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Session Topic: Deflection / Disruption Modeling & Testing

**Operationalizing the Didymos-Dimorphos Asteroid Test Site to Assess
Additional Deflection Technologies**

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On September 26, 2022, the DART spacecraft collided with the 160-meter asteroid Dimorphos and shifted its orbital period relative to its 700-meter companion asteroid Didymos by approximately 33 minutes. The Double Asteroid Redirection Test (DART) successfully demonstrated deflection of an asteroid by a high-speed kinetic impactor and enabled in-depth analysis of the experimental results.

The Didymos-Dimorphos binary system was chosen as a test site for this demonstration because the change in Dimorphos' orbital period is directly measurable from the Earth, thus providing an immediate and precise indication of the test outcome. DART's success suggests that, given sufficient time before impact, an Earthbound asteroid could be deflected away from the threatening trajectory.

This study considers new experimental mission scenarios that reuse Dimorphos as a testing environment for evaluation of additional asteroid deflection technologies and operationalization of abstract concepts into measurable capabilities. As the Didymos-Dimorphos binary system poses no threat to the Earth, further tests would incur no new risks. Experience gained from DART also provides ample context about the specific binary asteroid system as a testing environment.

The 2022 test revealed previously unknown details about the material composition of Dimorphos. This foundation can inform future tests, preempting the need to identify and evaluate a new experimental environment. Improved characterization of Dimorphos by the upcoming HERA mission can also further refine testing parameters for new methods of asteroid deflection. Thus, new tests conducted on this binary

system can provide valuable information on the science and technology of asteroid characterization and planetary defense.

Furthermore, future deflection technologies, such as the ion beam shepherd and the centrifugal mass driver, may provide additional benefits if tested in an international collaborative format. Cooperation and transparency can help identify and resolve the wide array of political, legal, programmatic, and operational issues that would arise in any actual campaign to prevent a NEO impact scenario.

Reusing the Didymos-Dimorphos test site can build upon the foundation of previous test missions, validate assumptions and models, demonstrate new asteroid deflection technologies, and expand the planetary defense toolbox that can be applied with confidence at the time of need.

Comments:

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