

Aerospace Europe Conference 2023

Joint 10th EUCASS – 9th CEAS Conference

Abstract #XXX (to be filled by the organizers)

Preferred Topics: SUSTSP /SPEXPLO /REUSYS

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Type: Oral

Status of corresponding author: Student

For student corresponding author: student member of one of the following:

Title

Propellant Management Challenges Related to the Operation of the Depot on Orbit.

Authors

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Abstract

This study analyses the comprehensive cryogenic propellant management challenges in low gravity that may be used to model an in-orbit cryogenic propellant depot for space exploration in the future. This research presents a framework that enables an analysis of a novel propellant depot as a preliminary case with the objective of understanding the problems associated with different subsystems of space depots such as Supply Tanks, Transfer Lines, and Receiver Tank, due to various parameters enlisted such as gas free removal of liquid, phase separation, boil-off, heat transfer, chill down, no-vent filling and so on. Environmental effects due to the location of the depot are too enlisted. Multifarious problems are also taken into account like in-space servicing and maintenance, parameters influencing pressurizing gas requirements, thermal management, space thermal environment, Heat Loads, Propellant Geysering, Storage Duration, Conditioning of Propellants, and Liquid Propellant Reorientation.

In addition to this, mitigation techniques to counter the aforementioned problems are also listed which can be taken into consideration such as the use of active which incorporates the use of Active Cryocoolers, Louvers Special Radiators, and Zero-boil off and cryogenic fluid conditioning techniques, and passive cooling techniques such as the use of insulations and radiators. Along with these, different propellant settling techniques such as Propulsive Settling, Centrifugal Settling, Gravity Gradient Settling, Electromagnetic Settling, and ED Tether Settling.