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NEO THREAT MITIGATION SOFTWARE TOOLS WITHIN THE NEOSHIELD PROJECT AND APPLICATION TO 2013 PDC15

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ABSTRACT

Nowadays, there are a number of institutions worldwide that contribute to the discovery, tracking, identification, cataloguing and risk characterisation of asteroids in general, and NEOs in particular. However, there is no currently an integrated set of tools that cover, in a complete manner, the assessment of the impact risk mitigation actions that can be taken to prevent the impact of a NEO on Earth and to allow helping the dimensioning of space missions to address such problem.

In that context the following set of utilities have been developed within the European Commission funded NEOShield project to allow covering the abovementioned activities:
- NEO Impact Risk Assessment Tool (NIRAT).
- NEO Deflection Evaluation Tool (NEODET).
- Risk Mitigation Strategies Evaluation Tool (RIMISET).

NIRAT, the first tool, allows evaluating, for possible impactors, the projection of the b-plane dispersion at the dates of possible impact and also the presence of keyholes that would enable future collision opportunities. This tool allows characterizing the impact probability for the different opportunities and, together with the knowledge of the asteroid features, the evaluation of the risk. This tool resembles current performances achieved by NEODyS and Sentry, but does not intend to represent the same level of accuracy in the obtained results. The services provided by this tool are required by the next other tools.

The second tool, NEODET, allows assessing the required optimal change in asteroid velocity (modulus and direction) at any given instant prior to the possible impact epoch that would allow shifting the dispersion ellipse out of the contact with the Earth. This would represent the effect of impulsive mitigation options (one or several impacts). It also allows evaluating the accumulated effect that slow-push techniques (e.g. gravity tractor) would impose on the asteroid orbit to achieve optimal deflection by those other means.

Finally, the RIMISET tool allows evaluating how some of the most relevant impulsive and slow-push mitigation techniques would meet the required changes in asteroid state to obtain the searched for deflection and the requirements that this could impose on the design of the mitigation mission. Following mitigation methods are included: explosive, kinetic impact, gravity tractor and ion beam shepherd. Each technological solution is simulated to allow ascertaining the efficiency in achieving the deflection goal by any of the proposed means (impact, explosive, gravity tractor and possible combinations of those). Ultimately, it shall serve to dimension the required mitigation space systems and solutions.

Validation cases have been executed over the now no-threat cases of asteroids 2011 AG5 and 2007 VK184. **An application case of the three tools to the proposed impact threat exercise for the conference 2013 PDC15 will be executed and presented at the meeting.**

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