

Summary of the 2011 IAA Planetary Defense Conference

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of the
United Nations Committee on the Peaceful Uses of Outer Space

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2011 IAA Planetary Defense Conference



<http://www.esa.int/>



<http://www.nasa.gov/>



<http://www.iaaweb.org>



<http://www.gmv.com/>



<http://www.b612foundation.org/>



<http://www.jaxa.jp/>



<http://www.iau.org/>



<http://www.space-explorers.org/>



<http://www.telespazio.it>



<http://www.spacegeneration.org/>



<http://www.csic.es/>



<http://www.federalspace.ru>

- 9-12 May, 2011, Bucharest, Romania
- 19 sponsoring organizations
- Over 160 participants

This presentation provides overview, highlights and preliminary recommendations from conference



Host: Romanian Space Agency



Organizing Committee

| | | | |
|---------------------|--|-------------------------|--|
| V. Adimurthy | Indian Space Research Organization/Department of Space | Lindley Johnson | NASA NEO Observation Program Executive |
| William Ailor* | The Aerospace Corporation | Tom Jones | Astronaut, Member B612 Foundation |
| Ivan Bekey | | Alex Karl | Space Generation Advisory Council |
| Bruce Betts | | Detlef Koschny | SSA Near-Earth Object Segment Manager, European Space Agency |
| Mark Boslough | The Planetary Society | Claudio Maccone | International Academy of Astronautics (IAA) |
| Juan-Luis Cano | Sandia National Laboratory | Nahum Melamed | The Aerospace Corporation |
| Sergio Camacho | Deimos Space | Patrick Michel | Côte d'Azur Observatory |
| Ian Carnelli | European Space Agency | David Morrison | NASA Lunar Science Institute |
| A.C. Charania | SpaceWorks Commercial | Marius Piso | Romanian Space Agency |
| Pingyuan Cui | Institute of Deep Space Exploration, Beijing Institute of Technology | Dorin Prunariu | Romanian Space Agency |
| Jean-Michel Contant | International Academy of Astronautics (IAA) | Rusty Schweickart | Chairman, ASE-NEO Committee |
| Richard Crowther | Rutherford Appleton Laboratory | Richard Tremayne-Smith* | |
| Alan Fitzsimmons | Queen's University, Belfast | Giovanni Valsecchi | IASF-Roma, INAF |
| Andres Galvez | European Space Agency | Frans von der Dunk | University of Nebraska-Lincoln |
| Mariella Graziano | GMV | Brian Weeden | Secure World Foundation |
| Pedro J. Gutiérrez | Instituto de Astrofísica de Andalucía - CSIC | Bong Wie | Iowa State University |
| Alan Harris | German Space Agency (DLR) | Ray Williamson | Secure World Foundation |
| Alan W. Harris | Space Science Institute | Don Yeomans | Manager, NASA Near-Earth Object Program Office |
| Dario Izzo | European Space Agency | | |

*Conference Co-Chair

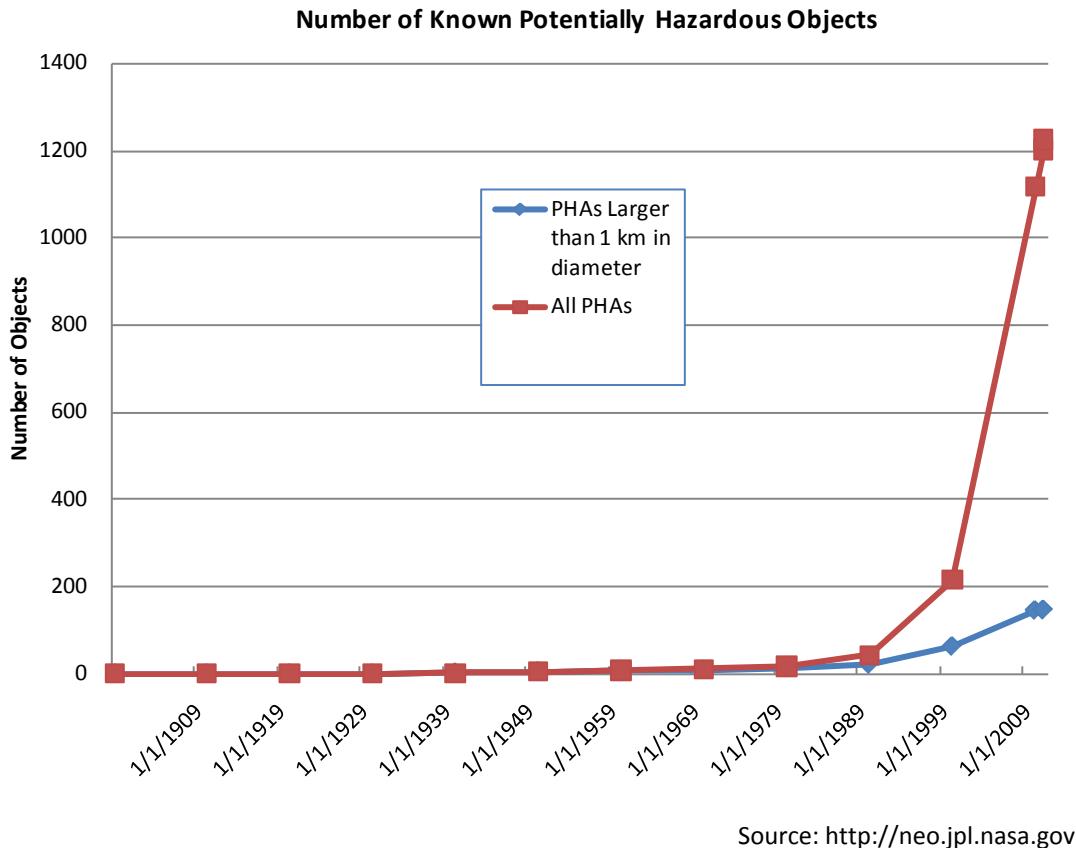


Topics Discussed

- Current state of knowledge on Near Earth Objects (how many, physical characteristics, orbits, current limitations, current risk, etc.)
- Consequences of an impact (tsunami, NEO size vs. consequence, economic impact, past events)
- Techniques for deflecting or mitigating a threatening NEO (kinetic impact, gravity tractor, explosive devices, others)
- NEO deflection mission and campaign design (launch requirements, cost, timelines, new tools)
- Political, policy, legal framework for planetary defense
- Increasing public awareness
- Current national and international activities supporting planetary defense



How many have been detected?



US Congressionally mandated effort to find and catalog 90% of NEOs larger than 140 meters by 2020

**Comets ~ 1% of overall threat
Orbits of comets difficult to predict accurately**

Definitions:

NEO: Near Earth Object--Perihelia <1.3 AU

PHO: Potentially hazardous asteroid or comet--pass within 0.05 AU of Earth's orbit

PHA: Potentially hazardous asteroid



Highlights (1 of 8)

Threats

- No threats yet identified for this century from objects larger than 1km
- Recognition that most frequent damaging threat is from smaller NEOs (e.g., less than 50 m diameter)
- Approximately 350 NEOs discovered with small but non-zero probability of impact this century



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Highlights (2 of 8)

Threats (concluded)

- Two known objects with diameters over 100m have impact probabilities of $\sim 1/4000$ in the 2050 timeframe (impact energy >100 MT)
- Recognition that Tunguska-class disaster could currently occur with no or little warning given available search and detection assets
- New wide sky search systems could provide 1-3 month warning time for 30-50m diameter object (Tunguska-class)



Highlights (3 of 8)

Discovery and Characterization

- Estimate that there are 990 ± 35 NEOs greater than 1km in diameter
- ~80% of objects larger than 140 m but smaller than 1KM are undiscovered
- Funding increased for discovery, tracking resources (e.g., funding provided by the European Commission, NASA support for Arecibo)



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Highlights (4 of 8)

Discovery and Characterization (concluded)

- Making significant progress on discovering NEOs >300 m in diameter (~45% completion)
- Increased understanding of keyholes and how deflection efforts vary if act before or after keyhole passage
- Potential for human missions to gather data that will minimize uncertainty for planetary defense efforts



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Highlights (5 of 8)

Preparing for Action

- Increasing international recognition of threat of NEO impacts
- UN COPUOS (Action Team 14) developing framework for international decision-making and coordinated action in event threatening object discovered



Highlights (6 of 8)

Public Education

- New interactive web tools being developed to help public understand mission design
- A survey of students indicates interest in asteroid impacts, planetary defense
- Suggestion that topics of past impacts and planetary defense might be included in the geography curriculum in schools, be highlighted at planetariums, and also include societal implications of an impact



Highlights (7 of 8)

Deflection and Disruption

- Characterization of deflection/disruption techniques advancing
- Use of nuclear devices discussed as a necessary mitigation technique for objects discovered with short warning before impact and for larger objects
- Proposal that “kits” of available parts would expedite fabrication of deflection or disruption payloads



Highlights (8 of 8)

Civil Defense

- Civil defense (evacuations, etc.) should include responses to the possibility of objects discovered with short warning times
- Public understanding of the NEO risk and effects can be increased via “teaching moments”
- Increase focus on civil defense/emergency management issues at future conference



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Recommendations (1 of 3)

- Develop deflection/disruption options, civil defense plans for the most probable impact threats of smaller NEOs with a short warning times
- Conduct flight validation/demonstration of key technologies for deflection/disruption options
- Encourage other nations to participate in planetary defense and present status at future conferences
- More governments should make funds available for planetary defense studies and civil defense exercises
- Put a sensor interior to Earth's orbit to discover NEOs with Earth-like and interior orbits and orbits with perihelia that take them close to the sun



Recommendations (2 of 3)

- Conduct more surveys of public opinions and use these to guide public education
- Examine how an airburst over water might couple with ocean surface to lead to a tsunami
- Examine impact energy transport into the atmosphere and resulting short and long-term effects
- Use teachable moments (November 2011 pass of object 2005 YU55*) to inform the public of the risk and how a mitigation effort might evolve

* 400m Diameter asteroid; will pass within the orbit of the Moon on November 8, 2011



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Recommendations (3 of 3)

- Consider system of university and amateur telescopes that could increase follow-up after new discoveries, detect short warning threats
- Determine what resources should be maintained over the long term to assure adequate deflection/disruption/civil defense actions are available when required
- Consider quick reassignment of general purpose missions to planetary defense for short warning time threats
- Pay attention to and resolve related policy and legal issues
- Work to better leverage funding to NASA, ESA, Russian, other space efforts for progress on planetary defense-related programs
- Continue evolution of framework for international decisions and coordinated action



Summary

- Planetary defense is an international issue
- 2011 IAA Planetary Defense Conference provided the most current information on NEO hazards, options for mitigation and related issues
- Mitigating a threat may require
 - Decisions and agreements by the world community
 - Coordinated actions by space-faring nations
 - Resolving related legal & policy issues
 - Planning for NEO-related disasters in civil defense exercises
- Proceedings and other details will be available at www.pdc2011.org and through IAA



Many Thanks...

...To the Romanian Space agency for outstanding hospitality and support of the conference.

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Next Meeting: 2013



1.2 kilometer BARRINGER (OR METEOR) CRATER, Arizona, was created about 49,000 years ago by a small nickel-iron asteroid (Photo by D.J. Roddy and K.Zeller, USGS; Reprinted courtesy of USGS)

2013 IAA Planetary Defense Conference
will be hosted by
NASA
in
Flagstaff, Arizona.
Will include
tour of
Meteor Crater

