

SPACE EXPLORATION SYMPOSIUM (A3)
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HOPPING VEHICLES FOR RAPID REGIONAL EXPLORATION OF THE SURFACE OF TITAN

Abstract

Saturn's moon Titan is a target of great interest for future planetary surface exploration, given the presence of a thick atmosphere and geological activity, both of which may help create conditions under which extraterrestrial organic material could exist.

The exploration of the largely unknown planetary surface of Titan could benefit from high mobility due to the large variety of terrain of interest present. Accordingly, this paper proposes the use of a hopping vehicle. A hopping vehicle uses its main landing engine(s) to make rapid traverses of significant range over potentially hazardous terrain, such as mountains, canyons, lakes, and rivers. Additionally, hoppers are less likely than rovers to become stuck in uncertain terrain and prematurely end a mission.

Hopping vehicles have previously been proposed for high mobility regional exploration of low-gravity planetary environments without the presence of a dense atmosphere, such as the Earth's moon and Mars. This paper discusses several possible modifications to these designs to take advantage of Titan's unique atmospheric and surface characteristics for increases in efficiency, range, and mission lifetime. Multiple propulsion types are compared, as well as the potential for in situ propellant production or electric power generation.

This paper presents a design for a hopping vehicle on Titan and proposes a mission profile, achievable science goals, and ways hoppers may complement other proposed missions to Titan.