emergency management in this workshop. In response, NASA's Near-Earth Object Observation Office (NEOO) and Secure World Foundation (SWF) organized the *Workshop on Communicating about Asteroid Impact Warnings and Mitigation Plans* on behalf of IAWN.

¹ National Research Council. *Defending Planet Earth: Near-Earth Object Surveys and Hazard Mitigation Strategies*. Washington, DC: The National Academies Press, 2010. p 27.

The workshop took place on 9-10 September 2014 at the Broomfield, Colorado office of SWF. The invitation-only workshop brought together a diverse group of experts from the NEO science, risk communication, policy, and emergency management communities to identify next steps towards institutionalizing communication strategy and planning in IAWN operations. Participants provided communication guidance and advice to managers and directors of IAWN member programs and institutions. A list of workshop participants is included in section VIII of this report.

A primary focus of this workshop was the analysis of historical cases of communications developed by the NEO community to convey information about potentially hazardous NEOs and predictions and warnings of possible impacts. Workshop participants used these case studies in considering whether and how asteroid impact hazard communication strategy, planning, and implementation could be improved to achieve IAWN goals.

This report, prepared for the IAWN Steering Committee and approved by the workshop participants, identifies themes, findings, and recommendations that emerged during the workshop. As the workshop was conducted under Chatham House Rule, specific comments are included without attribution.

The content of the report is organized by the major themes that were discussed in the workshop. Each section includes a number of findings that emerged from the discussion. These findings were used to formulate the recommendations included in Section VI.

II. Effective risk communication

Setting the stage for the communication of NEO hazards, the workshop began with a review of the fundamental principles of crisis and risk communication.² Previous observations and recommendations relating to communications about asteroid impact hazards were also considered. Participants agreed that cultivating and maintaining public trust, issuing notifications and warnings in a timely fashion, maintaining transparency in communications, understanding the diversity of audiences within the “general public,” and planning for a range of scenarios are important to effective communication about NEOs.

Finding: The fundamental principles of risk communication are well defined and widely embraced. IAWN can draw on these principles in developing its communication strategy and plans.

Finding: Cultivating and maintaining public trust, issuing notifications and warnings in a timely fashion, maintaining transparency in communications, understanding its various audiences, and planning for a range of scenarios are important to effectively communicate NEO impact hazards and risks.

² See, for example, *Communicating in a Crisis: Risk Communication Guidelines for Public Officials*, U.S. Department of Health and Human Services, 2002; *Outbreak Communication Guidelines*, World Health Organization, 2005.

The group discussed the need for IAWN to provide timely communications on a continuous, global basis. Expanding IAWN to include members on every continent could contribute to this goal. In addition, the group emphasized the need for consistent messaging among IAWN members and noted the challenges of translating messages into multiple languages and of understanding how audiences across a variety of cultures might interpret IAWN messages.

Finding: IAWN needs to operate as a global, round-the-clock communications network in order to become a trusted and credible source of information

Participants listed some of the questions that need to be considered, including:

- Where and when are decision points for IAWN activities? How will IAWN decide when to issue warnings?
- IAWN needs a communication strategy to guide action when a deflection mission is needed, as well as in a scenario when implementation of a deflection mission fails. Is this an IAWN task in collaboration with the Space Missions Planning Advisory Group (SMPAG)?
- Preparation of a basic information package, available on an IAWN website, might be useful for communication, education, and public outreach purposes. It could be part of a larger engagement strategy with partners at the state and local level, as well as science museums.

Workshop participants reviewed and discussed the results of analyses of several historical cases involving potentially hazardous NEOs.³ The following cases were chosen for analysis at the workshop on the basis of the public attention they drew and thus the likelihood that workshop participants might be familiar with them. Cases were chosen for their differences as well, to allow for some comparative analysis:

- Asteroid 2004 MN4, also known as Apophis, discovered June 2004. In December 2004 this NEO was rated 2 on the Torino impact risk scale (possible impacts in 2029 and 2036). By 2006, 2029 impact risk was eliminated. By 2013, 2036 impact risk was eliminated.
- Asteroid 2011 AG5, discovered June 2011. A chance of Earth impact in 2040 was predicted in September 2011. The asteroid was recovered in October 2012, and by December 2012, the risk of impact in 2040 was eliminated.
- Asteroid 2007 VK184, discovered November 2007. Based on observations from November 2007 to January 2008, this object was rated 1 on the Torino impact risk scale. The object was recovered in March 2014, and subsequent observations eliminated the impact risk.
- The coincidental occurrences on 15 February 2013 of the Chelyabinsk asteroid impact event and the close approach of asteroid 2012 DA14.

The group observed that in all of these cases, official statements were typically timely and accurate. They also observed that the mass media usually reframed official statements, quoting authoritative sources, but emphasizing risk and speculating about worst-case scenarios. The

³ Case-study reports are available at: <http://www.minorplanetcenter.net/IAWN/>.

group acknowledged that while IAWN cannot control how such messages are framed by the media, messages can be crafted in a way so as to reduce misinterpretation. Participants also discussed the benefit of IAWN-sponsored workshops for reporters as part of a larger effort to improve education of NEOs within the mass media community.

The case studies considered also illustrated the limited value of using probabilistic scales to characterize impact risk for non-expert audiences. Participants discussed possible alternatives to the scales currently employed by the NEO community.

Participants discussed factors that should be considered in characterizing impact effects in ways that might be meaningful to non-experts. Relevant pieces of information include:

- Type of impact – atmospheric impacts over water or over land, surface impacts on water or on land
- Size of object/energy release
- Type of object (solid, rubble pile, other, unknown)
- Angle of entry
- Geographic range and gradation of effects

Finding: Quantitative and probabilistic scales are of limited value when communicating with non-expert audiences. Qualitative measures of characterizing impact hazards and risks and describing potential impact effects may be more effective communication tools.

III. Political and institutional factors and constraints

A number of factors could affect whether, how, and when IAWN is ready to operate as an internationally recognized clearinghouse for NEO observations and a global portal for accurate and validated information on the NEO population. These factors include:

- The need to address the time-zone challenge to keep the network functioning continuously.
- The need to identify appropriate spokespeople, to determine who has the authority to speak on behalf of IAWN, and when.
- The currently limited membership in IAWN, which now includes institutions from the United States, the European Space Agency (ESA), several Western European national organizations, the Russian Academy of Sciences, the Japanese Space Exploration Agency (JAXA), and the Canadian Space Agency (CSA). Institutions in Asia, Africa, and Latin America are largely not represented in the network as yet.
- The need for a commitment of human and financial resources to enable IAWN to become fully operational.

Participants also considered that while IAWN's task is to inform and recommend appropriate action to address NEO hazards, the responsibility to manage risks lies at the national, state, and local level. The group considered that in the United States, there is a clear hierarchy among the agencies with emergency preparedness and response responsibilities that would respond to IAWN messages in the event of an identified NEO hazard. These roles and responsibilities have

not necessarily been defined within other countries, however. Participants discussed the possibility of IAWN sponsoring a series of workshops to encourage and aid in the development of national protocols to define who the major players are and how they are involved to respond to IAWN messages.

Finding: Responsibility for managing NEO impact risks may lie at the national, state or local level. IAWN could play a role in promoting the development of national protocols to respond to IAWN messages.

The group also considered other international organizations that IAWN might consider as possible models in building its leadership model, such as the Committee on Earth Observation Satellites (CEOS; www.CEOS.org) and the Inter-Agency Space Debris Coordination Committee (IADC; www.IADC.org). One option to consider toward insulating IAWN from changes in leadership at the national level and maintain institutional memory would be to create a permanent virtual secretariat, as CEOS has done. The terms of reference adopted by the Long-Term Sustainability of Outer Space Activities Working Group the Scientific and Technical Subcommittee of UN the Committee on the Peaceful Uses of Outer Space (COPUOS) might also be a useful reference.

IV. Social and psychological factors

Key social and psychological factors that IAWN should consider in formulating its communication strategy and plans include:

- The need to clearly distinguish among hazards, risks, and threats, and when it is appropriate to use these terms.
- The stigma attached to nuclear-related examples in characterizing impacts and their effects. If nuclear-explosion analogies are used, it must be made clear that asteroid explosions do not generate nuclear radiation.
- The need to focus on promoting awareness of asteroid impact hazards and avoid fanning people's fears. This should include a strategy for routine non-crisis communication.
- Established news routines that determine how the mass media frame stories about NEOs.
- The impact of context on how different audiences around the world receive and respond to IAWN messages, including:
 - cultural and political context, leadership changes, and current events;
 - definitions and translation issues; and
 - religious beliefs and world views.

Finding: Employing a common language to communicate about asteroid impact hazards across the different IAWN institutions could help IAWN build its identity and credibility. Establishing mechanisms for routine communication could help increase NEO awareness.

V. Messaging

Participants reviewed and discussed several sample messages in considering how IAWN members could improve their messaging. The group agreed that asteroid impact risk notifications and impact warnings must strike a balance between providing “just the facts” and appealing emotionally to the audience. Messages must be interesting enough to grab people’s attention. At the same time, they must provide all the information that audiences want and need to know, while accurately conveying what is not well understood and when more information may become available.

Standardizing content

While NEO messaging cannot be completely standardized - as messages are scenario-dependent and each scenario is unique - the information provided by the different IAWN member organizations should be consistent. The group agreed that IAWN and its members could employ a standard checklist of information to be included in messages, as needed and available, in a consistent format.

Such a checklist could include:

- Asteroid name/designation.
- Asteroid characteristics – size (metric and standard), brightness/albedo, etc.
- Observational history.
- Who discovered the asteroid and why the observation could be made.
- Prediction of asteroid trajectory including closest distance to Earth (surface, not center) and date and time of close approach.
- A colloquial (non-statistical) qualifier of impact risk (none, unlikely, possible...).
- Hazard to space assets (none, some...).
- Future observations (including radar observations).
- Will amateur observers be able to see the object?
- Consistent terms of measurement: “size” rather than “diameter” of object, brightness/albedo of object, etc.
- Authoritative source(s) for more information.

The group suggested that IAWN consider developing tiered sets of messages tailored to its various audiences: policy and decision makers, expert community and highly attentive non-experts, and mass media and “general public.” All IAWN messages should include a standard description of what IAWN is and does.

Participants agreed that IAWN needs to establish and maintain a website as a means of propagating its messages and providing more in-depth information for people who want or need to know more. To support consistent messaging, this website should include a glossary of terms, basic information on NEOs, links to relevant documents and reports, and information on how to contact IAWN. The group considered relevant domains that would be appropriate for IAWN,

and “.int” was preferred. The URL www.iawn.int is available at no cost. However, an IAWN member organization must complete a registration process to secure this URL.⁴

Additional means of propagating IAWN’s messages could include a periodic electronic newsletter, publications in peer-reviewed journals, opinion pieces and other articles in the trade press (science, aerospace, international affairs) and the mainstream media.

Finding: IAWN currently has a sparse and scattered online presence. Without a unified online presence, it will be difficult for the network to establish its identity as a trusted and reliable source of information. As IAWN does not have a dedicated website, it is difficult for interested parties to determine what IAWN is and does.

A qualitative hazard scale

Given the identified need for improved ways of characterizing impact hazards and effects, the group devoted a considerable amount of discussion to fleshing out a new hazard scale for IAWN to consider. The proposed Broomfield scale, shown in tabular form below, is a six-step scale based on a NEO’s size and kinetic energy potential, in tons of TNT equivalent, with each step assigned a color. On the Broomfield scale, an example of a Class 3 object is the object that exploded over Tunguska in 1908.

Broomfield Hazard Scale				
Class	Object size*	Energy potential [^]	Impact hazard	Color scale
1	<10 m	<50 kt	Visible fireball	Green
2	10 – 30 m	50 kt – 1 Mt	Localized damage possible	Yellow
3	20 – 80 m	1 – 20 Mt	City-wide damage	Orange
4	60 – 230 m	20 – 500 Mt	Regional damage	Red
5	160 – 800 m	500 Mt – 20 Gt	Country-wide destruction	Dark Purple
6	>600 m	>20 Gt	Global destruction	Black

**Sizes (in meters) are indications only: given size range is based on 3g/cc, the velocity range 15-25km
[^]Energy potential expressed in tons of TNT equivalent*

The Broomfield scale is non-statistical and does not address probability of impact. The group noted that blast radius information (distance plus severity of effects) should be added to each class on this scale. The group also acknowledged that the descriptive terms included in this scale – such as “localized damage” – are highly subjective and thus subject to interpretation. Identifying appropriate descriptive terms will require further work. It is important for IAWN to employ a scale that enables the disaster planning and emergency management community to determine thresholds for action.

⁴ Rules for registering a URL in the “.int” domain are available at: <http://www.iana.org/domains/int/policy>.

VI. Recommendations

Given the findings identified through the discussion, workshop participants made the following recommendations.

Recommendation 1: IAWN should establish a five-year plan with near and mid-term actions for becoming the global trusted and credible NEO information, notification, and warning network. This plan should consider the fundamental principles of risk communication.

Recommendation 2: IAWN should employ a full-time communications officer to oversee the development and execution of its five-year plan.

Recommendation 3: IAWN should sponsor briefings and workshops for reporters to improve NEO education of within the mass media community.

Recommendation 4: IAWN should develop and employ a new, non-probabilistic scale for characterizing asteroid impact hazards and impact effects. The Broomfield Hazard Scale is proposed for IAWN's consideration as an impact effects scale.

Recommendation 5: IAWN should create a website as soon as possible. An IAWN member organization should register the URL www.iawn.int immediately.

Recommendation 6: IAWN should employ a full-time Webmaster to create and maintain its website.

VII. Acknowledgements

The NASA NEOO Office and SWF provided substantive and financial support for the implementation of the workshop. This workshop report was prepared by Linda Billings and Laura Delgado López, co-leads of the workshop.

VIII. Participants

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