

23rd IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Spacecraft for Deep-Space Exploration (8)

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NEOTWIST - AN ASTEROID IMPACTOR MISSION FEATURING SUB-SPACECRAFT FOR
ENHANCED MISSION CAPABILITY

Abstract

Near Earth Object (NEO) deflection for the purpose of planetary defense has become increasingly recognized as a valid and valuable endeavor. NEOTWIST stands for Near-Earth Object Transfer of angular momentum Spin Test. This describes a demonstration mission intended to develop the capabilities required to execute an effective kinetic impactor NEO deflection mission. The chosen measurement technique and employment of small sub-spacecraft for observation purposes represent a novel approach to achieving the main goals of such a demonstration mission. The approach promises comparatively low cost and features capabilities that are unique and valuable for an operational deflection mission. Most standard deflection demonstration missions quantify momentum transfer from the impactor spacecraft to the target object by measuring a change in its heliocentric orbit. The change is typically so small that it must be performed via radio-science from a second observer spacecraft which rendezvous with the NEO prior to impact. In our case the NEO is struck off-center which changes its spin rate. This rate change, which can be measured from Earth via light curve measurements, allows quantification of the transferred momentum. Using this measurement method the need for an observer spacecraft for the purpose of NEO orbit measurement is eliminated. The second function of the observer spacecraft is the close-up observation of the impact event for improvement of impact effectiveness modeling. The NEOTIST mission achieves this observation by deploying several small sub-spacecraft from the main impactor spacecraft shortly before impact. These sub-spacecraft allow observation of the impact event from multiple vantage points some of which are unique because their destruction is accepted. At least one sub-spacecraft trajectory is planned such that survival is guaranteed, which enables it to receive observation data from the other spacecraft for delayed transmission to Earth. We present the overall mission concept as well as preliminary design work on the key technical challenges, in particular those

associated with the highly dynamic operation of the small sub-spacecraft that are a key feature of the NEOTIST mission.