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**RENDERER AND CAMERA EMULATOR (RCE) FOR NASA'S DOUBLE  
ASTEROID REDIRECTION TEST (DART)**

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**ABSTRACT**

The NASA Double Asteroid Redirection Test (DART) will be the first space experiment to demonstrate asteroid impact hazard mitigation using a spacecraft as a kinetic impactor to deflect an asteroid. The DART impactor spacecraft will hit the 170 meter diameter secondary of the Didymos binary system (Didymos B). The primary goal of DART is to measure and characterize the resulting deflection of the asteroid by the kinetic impact. The results will have implications for planetary defense and Near-Earth Object science and resource utilization. One challenge is accurately guiding the spacecraft to the center-of-figure of Didymos B. The Small-body Maneuvering Autonomous Real-Time Navigation (SMART Nav) algorithm [Chen 2018] is being developed to guide DART to the center of Didymos B. In order to test

the SMART Nav capabilities during development, realistic inputs in the form of simulated telescope images must be provided. This function is performed by the Renderer and Camera Emulator (RCE). The RCE renders scenes including the Didymos system and background stars and emulates the effects of the camera and associated readout electronics, including noise, optical point spread function, motion blur, image saturation, stray light, image artifacts such as ghosting, and analog to digital conversion. This paper describes the implementation, testing, and validation of the DART RCE model, and its applications in testing and analysis of the DART mission.

## REFERENCES

Chen, Michelle, et al. *Small-Body Maneuvering Autonomous Real-Time Navigation (SMART Nav): Guiding a Spacecraft to Didymos for Nasa's Double Asteroid Redirection Test (DART)*. 41st Annual AAS Guidance and Control Conference, Feb 2018. AAS 18-063.