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Ongoing and Upcoming Mission Highlights

Key International and Policy Developments

Near-Earth Object (NEO) Discovery

NEO Characterization

Deflection / Disruption Modeling & Testing

Space Mission & Campaign Design ☒

Impact Effects & Consequences

Disaster Management & Impact Response

Public Education and Communication

The Decision to Act: Political, Legal, Social, and Economic Aspects

CO-ORBITAL CONVERGENCE – RALLYING SOLAR SAILS, SMALL SOLAR-ELECTRIC SPACECRAFT AND NANOLANDERS TO HELP SAVE US FROM A NASTY NEIGHBOUR SOON

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ABSTRACT

Out of the shadow that ever since the beginning the Sun's glare cast on the telescopes of Earth, fictitious asteroid 2023 PDC enters the stage on January 10th to be recognized over the next few months as a serious threat with potential for impact on Earth. It is trailing Earth but catching up, and seen from Earth's hazy sky at dusk, it slowly but steadily corkscrews in over the next 13¾ years towards an impact corridor that wraps itself nearly all the way around Earth.

In 2015, we drew a mission sketch combining the last of our then just freshly cancelled solar sail demonstrators, GOSSAMER-3, with the Flight Spare of MASCOT (which still is by and large available) on a one-way journey to visit one of the larger (and much more friendly) of Earth's nearest neighbours, aiming at (419624) 2010 SO₁₆ or 2010 TK₇.

In 2017, we further explored the capabilities of such small spacecraft solar sails and nanolandings, working cooperatively and in larger numbers for in-situ surveying and characterization of NEAs, also taking a peek towards their utility in space resources utilization by fathoming the interior of such rocks and rubble piling up as unstaked claims in the sky.

In 2019, benefiting much from all the paths not taken during our solar sail development of the GOSSAMER Roadmap period, we found that the exploration of NEAs is one of the no-limits of even "now-term" technology solar sails: As soon as you fly on the power of your own sail, you can go see asteroids.

In 2021, adding to our Multiple NEA Rendezvous solar sail mission concepts another dimension that we nicked from the well-emerged new space sector on the 10th anniversary of our contribution of 2011, ASTEROIDSQUADS, we introduced the idea of massively serial kinetic impact – think *ASTEROIDS™* –; then, as a last-ditch attempt at deflecting or at least eroding a bit an incoming asteroid discovered only a few months out on its fatal swan dive.

All these concepts leverage agile design and construction of small, and in particular nano-spacecraft that combine the carefree handling of cubesats with the dependability of larger spacecraft while implementing fully fledged planetary science missions. In all elements, the cooperatively connected sub-spacecraft are designed with strategic re-use in mind, while ad-hoc (or 'tactical') re-use is well possible and frequently employed for the compressed timelines of asteroid deflection exercises as well as in concurrent engineering studies or for responsive space missions like MASCOT2@AIM.

Needless to say that all this would also be of much use and benefit for, and could well accelerate the near and far future industrial and scientific exploration of small solar system bodies. But don't worry, we'll anyway tell you what a small-spacecraft solar

sail, solar-electric, or a MASCOT can do for you. At real asteroids, not just the fictitious 2023 PDC.

Comments: *oral presentation preferred, poster (or equivalent) also welcome, corresponding coauthor intends to be on-site*