PDC2019
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Asteroid Interception at Atmospheric Entry

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Keywords: *Intercept, Atmosphere, Disrupt*

ABSTRACT

Asteroids 20-50 meters in size have the potential to elude detection systems until hours or minutes before impact, as seen in the case of the Chelyabinsk super bolide airburst in 2013. Atmospheric entry of such small objects is naturally more frequent than large objects and entry is more likely to be a short warning event. Therefore, lead times are too short for effective deep space deflection/destruction and expanding mitigation to the near-Earth regime is required. Since these small asteroids are not likely to survive reentry, their potential damage comes from the shockwave created by the airburst during entry into the atmosphere. Pre-built ground-based interceptors launched minutes before atmospheric entry could disrupt such a threatening asteroid before it reaches the altitude at which the air burst occurs and induce a release of energy at a higher altitude, presumably dispersing the energy over a wider area and decreasing the potential of the asteroid to harm life and property on Earth. This report provides results of three analysis: 1) concepts for

intercepting an approaching asteroid very close to Earth with existing ground-based technology; 2) application of hydrocode techniques to assess the disruption phenomenon of the asteroid with realistic kill-vehicles; and, 3) assessment of the ground effects with and without mitigation. Preliminary results show that small stony asteroids can be intercepted and disrupted with interceptor and kill-vehicle technologies. Alternate mitigation approaches and technology gaps and needs are discussed.

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