Winter 2024

IAF COMMITTEE ON PLANETARY DEFENSE AND NEAR-EARTH OBJECTS (NEOs)

Introduction

Planetary defense is the term used to encompass all the capabilities needed to detect and warn of potential asteroid or comet impacts with Earth, and to prevent and mitigate their possible effects. A Near-Earth object (NEO) is an asteroid or comet whose orbit brings it within about 50 million kilometers or less of Earth's orbit. The primary objective of the Technical Committee (TC) on Planetary Defense and Near-Earth Objects (NEOs) is to raise awareness among the global space community, particularly the IAC audience, about the ongoing work within the planetary defense community and to get more people, especially students and young professionals, interested and actively participating in the field.

Summary

Planetary Defense remains a hot topic with several missions in flight, in preparation, being planned, or being repurposed after the main mission has been successfully accomplished. Workshops, conferences, and scientific meetings are being held and outreach activities such as Asteroid Day on 30 June are taking place.

The DART team keeps analyzing the data from the first actual impact deflection test in September 2022 on Dimorphos, the small moon of the binary asteroid Didymos, to better understand its outcome and make predictions for what the ESA Hera mission will discover when reaching the Didymos system in fall 2026. A series of papers have been submitted in fall 2023 exposing the current understanding of the outcome and predictions to various journals, including those of the Nature and Science Groups.

Highlights

OSIRIS-Rex, launched on 8 September 2016, is the first U.S. mission to collect a sample from an asteroid. It returned to Earth on 24 September 2023, to drop off material from asteroid Bennu. The spacecraft did not land, but continued on to a new mission, OSIRIS-APEX, to explore asteroid Apophis a few days after its closest passage to the Earth on 13 April 2029. The analysis of Bennu's sample will help scientists investigate how planets formed and how life began, as well as improve our understanding of asteroids that could impact Earth, noting that Bennu has still a non-zero, but yet very small, probably of impacting the Earth in 2182. While writing this report, the cylinder containing the sample was not opened yet, but 70 grammes were already collected surrounding the cylinder in the re-entry capsule, which is more than the minimum goal of 60 grammes. Carbon, water-bearing minerals, sulfide minerals as well as iron oxide mineral have already been identified.

The JAXA Hayabusa# (# for Sharp, as Small Hazardous Asteroid Reconnaissance Probe) is on its way for a rendezvous to the small (30 m diameter) fast rotator (10 min spin period) 1998KY26, which will be the smallest NEO ever visited, in 2031. The object is a Tunguska-size object, and the knowledge of its properties will allow us to be best prepared if such a small object comes to Earth, which occurs on average every several hundred years.

Future Outlook

In October 2024 (one week before the IAC in Milan), ESA's Hera mission will launch the same binary asteroid system that saw the DART impact in September 2022. After its rendezvous with the binary system at the end of December 2026, it will measure in detail the effect the impact had on Dimorphos as well as the physical and compositional properties of the asteroid, including for the first time the internal structure, which have great influence on the impact outcome. With DART, it will offer the first fully documented impact deflection test at the scale of an asteroid and improve greatly our understanding of the geophysics of near-Earth asteroids.

The RAMSES mission is under study at ESA to perform a rendezvous with the asteroid Apophis before its closes passage to the Earth on April 13, 2029, in order to characterize the properties of the asteroid before and during the passage and observe possible surface change due to Earth tidal forces. The data can then be compared with those of NASA OSIRIS-APEX taken a few days after the closes passage, allowing to possible observe long time effects. RAMSES relies on the platform developed for Hera and, if funded, would allow demonstrations that we can rapidly implement a space mission, noting that the launch needs to occur in April 2027 for a rendezvous, which is very short in current standards. Discussions are taking place with ESA delegations to get it funded, so that we do not miss the unique chance to have a mission around Apophis while more than 2 billion people can observe it from the Earth in Western Europe and North Africa with naked eyes, something that only occurs once in a millennium.

A group is also proposing to the UN that 2029 officially becomes the international year of planetary defense. The proposal is under finalization and the decision should take place in 2024.

Committee activities

During the Special Session organized by the committee at IAC 2023 in Baku, Apollo 9 astronaut Rusty Schweickart announced the Schweickart prize, open to students globally who contribute to planetary defense. The committee is supporting this initiative.

https://www.schweickartprize.org/