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**NEOSHIELD-2: TECHNOLOGY READINESS LEVEL ASSESSMENT FOR VISUAL  
BASED GUIDANCE, NAVIGATION AND CONTROL ALGORITHMS APPLICABLE  
TO SMALL SOLAR SYSTEM BODY SPACECRAFT MISSIONS**

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**ABSTRACT**

NEOShield-2 is a study funded by the European Commission in the framework of the Horizon 2020 program addressing science and technology for Near Earth Object (NEO) impact prevention. The study is currently being carried out by a consortium of eleven partners from European research institutions and industry and is coordinated by Airbus DS GmbH in Friedrichshafen, Germany. One particular study goal is to advance and validate the development of specific Guidance, Navigation and Control (GNC) functions needed to operate spacecraft in different NEO mission scenarios: A reconnaissance spacecraft for exploration in a low-gravity environment exhibited by a very small, irregularly shaped NEO ( $d < 300\text{m}$ ), a landing spacecraft for sample return applications, and an impactor spacecraft designed to exert delta-velocity on a small NEO to influence its orbit. The project aims at raising the technology readiness of required GNC functions to a level between 5 and 6 which is typically requested before starting mission implementation. To this end, the developed GNC functions are verified in different verification steps on different test benches. Emphasis is given to the proper verification of critical elements with no flight-heritage which are mainly the visual based navigation and control functions. The desired technology readiness level (TRL) is achieved stepwise by meeting previously defined requirements on

simulated test scenarios conducted on different test benches. The benches feature increasing levels of real hardware in the loop, starting from flight-representative processing units to real camera hardware stimulated by either synthetic image generators or asteroid mock-ups placed on a robotic-arm facility. ISO standards for TRL assessment have been tailored to provide a significant means for deep space visual based GNC functions TRL assessment. This paper elaborates the test bench facilities, performance validation, test evaluation and the tailored TRL assessment criteria for the three GNC missions in NEOShield-2.

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