

IAF SPACE EXPLORATION SYMPOSIUM (A3)
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Author: Ms. Cheryl Reed

The John Hopkins University Applied Physics Laboratory, United States, cheryl.reed@jhuapl.edu

DART: DOUBLE ASTEROID REDIRECTION TEST

Abstract

NASA's Double Asteroid Redirection Test (DART) mission will be the first space experiment to demonstrate asteroid impact hazard mitigation by using a kinetic impactor. Under an international investigation effort (herein referred to as AIDA), ESA and NASA extensively collaborate. ESA continues to study (currently in Phase B1) a rendezvous mission to contribute to AIDA, to measure outcomes of the kinetic impact and to characterize the target body. This mission (known as Hera), is preparing for funding review in the up-coming 2019 ESA Ministerial Conference. The AIDA target is the near-Earth binary asteroid 65803 Didymos, which will make a close approach to Earth in October, 2022. The DART spacecraft is designed to impact the Didymos secondary at 6 km/s in October, 2022 in order to demonstrate the ability to modify its trajectory through momentum transfer. The DART mission will complete Phase B in May 2018. The primary goals of AIDA are (1) to perform a full-scale demonstration of the spacecraft kinetic impact technique for deflection of an asteroid; (2) to measure the resulting asteroid deflection; and (3) to study hyper-velocity collision effects on an asteroid, validating models for momentum transfer in asteroid impacts based on measured physical properties of the asteroid surface and sub-surface, and including long-term dynamics of impact ejecta. The DART mission is a strategic technology demonstration as the first planetary defense flight. The DART impact on the moon of the Didymos binary system will change the orbital period of the binary. This change will be measured by supporting Earth-based optical and radar observations. The DART impact will furthermore release a large volume of particulate ejecta that may be directly observable from Earth or even resolvable as a coma or an ejecta tail by ground-based telescopes. The baseline launch readiness date for the DART mission is in June, 2021 to impact the Didymos secondary in October, 2022. The Italian Space Agency proposes a cubesat to be carried by DART to Didymos, in order to document the DART impact. The cubesat would be released prior to the impact, so as to perform a separate flyby and to image the impact ejecta. DART will provide the first measurements of momentum transfer efficiency from a kinetic impact at full scale on an asteroid, where the impact conditions of the projectile are known, and physical properties and internal structures of the target asteroid are also characterized.