Successful Kinetic Impact into an Asteroid for Planetary Defence

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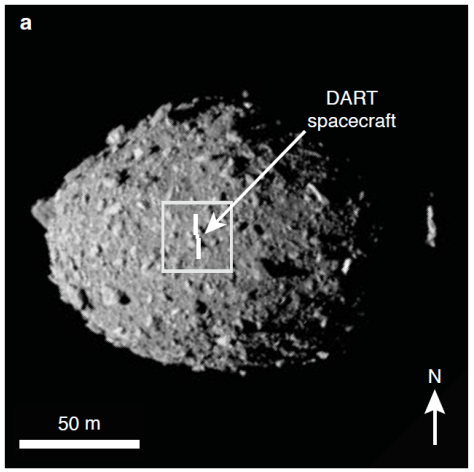
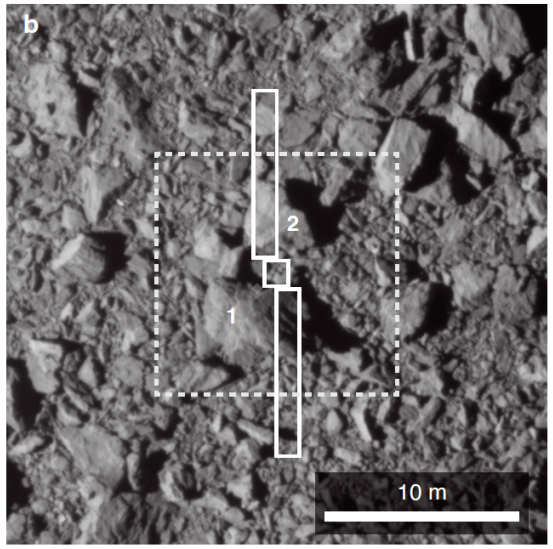
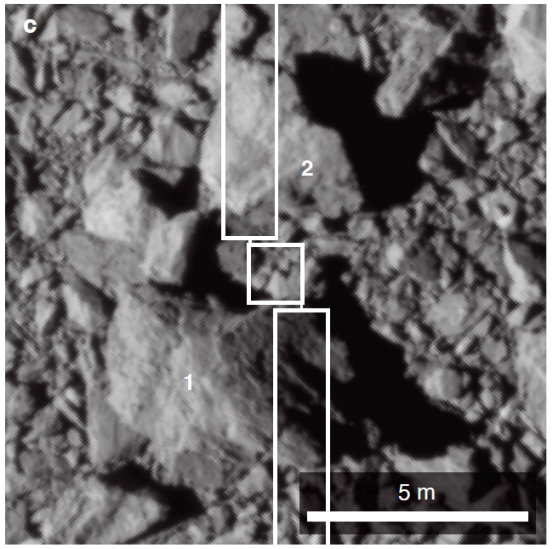


The researchers from CAB, Jens Ormö and Isabel Herreros, along with other DART Investigation Team members, reconstruct the impact of the DART spacecraft on Dimorphos, which may help with the planning of future missions and could help to predict outcomes with more certainty. They also describe the location and nature of the impact site, noting that it was between two boulders, one of which was grazed by the spacecraft as it made contact with the moon.





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While no known asteroid poses a threat to Earth for at least the next century, the catalogue of near-Earth asteroids is incomplete for objects whose impacts would produce regional devastation. Several approaches have been proposed to potentially prevent an asteroid impact with Earth by deflecting or disrupting an asteroid. NASA's Double Asteroid Redirection Test (DART) mission is the first full-scale test of kinetic impact technology. The mission's target asteroid was Dimorphos, the secondary member of the S-type binary near-Earth asteroid (65803) Didymos. This binary asteroid system was chosen to enable ground-based telescopes to quantify the asteroid deflection caused by DART's impact. While past missions have utilized impactors to investigate the properties of small bodies, those earlier missions were not intended to deflect their targets and did not achieve measurable deflections. They report the DART spacecraft's autonomous kinetic impact into Dimorphos and reconstruct the impact event, including the timeline leading to impact, the location and nature of the DART impact site, and the size and shape of Dimorphos. The successful impact of the DART spacecraft with Dimorphos and the resulting change in Dimorphos' orbit demonstrates that kinetic impactor technology is a viable technique to potentially defend Earth if necessary.

The research team at CAB conducted several experiments with impact velocities of about 400 meters per second with different target configurations to understand how boulders in the target material (i.e., "rubble-pile") affect the material ejection, the shape of the crater and lowers momentum transfer (i.e. the effective "push" of the asteroid).

These results assisted in the validation of the numerical models used by the DART Investigation Team to predict and interpretate the outcomes of the mission.

R.T. DALY ET AL., NATURE, 2023; HTTPS://DOI.ORG/10.1038/S41586-023-05810-5