EPSC Abstracts
Vol. 13, EPSC-DPS2019-1305-1, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

Planetary Defence: Science, Technology & Society

B.H. Foing (1, 2, 3, 4) (1) ESA ESTEC ; (2) ILEWG; (3) VU Amsterdam; (Bernard.Foing@esa.int)

We need to reinforce efforts for planetary defence in Science, Technology & Society aspects. ESA is developing a space safety programme that includes planetary defence: "ESA has been considering the use of space missions for asteroid risk assessment for almost two decades. Although the chance of a major asteroid impact is low, the potential consequences to our society could be very severe. Small bodies are continually colliding with Earth, however, the vast majority of these objects are very small and pose no threat to human activity.

The cratered face of the Moon is mute testimony to the frequency of asteroid strikes in the Solar System. And Earth itself is hardly immune., with upwards of three million impact craters larger than 1 km in diameter – the largest stretching more than 1000 km in diameter.

The 1908 Tunguska impact in Siberia, the largest impact in recorded history, is thought to have been triggered by an incoming object of 60 m to 190 m in diameter. The 2013 Chelyabinsk airburst, whose shockwave struck six cities across Russia, may have been caused by an asteroid just 20 m in diameter.

The effects of an asteroid impact on Earth depends on many factors, such as, for instance, the location of impact, trajectory and physical properties of the asteroid, etc.. We do have the technology available to mitigate such a threat, but it has never been tested in realistic conditions. Moreover, the design of an efficient mitigation strategy relies on our understanding of the physical properties of threatening objects and their response to a mitigation tool, which is still extremely poor.

Most of the techniques that have been proposed to avoid an Earth impact event are linked to altering the trajectory of an asteroid on a collision course with Earth. Among these proposals, the one that is currently being considered as more mature, because it is based on existing and affordable spacecraft technology, is the kinetic impactor, which changes the orbit of an asteroid by a direct hit of a spacecraft at a very high relative speed (several km/s).

Europe has conducted thorough studies of this approach which would be suitable to address the statistically most common threats, namely of bodies of up to a few hundred meters in diameter. In the framework of such mitigation studies, a better understanding of the fragmentation process resulting from an impact is required to answer essential questions:

- How does impactor momentum transfer depend on the bulk density, porosity, surface and internal properties of the target near-Earth object (NEO) and the velocity vector of the impactor relative to the NEO?
- How much impactor kinetic energy may be going into fragmentation and restructuring or into the kinetic energy of the ejected material?
- Can momentum enhancing ejecta production be characterised in terms of parameters that are, for many objects, only available from ground-based observations, such as the taxonomic type?

ESA's Planetary Defence Office is an essential element in the Agency's space safety and security activities. The goals of the Office are to:

Become aware of the current and future position of near-Earth objects relative to our planet

Estimate the likelihood of Earth impacts

Assess the consequences of any possible impact

Inform relevant parties, e.g. national emergency response agencies

Develop methods to deflect any risky asteroids

The Planetary Defence Office conducts regular observation campaigns to look for risky space rocks, predicts their orbits, produces impact warnings when necessary and is involved in potential mitigation measures. The office divides its work into three areas: 1. Observation; 2. Data provision; 3. Mitigation "