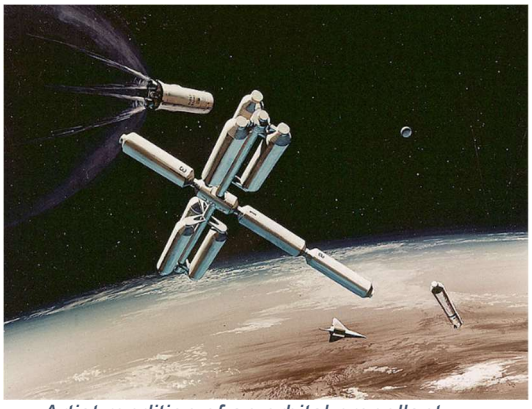
Technische Universität Braunschweig
Institut für Raumfahrtsysteme

Technische Universität Braunschweig

Student thesis announcement (BA/SA/MA)

Evaluation of thermal control strategies for in-space propellant depots

Utilizing cryogenic propulsion for in-space transfer vehicles significantly advances both the in-orbit servicing of existing hardware and exploration missions beyond Earth orbit. By employing in-space propellant depots, mission costs can be reduced and payload mass increased.
To minimize propellant loss caused by environmental heat leak and evaporation, the development of reduced or zero boil-off (ZBO) solutions is essential. Depending on mission requirements, the thermal control system will be comprised of both passive and active thermal control technologies.



Artist rendition of an orbital propellant depot (© 1971 NASA)

This thesis focuses on the parametric investigation of different propellant depot configurations. A model incorporating multiple thermal control measures is to be developed and applied to realistic operating scenarios. Considering the current maturity of thermal control solutions, the goal is to optimize depot configurations and determine operating limits.

Tasks:

- Literature research on the usage of cryogenic propellants for in-space transportation, ZBO depot architectures and state of the art thermal control technologies
- Development of a propellant depot thermal model
- System optimization and identification of key parametric relationships and operating limits
- Preliminary sizing of refrigeration system components (optional)

Requirements:

- Capable of working in a reliable and self-motivated way
- Basic knowledge in Python (advantageous)

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