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**PROCEEDINGS**

# Design and Optimization of the Combined Airbag Landing System for Lunar Cargo Delivery

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**ABSTRACT**

As lunar exploration advances, the transportation of substantial quantities of supplies to the lunar surface will be essential for forthcoming manned missions and lunar development initiatives. To address the unique lunar environment characterized by the thin atmosphere and low gravity, a new combined airbag landing system for lunar cargo delivery was proposed, specifically designed to avoid generating a lot of dust during venting processes. A cushioning dynamics model of the combined airbag landing system was developed and verified through the ground drop experiment. Given the complexity of actual landing conditions, the effects of landing parameters such as horizontal velocity, landing inclination, lunar surface slope, bulges and pits were investigated on the cushioning performance of the combined airbag landing system. Furthermore, the extreme condition during the lunar landing was identified by analyzing its cushioning process under various combinations of landing conditions. Based on the idea of vent mode optimization, the design method for the combined airbag lunar landing system without overturning was proposed, and two vent modes were given. By this method, a combined airbag lunar landing system without bouncing back and hard landing under the extreme landing condition was obtained, thereby validating the effectiveness and feasibility of the proposed optimization method.

**KEYWORDS**

Lunar surface; cargo delivery; landing cushioning; combined airbag; optimized design

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