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Exploration of Near Earth Asteroids (06)
Planetary Defense (3)

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DART: DOUBLE ASTEROID REDIRECTION TEST CONCEPT

Abstract

The Near Earth objects are a population of small bodies orbiting the Sun near Earth's orbit, some of which impact the Earth. The impact of an object as large as 30 m in diameter occurs every few centuries. The impact of such an object would already release an energy of at least a megaton of TNT, and the impact of a larger object, which would occur less often, would be even more hazardous. To protect the Earth from a potential asteroid impact, various mitigation methods have been proposed, including deflection of the asteroid by a spacecraft impact. The Double Asteroid Redirection Test is such an asteroid mitigation mission concept. By measuring the response of an asteroid to an impact and the associated momentum transfer, this mission would be a valuable precursor to human spaceflight to an asteroid, as it would return unique information on an asteroid's strength and internal structure. It would be particularly relevant to a human mission for asteroid mitigation. We report initial results of a mission concept study which was jointly undertaken by the Johns Hopkins Applied Physics Laboratory and the European Space Agency with support from NASA centers including Goddard, Johnson and Jet Propulsion Laboratory. This project follows the previous Don Quijote mission study performed by ESA in 2005-2007, with the objective of demonstrating the ability to modify the trajectory of an asteroid and measure the trajectory change. Don Quijote involved an orbiter and an impactor spacecraft, with the orbiter arriving first and measuring the deflection, and with the orbiter making additional characterization measurements. Unlike Don Quijote, DART envisions an impactor spacecraft to intercept the secondary member of a binary near-Earth asteroid, with ground-based observations to measure the deflection as well as possible additional spacecraft observations. Low cost mission approaches will be presented.