IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (IPB)

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CONCEPTUAL DESIGN OF AUTONOMOUS MOBILE LANDING PLATFORM TO EXPEDITE MULTIPLE CREW AND CARGO LANDINGS.

Abstract

Dreaming about space travel is a thing of the past. It is now becoming a reality as a result of tremendous advancements in technology and capabilities. The global goal of establishing a permanent settlement on the Moon, followed by Mars, is being met by space agencies and private industries all over the world, by consistently and successfully achieving their milestones. Along the way, the space community is not only optimizing the existing technologies but also constantly inventing new technologies to solve the problems in space travel. Frequent transportation of crew and cargo in space will become inevitable in the future. The space community has been working tirelessly to improve the launch of spacecraft. However, space travel entails more than just launching spacecraft into orbit.

Landing is fraught with uncertainty due to the difficulty of the terrain, but it is a critical component for the mission's success. When landing on unknown terrains such as massive impact craters, cliffs, and jagged boulders, the likelihood of failure increases considerably. For instance, the Rosetta's Philae lander failed due to multiple contact landings on the soft comet's terrain. As a result, designing such critical systems necessitates a significant investment in both money and time. For example, the industry-defined price for delivering payloads to the moon by lunar logistic companies is $1.2 million per kilogram.

The Artemis program identifies problems during lunar landings, but the solution is focused on identifying potential landing sites. Establishing a permanent landing infrastructure, on the other hand, may eliminate the majority of landing challenges. However, they are expensive and restricted to that location. In this paper, we present a novel landing system, the Autonomous Mobile Landing Platform (AMLP) that facilitates landing at multiple locations including unknown and unexplored terrains. AMPL has a large platform with station-keeping engines capable of precise positioning to decomplexify the landing and further eliminate the need to land on unknown terrain while avoiding the construction of permanent landing pads. AMPL continuously receives signals from the landing spacecraft allowing it to be fully autonomous and telerobotically controlled. This paper presents the conceptual design of AMLP and its advantages over the traditional landing technologies. Preliminary analysis for a case study on the moon shows that the proposed landing system reduces the weight of the lander by 18% and its cost by 13%.