



Task Description Master's Thesis veCROP Model Validation

Motivation:

Biological life support systems are crucial for a long-term human presence in space. Only systems that incorporate living organisms (other than humans) can close the carbon loop and produce food for crews on exploration missions. Life support systems for human space missions are already very complex, and the addition of higher plants and algae only increases this complexity due to the addition of subsystems and the comparatively long time constants compared to physico-chemical components. In order to deal with this complexity, the Virtual Habitat (V-HAB) simulation tool was developed. This MATLAB-based system allows engineers to design life support systems and assess their dynamic behavior using desktop computers, rather than building large and expensive test rigs.

To increase the fidelity of simulation models of higher plants, the Virtual Evapotranspiration, Carbon assimilation, Respiration and Oxygen Production (veCROP) model was developed for V-HAB. It consists of two submodels for photosynthesis and evapotranspiration. As new plant data has been made available from our partners at NASA's Kennedy Space Center, it is now possible to validate the veCROP model against real plant measurements. The goal of this thesis is therefore to validate the plant model to identify any shortcomings and areas of improvement. Additionally, the thesis shall produce recommendations for future hardware testing in the Life Support Lab at IRS.

Task Description:

- Familiarization with V-HAB
- Familiarization with the veCROP model
- Validation of veCROP using NASA data
- Documentation of major and minor differences
- Recommendations for future work on veCROP and associated testing

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Start date:

01.04.2025

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