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PLANETARY DEFENCE ACTIVITIES AT THE EUROPEAN SPACE AGENCY

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Extended Abstract—

ESA is preparing an ambitious Space Safety programme for which it seeks approval at the next council meeting on ministerial level at the end of the year 2019, called Space19+. It encompasses space weather, space debris, clean space and planetary defence. In a preparatory step, the Planetary Defence Office was founded on 1 October 2018. This paper will summarize the main tasks of this office.

1. First Pillar: Observations

The first pillar of ESA's Planetary Defence Office comprises surveying the sky in search for asteroids or in particular near-Earth objects (NEOs), and follow-up observations. As of today, the Optical Ground Station, a 1-m telescope located in Tenerife, is the major optical facility used by ESA for asteroid follow-ups and survey test observations. It is typically used 4 nights around new Moon for NEO observations, 4 other nights are used for space debris observations. Figure 1 shows the dome of the telescope.

Figure 1. ESA's 1-m telescope on Tenerife.

A 56-cm test-bed telescope (TBT) in Madrid is not yet fully operational, and a twin TBT is currently shipped to la Silla in Chile. Both telescopes will be primarily used to test the data processing chain that is currently being developed for the future Flyeye telescope.

Figure 2. ESA's 56-cm Test-Bed telescope close to Madrid.

Figure 3. ESA's Flyeye telescope currently under construction.

ESA is also sponsoring other national telescopes in Europe, like the Klet observatory in the Czech Republic and telescopes in Tautenburg, Germany, and in Spain. Furthermore, a collaboration with the 0.8 m Telescopi Joan Oró in the Spanish Pyrenees, the 0.6 m Observatoire des Makes, at Saint-Louis on Réunion Island and the International Scientific Optical Network (ISON) is performed.

In a few years the so-called Flyeye telescope will be deployed in Sicily, Italy (Ref. 1). It is currently being built by the Italian company OHB-I. A beam splitter will distribute the images on to 16 cameras each equipped with a 4k x 4k CCD. It will have a limiting magnitude of 21.5 at typical exposure times of 40 s and a field-of-view of 45 square degrees. By placing one in the Northern and one in the Southern hemisphere, the entire sky will be scanned within 48 hours. Simulations have shown that about 4 asteroids larger than 1 meter can be detected every year before they will impact on Earth (Ref. 2).

2. Second Pillar: Data Provision

The second pillar comprises orbit determination, impact risk calculation and data provision. The NEODyS software developed at the University of Pisa is currently migrated (Ref. 3) to our NEO Coordination Centre (NEOCC) at ESRIN (Frascati, Italy). It consists of an orbit determination tool that runs hourly scripts to continuously digest new observations from the Minor Planet Center, and of an impact monitoring tool, that calculates the impact risk of potential impactors typically for the next 100 years. Figure 4 shows the risk list of potential impactors as of 27 March 2019. 834 objects are listed with an impact probability larger than zero.

A more detailed description of the NEOCC will be given in a separate paper at this conference.

Object Name	Diameter [m]	Date/Time	IP max	PS max
2010RF12	9*	2095-09-05 23:50	1/16	-3.26
1979XB	900*	2113-12-14 18:07	1/1.84E6	-3.28
2000SG344	50*	2071-09-16 00:26	1/2096	-3.63
99942 Apophis	375	2068-04-12 15:13	1/531914	-3.67
2018XB4	70*	2092-06-22 22:49	1/6896	-3.69
2009JF1	16*	2022-05-06 08:12	1/4464	-3.75
2006QV89	40*	2019-09-09 07:03	1/11428	-3.79

Figure 4. Asteroid risk list maintained at the NEOCC at the NEO Coordination Centre in Frascati, Italy.

3. Third Pillar: Mitigation

The third pillar covers possible mitigation options and the related information flow. A space-based fireball camera is being developed, an impact effects knowledge base and an impact effects simulation tool is built and deflection techniques are investigated. If the funding is secured a spacecraft called Hera will be sent to Didymoon to observe the crater which was caused by the impact of the US-funded DART space mission. Hera is currently in Phase B1 with the system requirements review as the next coming milestone in this summer.

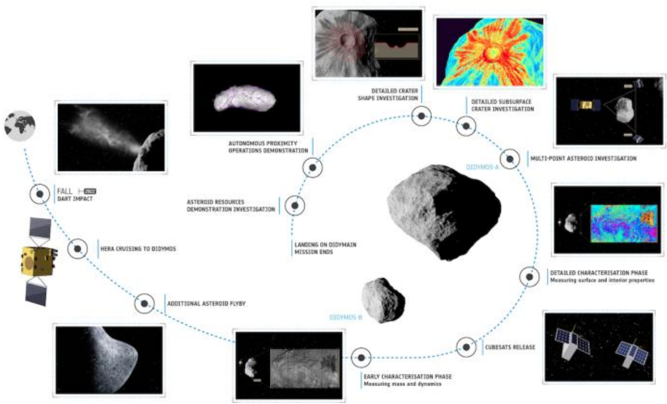

Figure 5. Hera mission scenario to characterize the crater produced by DART on Didymoon.

Finally, workshops with national civil protection authorities have taken place and are continuing. These aim at implementing information distribution guidelines and informing them about the asteroid impact threat. This work follows the guidelines defined by IAWN and SMPAG.

References

1. Cibin, L., Chiarini, M., Gregori, P., Bernardi, F., Ragazzoni, R., Sessler, G., Kugel, U. (2019, Jan.). The fly-eye telescope, development and first factory tests results. Paper presented at the ESA NEO and Debris Detection Conference, Darmstadt.

2. Ramírez Torralba, O., Jehn, R., Koschny, D., Michael Frühauf, M., Jehn, L. S., Praus, A. (2019, Jan.). Simulation of sky surveys with the Flyeye telescope. Paper presented at the ESA NEO and Debris Detection Conference, Darmstadt.

3. Drolshagen G., Bassano E., Bernardi F., Hahn G., Koschny D., Milani A., Perozzi E., Sanchez N., Valsecchi G., Weikert S, (2012). Precursor Services for a Near-Earth Object Segment of ESA's Space Situational Awareness Programme. Asteroids, Comets, Meteors 2012.