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**COMMUNICATING ABOUT ASTEROID IMPACT HAZARDS:
A CALL FOR RESPONSIBLE COMMUNICATION ABOUT
SCIENCE AND RISK**

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ABSTRACT

The global community of scientists involved in finding and tracking asteroids, identifying potentially hazardous objects, and characterizing the possible effects of impacts is increasingly aware of the need to improve and expand efforts to communicate with policy makers, journalists, and citizens about the work they do.

I will address progress in communication about NEO hazards and impact risks since 2013. Among topics I will discuss are new recommendations from expert groups, guidelines for responsible communication about hazards and risks, scholarly research that can inform NEO communication strategy and planning, communication issues raised at joint NASA-Federal Emergency Management Agency NEO impact tabletop exercises in 2013 and 2014, and other relevant developments. I also will consider the sorts of communication challenges posed by the scenario for PDC 2015's NEO-impact tabletop exercise.

Introduction: progress since 2013

A white paper published on the International Academy of Astronautics' 2013 Planetary Defense Conference [1] included a number of recommendations relating to communication across expert-non-expert boundaries, including the need for:

- Expanded efforts in communication.
- Characterization of impact hazards, risks, and effects in ways that are meaningful to decision makers and other non-experts.
- “A clear international chain of command for dealing with NEO risk” and a communication strategy that makes use of findings from experts in communication.
- Open and transparent communication of information about NEO hazards.
- A common language to characterize NEO hazards and impact mitigation options.

Since 2013, I've seen improvements in explanations of NEO science and in coordination of public statements on asteroid flybys and other NEO-related matters. The community continues to discuss the need for a common language, the International Asteroid Warning Network's steering committee has recognized this need, and most are in agreement that communication strategy and planning are critical. Strategies and plans are under way. Implementing them is a major challenge, as governmental organizations must play a key role in implementation.

NASA and the U.S. Federal Emergency Management Agency (FEMA) have held two asteroid-impact tabletop exercises, acting out credible scenarios. Both of these exercises highlighted the need for communication planning and coordination.

A report on the first NASA-FEMA tabletop exercise [2], held 5 April 2013 in Washington, D.C., included three main recommendations:

Improve tools for communications on the nature and evolution of NEO threats to make it more clear to the public and decision makers how an actual threat might evolve. The communications tools should include an authoritative website that would explain orbit position uncertainty and other terms used in describing a threat, discuss options that are available for deflecting or disrupting a threatening object, and describe the nature of an impact disaster. This same website would be frequently updated with relevant information in the event of an actual impact warning.

Develop a national response plan outlining actions that should be taken to prepare a deflection or disruption mission/campaign and activate preparations for disaster mitigation. The plan would include links to international disaster mitigation organizations and space agencies that might be involved in a deflection/disruption campaign.

Explore establishment of a FEMA-led NEO Impact Working Group to guide the evolution of disaster response measures and provide recommendations on future exercises and specific warnings for this scenario. This group would:

Develop materials for an authoritative website on issues related to an impact warning and disaster.”

Develop and maintain a “Rolodex” of key players—a list of who has what capability to support key information requests, tools the science team community has to support information needs, etc.

Design and conduct two follow-on tabletop exercises. The first would exercise an actual message format via the National Warning Systems in order for all concerned to learn differences between a man-made object returning from earth orbit (routine, happens every day) and a NEO impact, which has a low probability of occurrence, but extremely high consequences based on size, compositions, velocity, etc. The second would involve the Federal Interagency (Whole of Government), perhaps using the Emergency Support Functions Leadership Group, and “role players” might be designated to actually exercise the

national level decisions which may have to be made.

Primary findings of the second NASA-FEMA tabletop exercise [3], held 20 May 2014 in Washington, D.C., were that responsible parties in the federal government should:

- Perform strategic planning that links emergency management, domestic policy, national security, and scientific missions and provides actionable guidance for investment decision-making, analysis and operational planning;
- Establish a dedicated working group to plan for U.S. and international responses to and involvement in a NEO emergency [PIERWG];
- Develop communications protocols describing actions that will be taking place and agencies responsible for those actions; and
- Develop a communications plan for describing deflection options, the risk of failure, and the possibility of false alarms to the public.

IAWN communications planning

The author was invited to organize a panel discussion on science and risk communication for the first meeting of the International Asteroid Warning Network's Steering Committee, which took place in January 2014 in Cambridge, MA. Expert panelists were Dennis Mileti, Ph.D., Professor Emeritus, Institute of Behavior Science, University of Colorado at Boulder; David Ropeik, M.A., Ropeik & Associates, Instructor, Harvard School of Continuing Education, Environmental Management; and Richard M. Sheldon, Jr., ARM, Environmental Practice Leader, Willis North America (a global reinsurance company).

The panel stimulated considerable discussion about communication issues, and one of the five findings from this meeting was that Steering Committee should organize a two-day workshop to help refine messages and improve overall communication strategy and planning regarding NEO impact hazards:

The workshop will focus on the analysis of historical and hypothetical messages, strategies, and plans developed by the NEO community to convey information about potentially hazardous asteroids and impact risks. Social scientists with expertise in communication, risk communication, cross-cultural communication, risk perception, emergency preparedness and disaster management should be employed to organize and conduct the workshop. Drawing on theory, research, and experience, these experts can assist IAWN participants in implementing best practices for effective international NEO communications [4].

With Laura Delgado Lopez of the Secure World Foundation, the author was a co-organizer and co-facilitator of this workshop, which took place in September 2014 in Broomfield, Colorado. (See the author's poster paper on the workshop.) Workshop participants included scholars and practitioners of science and risk communication, a television producer, an ESA representative, and U.S. government representatives of NASA, FEMA, and the Department of State.

Workshop participants formulated the following recommendations for IAWN [5]:

- 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.
- Employ a full-time communications officer to oversee the development and execution of its five-year plan.
- Sponsor briefings and workshops for reporters to improve NEO education within the mass media community.
- 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.
- Create a website as soon as possible.
- Employ a full-time Webmaster to create and maintain its website.

It remains to be seen whether IAWN members can commit the time and funds necessary to put these recommendations into action.

Science and the media

Meanwhile, non-governmental organizations are not subject to the same constraints as governmental organizations are in communicating about plans for planetary defense. On 25 October 2013, the Association of Space Explorers held a media event in New York City to issue “a challenge to the global community to take the next vital steps to confront the threat from dangerous asteroids. The ASE Committee on Near-Earth Objects statement follows the United Nations General Assembly adoption of a suite of proposals to create an international decision-making mechanism for planetary asteroid defense...” [6]

“Asteroid impacts have dramatically altered the course of life on Earth and a rogue asteroid will certainly strike Earth, posing a global threat to human life and society,” ex-astronaut and ASE member Tom Jones stated in his opening remarks. “Search efforts to date have discovered scarcely 1% of potentially hazardous near-Earth objects (NEOs), and current telescopes were unable to warn us of the Feb. 2013 Chelyabinsk impact, which released 440 kilotons of explosive energy and injured more than 1,000 people. This leaves 99% of the objects big enough to level a major metropolitan area -- undiscovered.”

Some members of the NEO community (including the author) were surprised by the proceedings of this event, which was widely publicized and drew considerable media coverage. While ASE members reported on United Nations actions at this event, no representative of the U.N. participated. Many, many emails were exchanged about what was said, and not said. The media reported on the proceedings of the event with little if any fact checking. It turned out that in verbal and written statements for this event, the ASE had reported incorrect information on U.N. activities. The author queried Sergio Camacho, chairman of the U.N. Committee on the Peaceful Uses of Outer Space Action Team on NEOs (Action Team 14, or AT-14), about some of the ASE's statements.

Camacho told the author, and the ASE, that ASE had made a number of inaccurate statements. [7]

Camacho reported via email, “The ASE statement...of this past 25 October is not accurate on several points,” and he quickly contacted the ASE to correct the record. In comments on selected paragraphs of ASE’s 25 October 2013 NEO Statement, Camacho noted, for example, that ASE had said, “The General Assembly has approved concrete measures to help prevent asteroid disasters.” “This phrase is not accurate,” he said. “The GA will have approved the recommendations in the STSC report once it agrees (without a vote) on the draft resolution discussed and agreed upon by the Fourth Committee.” The ASE had said, “The resulting 2013 COPUOS report includes specific language authorizing and endorsing all three of these functions, and the General Assembly has now approved them.” This sentence is not accurate,” Camacho said. “The STSC did not include a recommendation on authorization and oversight; also the GA has not yet approved anything.” This is just a small sample of a long list of corrections. While these matters may seem rather small, it is important to note that in intergovernmental relations, details matter.

In recent years, the Slooh Observatory has drummed up considerable media attention for asteroid close approaches to Earth. During Slooh’s live webcast of a March 2014 close approach of asteroid 2014 DX110, commentator Paul Cox said the Slooh crew were not “scare-mongering” by publicizing the NEO impact “threat.” “We’re doing our best to keep this whole subject in the news,” he said, reporting on “what a tremendously serious threat these objects pose to Earth.” Slooh’s reporting on the close approach of asteroid 2004 BL86, in January 2015, was much improved over previous Slooh fly-by reports, in large part due to improved coordination of communication planning between Slooh and NASA’s Near Earth Object Observations Program and Asteroid Grand Challenge. This time around, the Slooh crew focused on reporting what we knew about 2004 BL86 and avoided spinning scenarios of death and destruction.

It is useful to keep an eye out for opportunities to update various audiences on the status of NEO science. In November 2013, *Science* and *Nature* published a number of studies of the Chelyabinsk airburst event. Respecting the embargo on these publications, NASA took the opportunity to hold a media teleconference on 6 November 2013 to discuss the findings reported in these papers and report on progress in finding, tracking, and characterizing NEOs. These papers had been widely publicized. Media coverage preceding the NASA teleconference emphasized the idea that the Chelyabinsk event raised the threat level of NEO impacts with Earth. The focus of post-teleconference media reports shifted to what the *Science* and *Nature* papers were primarily about: a detailed, in-depth understanding of the impact event, the first such event to be widely observed and recorded.

On 9 January 2014, at the annual meeting of the American Astronomical Society, the NASA NEO Observations Program held a seminar for science writers on NEO science – “Everything you’ve always wanted to ask about near-Earth objects: what we know, what we don’t know, what we need to know.”

On 2 April 2014, JPL's NEO Program Office published a report on its web site about asteroid 2007 VK184, stating that recent observations had led to the removal of the object from NASA's asteroid impact hazard list of near-Earth objects (NEOs) known to pose the most significant risk of Earth impact over the next 100 years. 2007 VK184, an asteroid estimated to be roughly 130 meters in size, had been on NASA's Impact Risk Page for several years, with an estimated 1-in-1800 chance of impacting Earth in June 2048. In months leading up to its elimination, 2007 VK184 had been the only known NEO with a non-zero Torino Scale rating.

On 22 October 2014, NASA released a map of bolide impacts with Earth's atmosphere over a 20-year period, 1994-2013. The map showed that bolide impacts occur frequently and randomly. While we could not persuade the NASA Office of Communications to issue a press release about the map, it was posted on JPL's NEO Program Office web site with explanatory text.

Conclusions

For all the efforts of members of the NEO community to improve the way they communicate with non-expert audiences about NEO detection and tracking and NEO impact risks and hazards, scare tactics, misinformation, loaded language, fuzzy thinking, and conspiracy theories are still all too common in the public discourse about NEOs and potentially hazardous asteroids.

The NEO community still tends to lean heavily on "threat" language, when often what we're talking about is not a "threat" but a risk or a hazard. In the U.S., NASA's collaboration with FEMA on NEO impact hazard assessment and impact emergency planning is helping the NEO community to learn about emergency management, including emergency communications. NASA has learned that the emergency management community is well versed in best practices of risk and crisis communications, and we can count on them to tell people what to do in the event of a real impact threat. The NEO community's role in disaster planning is to keep these professionals informed of NEO impact risks, hazards, and threats.

Another thing that's become clear in working with FEMA and other organizations outside the space community is that probabilistic risk assessments are of limited use in communicating with non-experts about NEO impact risks. Predicting asteroid impacts with Earth depends on probabilistic risk assessment. Space scientists are beginning to understand that, to avoid misinterpretation, enable informed decision-making, and sustain public trust, they must find non-statistical ways of characterizing impact risks.

While mass media and social media may continue to overdramatize the details of NEO close approaches and impact risks, the NEO community can and should continue to refine its methods of communication. To start, employment of common terminology would be helpful. Distinguishing among key terms is necessary, too: a hazard is a potential to cause harm, a risk is an assessment of the probability and extent of harm, and a threat is a declaration or determination to inflict punishment or injury in retaliation for, or conditionally upon, some action or course. It would be useful for us to choose "hazard" over "threat" whenever it's appropriate and choose "risk" over "danger" whenever

possible. We also would do well to avoid subjective terms whenever possible, such as “important,” “significant,” or “serious.” If using subjective terms, we should provide explanations (e.g. “significant because”...). We should stick to the facts, avoid speculation, acknowledge and explain uncertainties, and address all questions and concerns respectfully.

Today, in the United States, the disaster management community appears to be better prepared than the scientific community is when it comes to public communications about asteroid hazards and risks. Adequate planning for possible asteroid impacts will require a partnership between scientists and disaster managers, and a critical element of this planning will be determining who speaks about what, and when, and where, and how. NASA might consider deferring to FEMA with regard to communication with non-expert audiences about asteroid impact hazards. Planetary scientists as a group do not speak a useful language on this subject. Disaster managers do. They are prepared to tell people what they can do in the face of a hazard – a key element of successful risk communication.

To be responsible in communications with all of its audiences, the NEO community must strive to be timely, transparent, correct (rather than “right”), respectful (which requires understanding our audiences), and ethical (which requires acknowledging our biases and our motives). It will be useful to shift focus from “educating” various audiences to “informing” them. The emphasis on education belies a dependence on the discredited cognitive-deficit model of science communication, which posits that successful science communication is a matter of transferring knowledge from experts to non-experts. A focus on informing audiences opens the door to dialogue, the means of finding out what audiences want and need to know and a better path to building relationships and trust.

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