IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Virtual Presentations - IAF HUMAN SPACEFLIGHT SYMPOSIUM (VP)

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# USING IN-SITU RESOURCES FOR TITAN'S HABITABILITY

**Abstract**

Titan is one of the largest moons of Saturn and has many unique and interesting features among other moons in our solar system. It contains a significant amount of resources like hydrocarbons and liquid water. Plus, having a meteorological cycle like the one on Earth makes it a potential candidate to be considered to harbor human life in the future. Therefore, Titan holds great importance as a celestial body, whose exploration could lead us to drive forward in scientific arena by studying new forms of life and by understanding the formation of atmosphere and gravity on a star. In addition, Titan can serve as an ideal choice for the settlement of an advanced base for exploration beyond our solar system.

However, this icy moon being at a considerable distance from Earth, any expedition would require numerous energy and life support resources, which cannot be transported from Earth with actual technology. Thus, the use of in-situ resources is essential and could lead to interplanetary exploration and sustained human footprint. Motivated by the facts, the students of the SpacE Exploration and Development Systems (SEEDS), with the support of Thales Alenia Space, CNES, ASI and ESA; proposed a global robotic system capable to generate energy, life support resources and structures by using in-situ resources.

This study highlights the key points needed to produce a global system that could fulfil these goals, ensuring a sustained human base on Saturn's satellite. Three main topics are assessed, considering Titan's both renewable and non-renewable resources and considering that we can transport the production means from the Earth or the Moon. First, the production of energy with diverse sources (using the meteorological cycle, the hydrocarbons, gases, water and other chemical elements). Second, the production of life support resources using water, oxygen, nitrogen, methane and ammonia to generate breathable air and create fertilizer for growing food. Third, the production of structures using Titan's minerals and 3D printing.

We describe in this paper all the operations and key technologies needed to produce the different resources. The related performances and issues to overcome are highlighted. Thus, this study demonstrates the need of using Titan's in-situ resources and the way to achieve it.