

PDC2023
Vienna, Austria

NEO Characterization

RISK ASSESSMENT PILLAR AT ESA'S PLANETARY DEFENCE OFFICE

L. Faggioli⁽¹⁾, F. Gianotto⁽¹⁾, M. Fenucci⁽¹⁾, J.-L. Cano^(1,2), L. Conversi^(1,2), D. Fohring⁽¹⁾, D. Koschny⁽³⁾, R. Kresken⁽¹⁾, M. Micheli⁽¹⁾, R. Moissl^(1,2), F. Ocaña⁽¹⁾, D. Oliviero⁽¹⁾, A. Porru⁽¹⁾, P. Ramirez Moreta⁽¹⁾, R. Rudawska⁽¹⁾

⁽¹⁾ESA NEO Coordination Centre, Via Galileo Galilei, 00044 Frascati (RM), Italy,
neocc@esa.int

⁽²⁾ESA ESRIN, Via Galileo Galilei, 00044 Frascati (RM), Italy

⁽³⁾Technische Universität München, Arcisstraße 21, 80333 München, Germania

Keywords: orbit determination, impact monitoring, imminent impactors, ESA's planetary defence office.

ABSTRACT

One of the main goals of the ESA's NEO Coordination Centre (NEOCC) is the computation of the orbits of near-Earth objects (NEOs) and their probability of impact with the Earth. These activities are carried out by the Risk Assessment Pillar, one of the three pillars of ESA's Planetary Defence Office.

To achieve this goal, the NEOCC operates Aegis, an automated orbit determination and impact monitoring system developed by SpaceDyS s.r.l. through industrial contracts with ESA. This system is completely independent from the Sentry and Clomon-2 systems, operated by NASA and NEODyS, respectively. The Aegis system updates astrometric data of asteroids from the Minor Planet Center on a daily basis, and provides a catalogue of NEOs which comprises orbits with their uncertainties, some physical properties, observations and residuals, close approaches and ephemerides.

More importantly, it computes the impact probabilities of NEOs in the next 100 years, and the results are collected in the so-called [Risk List](#). When the impact probability is high enough, the software computes the related impact corridor.

All the data generated is publicly available in the [NEOCC web-portal](#). Aegis is used to produce the input of several tools and services available in the portal, such as the orbit and fly-by visualizers, ephemerides requests, and all the tools of the [NEO Toolkit](#). In the future it will also be used to support the Fly-eye observation scheduling.

The Risk Assessment Pillar is also operating and developing the Meerkat tool [1], an automated monitoring system for imminent impactors. Since its introduction at the PDC 2021, Meerkat successfully detected the last two impactors, 2022 EB5 and

2022 WJ1, and it has been improved in terms of stability, reliability, and performance. In December 2022, Meerkat started sending its results through an open mailing list to the Planetary Defence community.

In addition to daily operations, the Risk Assessment Pillar carried several other activities in the field of NEOs since the last PDC, including the orbital stability analysis of the second Earth's Trojan asteroid (614689) 2020 XL5 [2], the negative observations exercise of 2010 RF12, the creation of an automated Yarkovsky effect detection procedure, the update of the risk assessment of [\(29075\) 1950 DA](#) and [\(99942\) Apophis](#) (subsequently excluded from the risk list), and the participation to the [Apophis 2021 campaign exercise](#).

References:

[1] M. Frühauf, Michael et al., Meerkat asteroid guard imminent impactor warning of the European Space Agency, 7th IAA Planetary Defence Conference (2021).

[2] T. Santana-Ros et al, Orbital stability analysis and photometric characterization of the second Earth Trojan asteroid 2020 XL5, Nature Communications 13, 447 (2022).

Comments:

An oral talk would be preferred