

# Near-Earth Object Observations Program

The key element of NASA's Planetary Defense effort is the Near-Earth Object (NEO) Observations Program, which is composed of projects to find, track, and characterize NEOs.

## **THE OBJECTIVE**

The current congressionally directed objective of the NEO Observations Program is to find, track, and characterize at least 90 percent of the predicted number of NEOs that are 140 meters and larger in size - larger than a small football stadium - and to characterize a subset representative of the entire population. Objects of this size and larger pose a risk to Earth of greatest concern due to the level of devastation an impact would cause, and should continue to be the focus of global search efforts. While no known asteroid larger than 140 meters in size has a significant chance to hit Earth for the next 100 years, only about 40% of those asteroids have been found to date.

## **FIND AND OBSERVE**

The NEO Observations Program sponsors projects that make use of telescopes around the world to search for NEOs, track them across the sky to determine their orbits, and gain information on their sizes, shapes, and composition.

The Minor Planet Center (MPC) is the internationally agreed-to public archive of small-body orbit data submitted by observers from around the world. The MPC notifies observers worldwide about NEO discoveries so that timely follow-up observations can be collected for identification, and orbit computation.

The MPC is sanctioned by the International Astronomical Union and supported by the PDCO as an element of NASA's Planetary Data System.

## **PREDICT THE ORBIT**

The Center for Near-Earth Object Studies (CNEOS) computes high-precision orbit paths for NEOs from positions reported to the MPC. CNEOS computes orbits for new asteroid discoveries and performs long-term analyses of possible future positions of hazardous asteroids relative to Earth to determine and warn of any impact hazard. CNEOS computes impact time and location in the event of a predicted impact. The Jet Propulsion Laboratory hosts CNEOS for the NEO Observations Program, and its website makes all orbit computation public.

## **CHARACTERIZE THE RISK**

The more that is known about a particular asteroid, the better it can be determined what effects an impact might cause and what sort of damage might occur. The Asteroid Threat Assessment Project at NASA Ames predicts if an asteroid might disintegrate in Earth's atmosphere or reach the surface and determines the level of potential damage to inform a strategy for a response. Any possible in-space deflection mission would depend on the asteroid's physical characteristics such as size, shape, density, and composition. NASA's NEO Observations Program supports research aimed at characterizing NEOs through telescopic measurements, made with radar telescopes, and analyses of meteorites found on Earth.

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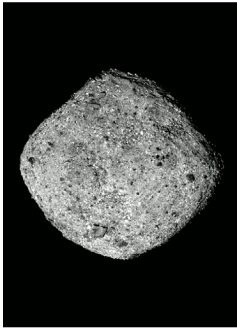


Planetary Defense  
Coordination Office





Chelyabinsk Meteor



Bennu  
NASA



Radar Image of  
2012 JO25  
Arecibo/NSF/NASA



Itokawa  
JAXA

## NASA's Planetary Defense Coordination Office

Near-Earth objects (NEOs) are asteroids and comets that orbit the Sun like the planets, but their orbits can bring them into Earth's neighborhood - within 30 million miles of Earth's orbit. NEOs are of great interest to the scientific community, but planetary defense is "applied planetary science" to address the NEO impact hazard.

"Planetary Defense" encompasses all the capabilities needed to detect the potential and warn of asteroid or comet impacts with Earth, and then either prevent them or otherwise mitigate their possible effects. NASA established the Planetary Defense Coordination Office (PDCO) to manage its ongoing mission of planetary defense.

The PDCO:

- Provides early detection of hazardous NEOs whose orbits predict they will come within 5 million miles of Earth's orbit; and of a size large enough (30 to 50 meters) to damage Earth's surface;
- Tracks and characterizes NEOs and issues warnings of the possible effects of potential impacts;
- Provides timely and accurate information on NEOs; and

- Plays a lead role in coordinating U.S. government planning for response to an actual impact threat.

### FIND

The PDCO sponsors projects through its Near-Earth Object (NEO) Observations Program that employ a variety of ground and space based telescopes to search for NEOs, determine their orbits, and measure their physical characteristics. The PDCO is studying possible space-based telescope missions optimized for NEO search and characterization that could accelerate the discovery of the currently undetected NEOs.

### WARN

The PDCO is responsible to provide timely and accurate information to the government, the media, and the public on close approaches to Earth by NEOs and any potential for impact. If any NEO is found to pose a significant chance of impacting Earth (greater than 1 percent over the next 50 years), the PDCO will provide notification messages for NASA to send to the Executive Office of the President, the U.S. Congress, and other government departments and agencies.

### MITIGATE

The PDCO sponsors studies of technologies and techniques for deflecting an asteroid off a predicted impact course with Earth. It is developing missions to demonstrate those technologies and determine their effectiveness in the event that these techniques must be utilized against a predicted asteroid impact threat.

### COORDINATE

The PDCO works with other government agencies to develop and update a National NEO Preparedness Strategy and Action Plan. The PDCO also provides expert input on the nature and effects of asteroid impacts to the Federal Emergency Management Agency (FEMA), so that adequate emergency response can be prepared in the event of an NEO impact that is not possible to avoid.

The PDCO also coordinates efforts with the space agencies of other nations as a member of the multinational International Asteroid Warning Network and the Space Missions Planning Advisory Group, under the endorsement of the United Nations Committee on the Peaceful Uses of Outer Space.

### Cover Image

Pan-STARRS, University of Hawaii

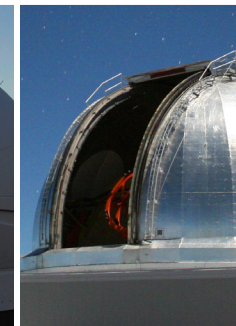
Catalina Sky Survey  
University of Arizona



Pan-STARRS  
University of Hawaii



NASA's Infrared  
Telescope Facility (IRTF)



Goldstone Radar  
NASA/JPL



The PDCO is managed within the Planetary Science Division of the Science Mission Directorate at NASA Headquarters in Washington, D.C.



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