

## **Status of the International Asteroid Warning Network (IAWN)**

**L. Johnson, NASA NEO PE**

## **Space Mission Planning Advisory Group (SMPAG)**

**G. Drolshagen, ESA, Chair of SMPAG**

# IAWN and SMPAG Establishment

Establishment of the International Asteroid Warning Network (IAWN) and Space Mission Planning Advisory Group (SMPAG) was recommended by the Working Group on near-Earth objects of the STSC during its 50<sup>th</sup> session in February 2013 and formally endorsed by UN COPUOS at its 56<sup>th</sup> session in June 2013 and by the 68<sup>th</sup> session of the UN General Assembly in December 2013.



# International Asteroid Warning Network - Status

## ■ **Two Steering Committee Meetings in 2014**

- Formulation Meeting – Jan 13-14 hosted by Minor Planet Center
- NEO Characterization Activities – Nov 11 @ AAS/DPS Tucson, AZ

## ■ **Letter of Intent for Participating Partners**

- Operational Principles
- Functions

## ■ **Contributing Observatories**

## ■ **Communications Workshop**

- Findings and Recommendations

## ■ **See further information:**

**<http://minorplanetcenter.net/IAWN/>**

# International Asteroid Warning Network Steering Committee

Representatives of core capabilities for the IAWN will form a Steering Committee to better coordinate the operation and interchange of the network, and guide its growth, enhancement and evolution. The Steering Committee intends to meet on approximately an annual basis to perform a review and provide guidance and recommendations.

Current Steering Committee Members:

|  |                                |
|--|--------------------------------|
| Sergio Camacho (UNCOPUOS/NEO WG Chair)               | Alan Harris (DLR)              |
| Lindley Johnson (NASA HQ/NEO PE)                     | Detlef Koschny (ESA/ESTEC)     |
| Boris Shustov (Institute of Astronomy, RAS)          | Tim Spahr (MPC)                |
| Giovanni Valsecchi (INAF-IAPS/NEODyS)                | Karel van der Hucht (SRON/IAU) |
| Patrick Michel (Observatoire de la Côte d'Azur/CNRS) | Don Yeomans (JPL/NASA NEO PO)  |

# International Asteroid Warning Network

## Letter of Intent

### **Participation:**

Participation in the IAWN is entirely voluntary and each participant's activities are funded through their own resources. The IAWN can be supported by:

- Survey telescope operations;
- Critical follow-up observations;
- Orbit computation and hazard analysis;
- Observations to characterize specific NEOs;
- Data distribution, processing, and/or archiving;
- Other analysis and infrastructure contributions.

New facilities and capabilities may contribute to the IAWN as they come online and are integrated into the network.

Partners signal their willingness to participate in IAWN activities by sending a Letter of Intent to the IAWN Steering Committee.

# Existing Worldwide Observing Network



In 2014

Received ~15 Million Observations from 239 Observatories in 31 countries  
(and one in space!)

IAWN status, Feb 2015, L. Johnson

# International Asteroid Warning Network

## Letter of Intent

### Operational Principles

The overall needs, goals, and objectives of the IAWN are to:

- Maintain, support, and enhance existing ground-based observation facilities that currently perform discovery and physical characterization of NEOs;
- Develop international rapid all-sky search capacity, geared towards discovering small, imminent impactors;
- Build ground-based facilities to globally survey larger areas of sky to fainter magnitudes;
- Develop a well-positioned space-based infrared survey to discover objects much faster than the current rate; and
- Establish an international communication policy and procedures regarding close approaches and impact risks.

# International Asteroid Warning Network

## Letter of Intent

### **To execute the objectives, the functions of the IAWN are to:**

- Discover, monitor, and characterize potentially hazardous NEOs using optical and radar facilities and other assets based in the northern and southern hemispheres and in space;
- Provide and maintain an international clearing house for the receipt, acknowledgement, and processing of all NEO astrometric observations and orbits to provide a global NEO database;
- Serve as the international focal point for accurate information on the NEO population and any hazards they pose to the Earth;
- ....
- Recommend policies regarding criteria and thresholds for notification of an emerging NEO impact threat;
- Develop a database of potential impact consequences, depending on geography, geology, population distribution, and other related factors;
- Assess hazard analysis results and communicate them to entities identified by partners as being responsible for the receipt of notification of an impact threat in accordance with established policies; and
- Assist Governments in the analysis of impact consequences and in the planning of mitigation responses.

# IAWN Communications Workshop

- Secure World Foundation hosted a 1.5 day workshop on communication about near-Earth object (NEO) hazards and plans for NEO impact mitigation at the request of the International Asteroid Warning Network (IAWN), an international group of organizations involved in detecting, tracking, and characterizing NEOs.
- The goal of the workshop was to constitute a first step toward embedding communication strategy and planning in IAWN operations by providing communication guidance and advice to managers and directors of IAWN member programs and institutions. Key themes, findings and recommendations derived from the discussion were captured in a workshop report submitted to IAWN.



# IAWN Comms Workshop Findings

## **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 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 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.

# IAWN Comms Workshop Recommendations

## **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. A “Broomfield Hazard Scale” is proposed for IAWN 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](http://www.iawn.int) immediately.
- IAWN should employ a full-time Webmaster to create and maintain its website.

# **Status of SMPAG**

# SMPAG Purpose

The purpose of the SMPAG is to prepare for an international response to a NEO impact threat through the exchange of information, development of options for collaborative research and mission opportunities and NEO threat mitigation planning activities.



# SMPAG Formation and Schedule

The SMPAG was officially established during a meeting at ESOC, Darmstadt, on 6/7 February 2014.

During a second meeting on 12-13 June 2014, held at the margins of COPUOS, the Terms of Reference were finalized.

ESA was elected as SMPAG chair for 2 years.

The establishment of a work plan was started.

A SMPAG Steering Committee meeting will be held on 5/6 February 2015 on the margins of this STSC meeting.

The next SMPAG plenary meeting will be held on 9/10 April 2015 at ESRIN, Frascati (Italy).

# SMPAG Terms of Reference

## **Main points of the SMPAG Terms of Reference:**

- Membership is open to all national space agencies or governmental or inter-governmental entities that coordinate and fund space activities and are capable of contribution to or carrying out a space based NEO mitigation campaign.
- SMPAG consists of a plenary group and a steering group with a rotating chair.
- Delegates have to be nominated by the SMPAG members.
- New members may be included upon consensus of the current members.
- Any member may withdraw its membership at any time.
- Each member shall provide its own funding and resources for its activities

# **SMPAG Membership**

## **(Status 4 February 2015)**

### **Official members with nominated delegations:**

|                   |                                |
|-------------------|--------------------------------|
| AEM (Mexico)      | ESA                            |
| ASI (Italy)       | NASA (USA)                     |
| Belspo (Belgium)  | ROSA (Romania)                 |
| CNES (France)     | ROSCOSMOS (Russian Federation) |
| DLR (Germany)     | SSAU (Ukraine)                 |
| IAWN (ex officio) | SUPARCO (Pakistan)             |
| JAXA (Japan)      | UKSA (UK)                      |

### **Official application received:**

ISA (Israel)

### **Intention of Membership indicated:**

CSA (Canada)

China

# SMPAG Draft Work Plan

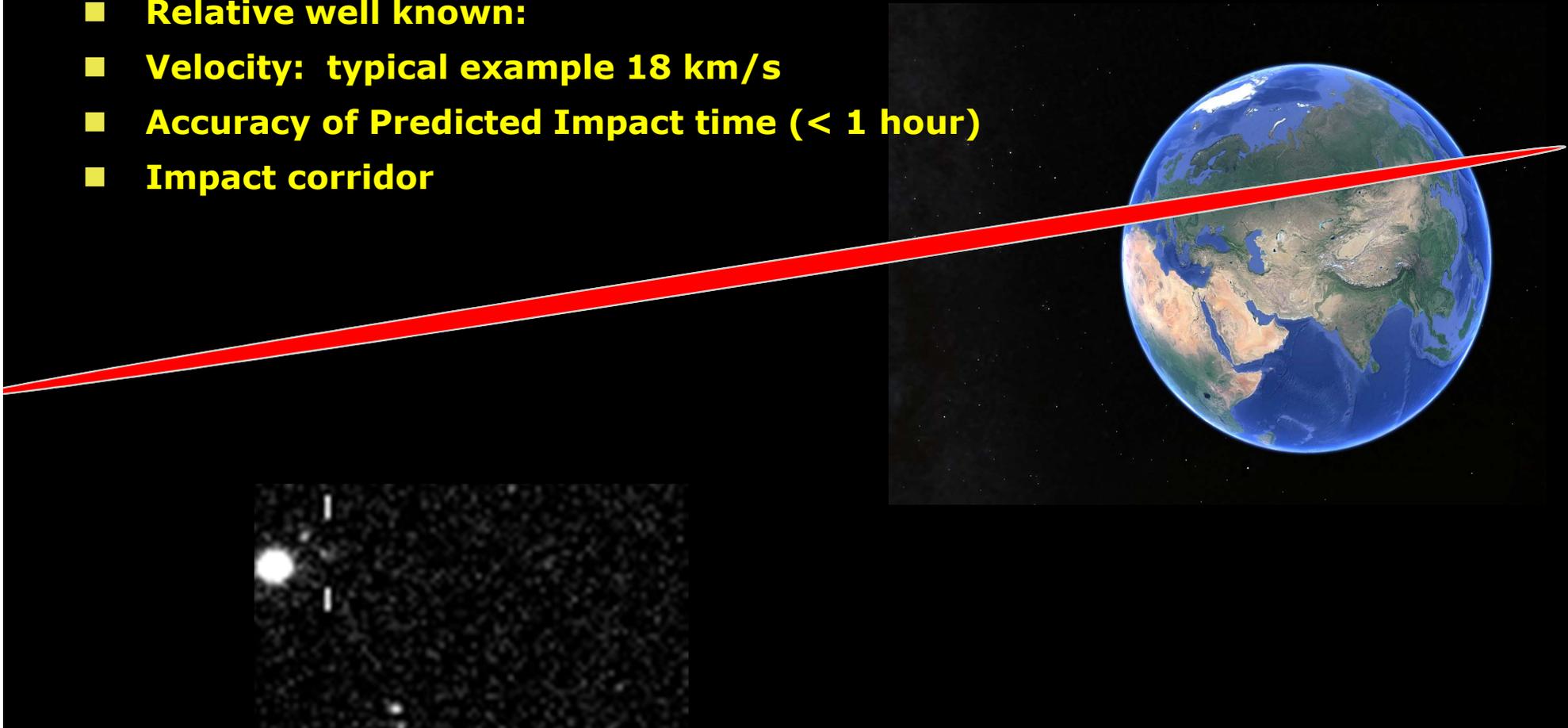
## **An initial list of 10 activities has been identified by SMPAG:**

- Recommend, in collaboration with the IAWN, criteria and thresholds for action. (Lead: NASA)
- Develop and agree to a set of reference missions addressing a variety of potential NEO impact cases and deflection/disruption possibilities. (Lead: ASI)
- Develop a plan for SMPAG action to be implemented in case of a credible threat identified by the IAWN. (Lead: TBD)
- Develop guidelines for communication to be followed in case of a credible threat identified by the IAWN. (Lead: NASA)
- Produce a 'road map' for work that is needed in the future to support planetary defense. (Lead: DLR)

# Threshold and criteria for NEO deflection mission

## Example of initial uncertainties:

- **Impact probability: < 10 %**
- **Size estimate: 40 m - 120 m (based on brightness)**
- **Relative well known:**
- **Velocity: typical example 18 km/s**
- **Accuracy of Predicted Impact time (< 1 hour)**
- **Impact corridor**



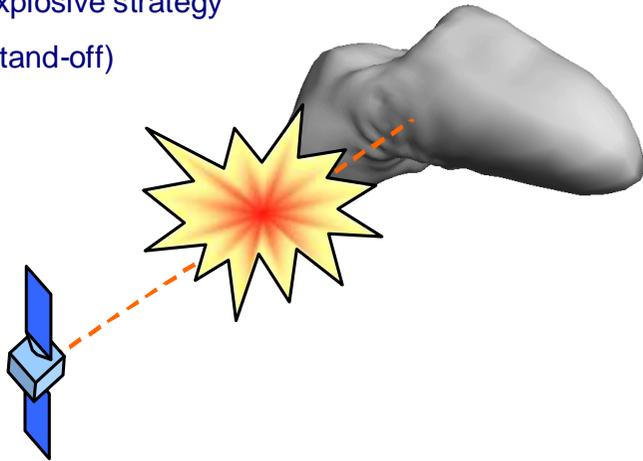
**Orbit uncertainty as seen from the asteroid**

# SMPAG Draft Work Plan, cont.

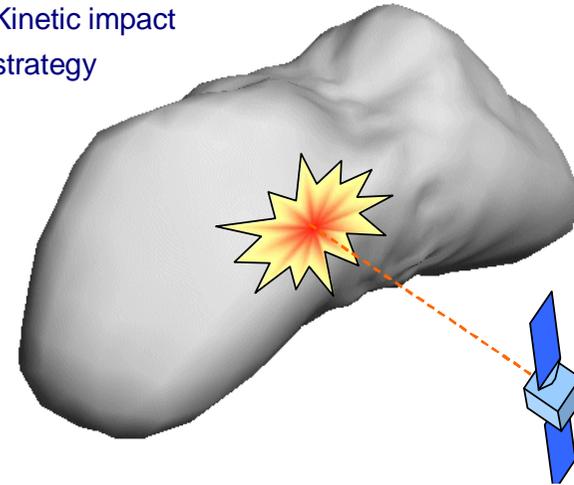
- Develop decision and event timelines for a variety of potential Earth impactors and trajectories identified in the applicable reference missions. (Lead: ESA)
- Evaluate the technical maturity and consequences, including failure, of space based NEO mitigation techniques. (Lead: TBD)
- Recommend criteria for deflection targeting, such as a minimum acceptable Earth-miss distance. (Lead: TBD)
- Study the nuclear device option and how to deal with it. (Lead TBD)
- Identify a 'toolbox' for a characterization payload (Lead: proposal to lead this activity was received from CNES)

# Possible NEO Deflection Strategies (Illustrationen von L. Cano, Deimos)

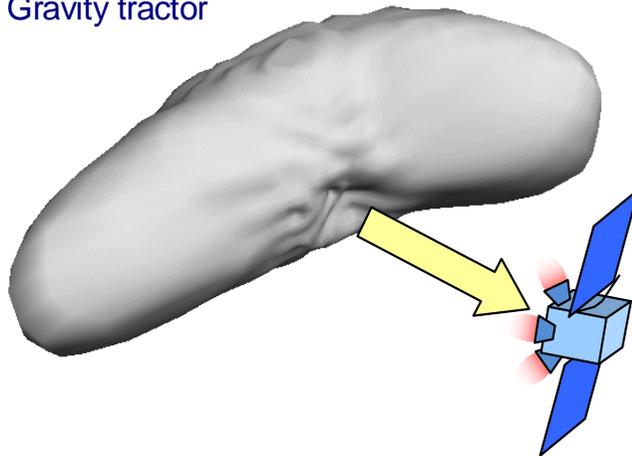
Explosive strategy  
(stand-off)



Kinetic impact  
strategy



Gravity tractor



Ion beam shepherd

