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A permanently acting NEA mitigation method

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For some potentially hazardous Near Earth Asteroids, it might be desirable to implement a "slow push" mitigation technique that is capable of altering the NEA orbit continuously and permanently. This possibility was suggested in a companion paper that outlined an archetypal exploration/mitigation mission to the NEA 99942 Apophasis. In this scheme, long term mitigation is achieved using a novel albedo change approach. This paper describes the details of the albedo modification technique and apparatus. To continually alter the orbit of Apophasis (or similar NEAs) over an extended period, and eventually eliminate the threat of impact altogether, we propose to alter the NEA albedo to either diminish or enhance the Yarkovsky effect. Detailed calculations show that within reasonable bounds for the absorptivity and mass, and depending upon the spin state, a 5% change in the albedo of Apophis, starting in May 2022, and using approximately 45kg of surfacing material, will deflect Apophasis between 17 and 45 Earth radii by 2036.At present, the albedo change mechanism that appears the simplest and most effective involves a device that dispenses, in a controlled fashion, ionized powder onto Apophasis' surface – which is itself ionized by ultraviolet radiation. Electrostatic attraction provides the dominant force that will distribute and bind the powder to the surface. The albedo change dispenser described here is based upon turboelectric powder dispensing technology and contains two supply canisters containing either very high or very low albedo powders. Either one or the other will be used, depending on the albedo/thermal emission data and the tracking/orbit prediction data collected during the exploration phase of the mission. We describe the design details and the constraints on particle size (to prevent electrostatic levitation and escape) and dispensing speed (to achieve the desired coverage zone and prevent particles from orbiting or escaping)

Biography

Altwaijry received his Bachelors Degree in Mechanical Engineering from King Saud University, Riyadh, Saudi Arabia. He subsequently joined KACST and was awarded a scholarship to pursue graduate studies. He received an MS in Mechanical engineering in 1997 from the University of Michigan - Ann Arbor; an MS in Aerospace Engineering and a Ph.D. in Aerospace engineering. In 2005 Dr. Altwaijry rejoined KACST as Deputy Director of the National Satellite Program. In 2008, he was appointed to his present position of Director of the Space Research Institute of KACST.

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