

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Solar System Exploration including Ocean Worlds (5)

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## CONCEPTUAL DESIGN OF TECHNOLOGIES FOR A TITAN EXPLORATION MISSION

### Abstract

Considering its Earth-like characteristics such as the atmosphere, mostly composed of nitrogen and methane, and the presence of oceans, Titan has been considered as one of the most promising bodies for space exploration in the Solar system. Following the global roadmap, the students from the Space Exploration and Development Systems (SEEDS) Specializing Master's program have chosen to focus on deep space exploration and target Titan by developing state-of-the-art technologies.

In this regard, this particular study presents the selection and preliminary design of space probes to be sent to Titan in order to examine the viability of in-situ resource utilization and broaden the knowledge of Saturn's satellite. Depending on the requirements provided for the mission, the concept design includes multiple tools and instruments attached to the system selected through tradeoff analysis techniques. Therefore, the paper provides investigations concerning the design of probes that can withstand Titan's environmental conditions. Concepts of modules have been developed to analyze the available resources, to study the liquid bodies on Titan as well as to collect data about its seismic activity and atmosphere. Furthermore, the power system of the vehicle will be considered according to its availability and relatively cost-effective production.

The outcome of this work presents a configuration of the system, including the required technologies to perform the aforementioned activities, general dimension specifications and physical architecture. This proposed mission to Titan aims to enable exploration with an excellent suite of benefits such as in-situ resource utilization evaluation, an operational experience beyond cislunar space and a confidence-building for future mission scenarios. The data collected could provide more information on the history of the Solar system, raising the question about the possibility of sending humans to Titan.