Near-Earth Object Surveys and Hazard Mitigation Strategies

An NRC Study

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Background

- Study by NRC mandated by congress as part of Consolidated Appropriations Act of 2008
  - Congress found NASA's own study in 2006 (submitted in 2007) to be not sufficiently responsive to the George E. Brown Near-Earth Object Survey Act of 2005
- NOT driven by science!
  - Primarily a sociological issue
  - Science is involved
    - As necessary input
    - As byproduct output
- SBAG needs to keep this issue in context

Mandate

- Review NASA's 2006 study
  - *Near-Earth Object Survey and Detection Study*, *Near-Earth Object Survey and Deflection Analysis of Alternatives: Report to Congress*
  - Any other relevant material
- Provide recommendations focusing on both
  - Optimal approach to surveying NEO population (≥ 140m)
  - Developing a deflection capability

NEO Surveys

- What observational, data-reduction, and data-analysis capabilities are needed to achieve the congressional mandate of identifying the NEO population of interest?
- What characteristics of individual objects must be determined (beyond accurate orbits) to support mitigation efforts
- What are relative roles of ground-based & space-based, including PanSTARRS & LSST?
- What radar resources are needed & what role should Arecibo play?
  - How important is range+velocity for data triage?
  - How important is ability to distinguish multiples?
  - How should radar be efficiently integrated with optical surveys?
  - What is current status of and future prospects for radar systems capable of observing NEOs?

Mitigation

- What mitigation strategy should be followed when a potentially hazardous NEO is identified?
- What are relative merits & cost of various deflection scenarios that have been proposed?
- How should U.S. strive to make efforts international?

Members

Steering Committee

- Irwin Shapiro
  - Chair
- Faith Vilas
  - Vice-Chair - Survey
- Michael A'Hearn
  - Vice-Chair - Mitigation
- Andrew Cheng
- David Jewitt
- Stephen Mackwell
- Frank Culbertson
- H. Jay Melosh
- Bong Wie
- 1 TBD

NRC Study Directors

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- Paul Jackson
- David Smith

Detection Panel

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  - Chair
- Paul Abell
- Robert F. Arentz
- Lance A. M. Benner
- William E. Burrows
- Andrew Cheng
- Robert D. Culp
- Alan Dressler
- Yanga (Yan) Férnandez
- Lynne Jones
- Amy Mainzer
- Gordon Pettengill
- John Rice

Mitigation Panel

Not Yet Appointed

Schedule

- Steering Committee
  - Met 9-11 December
  - Will meet twice more
- Detection Panel
  - Will meet 28-30 January
  - Will meet twice more
- Mitigation Panel
  - Will meet three times
  - First meeting to be after second meeting of Detection Panel
- Request for Information
  - Mini-proposals for systems to address either aspect
  - Some will be sent for independent cost estimates
  - Letter of intent desired by 30 Jan
  - Proposal due by March 20

Contacts

- Web Page for Study
  - http://www7.nationalacademies.org/ssb/NEO_surveys_mitigation.html
- Questions to Study Director
  - dday at nas.edu
- Questions to Committee
  - ishapiro at cfa.harvard.edu; fvilas at mmto.org; ma at astro.umd.edu
- RFI responses and inquiries
  - neorfi at nas.edu

Backup

TITLE VIII--NEAR-EARTH OBJECTS

SEC. 801. REAFFIRMATION OF POLICY.

(a) Reaffirmation of Policy on Surveying Near-Earth Asteroids and Comets- Congress reaffirms the policy set forth in section 102(g) of the National Aeronautics and Space Act of 1958 (42 U.S.C. 2451(g)) (relating to surveying near-Earth asteroids and comets).

(b) Sense of Congress on Benefits of Near-Earth Object Program Activities- It is the sense of Congress that the near-Earth object program activities of NASA will provide benefits to the scientific and exploration activities of NASA.

SEC. 802. FINDINGS.

Congress makes the following findings:

(1) Near-Earth objects pose a serious and credible threat to humankind, as many scientists believe that a major asteroid or comet was responsible for the mass extinction of the majority of the Earth's species, including the dinosaurs, nearly 65,000,000 years ago.

(2) Several such near-Earth objects have only been discovered within days of the objects' closest approach to Earth and recent discoveries of such large objects indicate that many large near-Earth objects remain undiscovered.

(3) Asteroid and comet collisions rank as one of the most costly natural disasters that can occur.

(4) The time needed to eliminate or mitigate the threat of a collision of a potentially hazardous near-Earth object with Earth is measured in decades.

(5) Unlike earthquakes and hurricanes, asteroids and comets can provide adequate collision information, enabling the United States to include both asteroid-collision and comet-collision disaster recovery and disaster avoidance in its public-safety structure.

(6) Basic information is needed for technical and policy decisionmaking for the United States to create a comprehensive program in order to be ready to eliminate and mitigate the serious and credible threats to humankind posed by potentially hazardous near-Earth asteroids and comets.

(7) As a first step to eliminate and to mitigate the risk of such collisions, situation and decision analysis processes, as well as procedures and system resources, must be in place well before a collision threat becomes known.

Cont.

SEC. 803. REQUESTS FOR INFORMATION.
The Administrator shall issue requests for information on--
(1) a low-cost space mission with the purpose of rendezvousing with, attaching a tracking device, and characterizing the Apophis asteroid; and
(2) a medium-sized space mission with the purpose of detecting near-Earth objects equal to or greater than 140 meters in diameter.

SEC. 804. ESTABLISHMENT OF POLICY WITH RESPECT TO THREATS POSED BY NEAR-EARTH OBJECTS.
Within 2 years after the date of enactment of this Act, the Director of the OSTP shall--
(1) develop a policy for notifying Federal agencies and relevant emergency response institutions of an impending near-Earth object threat, if near-term public safety is at risk; and
(2) recommend a Federal agency or agencies to be responsible for--
(A) protecting the United States from a near-Earth object that is expected to collide with Earth; and
(B) implementing a deflection campaign, in consultation with international bodies, should one be necessary.

SEC. 805. PLANETARY RADAR CAPABILITY.
The Administrator shall maintain a planetary radar that is comparable to the capability provided through the Deep Space Network Goldstone facility of NASA.

SEC. 806. ARECIBO OBSERVATORY.
Congress reiterates its support for the use of the Arecibo Observatory for NASA-funded near-Earth object-related activities. The Administrator, using funds authorized in section 101(a)(1)(B), shall ensure the availability of the Arecibo Observatory's planetary radar to support these activities until the National Academies' review of NASA's approach for the survey and deflection of near-Earth objects, including a determination of the role of Arecibo, that was directed to be undertaken by the Fiscal Year 2008 Omnibus Appropriations Act, is completed.

SEC. 807. INTERNATIONAL RESOURCES.
It is the sense of Congress that, since an estimated 25,000 asteroids of concern have yet to be discovered and monitored, the United States should seek to obtain commitments for cooperation from other nations with significant resources for contributing to a thorough and timely search for such objects and an identification of their characteristics.

Cont.

Language directing the study (from the joint explanatory statement for the 2008 appropriations):

Further, the Appropriations Committees are concerned that NASA may reduce support for the Arecibo Observatory which is used by NASA to observe and detect NEOs. The Committees believe that this observatory continues to provide important scientific findings on issues of near-space objects, space weather, and global climate change, as well as numerous other research areas. The Committees believe that these endeavors will have scientific merit far beyond the end of the decade. NASA is directed to provide additional funding the Arecibo Observatory.

In order to assist Congress in determining the optimal approach regarding the Arecibo Observatory, NASA shall contract with the National Research Council to study the issue and make recommendations. As part of its deliberations, the NRC shallį review NASA's report *2006 Near-Earth Object Survey and Deflection Study* - and its associated *March 2007 Near-Earth Object Survey and Deflection Study* as well as any other relevant literature. An interim report, with recommendations focusing primarily on the optimal approach to the survey program, shall be submitted within 15 months of enactment of this Act. The final report, including recommendations regarding the optimal approach to developing a deflection capability, shall be submitted within 21 months of enactment of this Act. The NRC study shall include an assessment of the costs of various alternatives, including options that may blend the use of different facilities (whether ground- or space-based), or involve international cooperation. Independent cost estimating should be utilized.