

PDC2025
Stellenbosch, Cape Town, South Africa

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ESA NEOCC: Impact Assessment of 2024 PDC25

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As part of the SMPAG exercise held this year, the ESA NEO Coordination Centre (NEOCC) contributed in assessing potential impact scenarios for the simulated asteroid 2024 PDC25. By using all the available data at epoch 1 publicly realized in July, we used our Aegis system⁽¹⁾ to compute the orbit and the impact probability (IP) of 2024 PDC25 for the next 100 years. We found an IP of 1.6% in April 2024, with the nominal impact location over South Africa, and an impact corridor that extends from the South Pacific to the Arctic Sea passing through Africa, Western Asia, and Eastern Europe.

We later focused on predicting the IP evolution in the following months, and for

that we generated synthetic observations using JPL’s Horizons system. The NEOCC observers team provided us with the necessary observational constraints. These synthetic data points enabled us to track how the asteroid's projected trajectory and impact probability shifted over time, ultimately confirming a 100% impact certainty as early as October 2025. In parallel, our team produced detailed keyholes map to better understand potential long-term perturbations and prepared comprehensive skyprints to aid observation efforts, providing critical insights for planetary defense strategies. Our work provided robust orbital determinations and impact probabilities that were crucial to the decision-making process during this exercise. The synergy between risk assessment and observation teams enabled a seamless integration of data, yielding accurate predictions and highlighting the importance of coordinated international efforts in planetary defense.

(1) Fenucci, M., et al.: “*The Aegis orbit determination and impact monitoring system and services of the ESA NEOCC web portal*”, *Celestial Mechanics and Dynamical Astronomy*, (2024) 136:58

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