POST2 END-TO-END DESCENT AND LANDING SIMULATION FOR ALHAT DESIGN ANALYSIS CYCLE 2 (IPPW-7)

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ABSTRACT

The Autonomous Landing and Hazard Avoidance Technology (ALHAT) project is an agency-level program involving NASA centers, academia, and industry, with a primary goal to develop a safe, autonomous, precision-landing system for robotic and crew-piloted lunar descent vehicles. The Program to Optimize Simulated Trajectories II (POST2) is used as the fully integrated end-to-end, descent and landing trajectory simulation for determining integrated-system performance of various lunar landing-system models (i.e. guidance, navigation and control, and sensors) and lunar environment models (i.e. gravity and topography) for the ALHAT project. The ALHAT POST2 trajectory simulation provides a 6DOF capability necessary to test, design and operate a descent-landing system for lunar-landing success. This paper presents updates in the development and model-validation of the ALHAT POST2 simulation, as well as preliminary system performance analysis for ALHAT Design Analysis Cycle 2 (ALDAC-2), used for the testing and assessment of ALHAT system models.

The ALHAT POST2 simulation incorporates an Altair-based lunar lander vehicle model, propulsion model, lunar gravity-field and topography model. Low fidelity, statistically based sensor models such as an IMU, star tracker, altimeter, velocimeter and Terrain Relative Navigation (TRN) are also included. Updates to the ALHAT Autonomous Guidance, Navigation and Control (AGNC) and Terrain Sensing and Recognition (TSAR) model in POST2—including Hazard Relative Navigation (HRN)—are discussed, along with system performance simulation results for ALDAC-2. The ALDAC-2 POST2 simulation results, in the form of nominal trajectories and Monte Carlo simulations, have been generated and focus on HRN (low and high fidelity) model performance with the fully integrated system, as well as the improvements in performance of the AGNC and TSAR model since the previous design analysis cycle.