

## Duckweed: A Tiny Aquatic Plant with Enormous Potential for Bioregenerative Life Support Systems

Poster Abstract for 2019 AIAA RM ATS

Duckweed (family Lemnaceae) is a tiny flowering plant with enormous potential for bioregenerative space life support. Also known as water lentils or water meal, this small angiosperm is gaining global recognition as a powerful and ecologically friendly means of absorbing nutrients from wastewater. In addition, duckweed has a very high nutritional density and little fibrous material, making it a 100% edible and potentially valuable fresh food supplement to crew diets on long-duration exploration missions. This poster reviews the benefits of duckweed as a potential space crop, lists operational and design challenges for growing duckweed in space, and identifies research needed to address those challenges. In addition, this poster highlights the collaborative efforts of Space Lab Technologies, LLC and researchers in plant biology and aerospace engineering at the University of Colorado at Boulder to establish duckweed as a nutrient dense space crop for deep space exploration.  $\mu$ G-LilyPond™, an autonomous aquatic plant growth chamber for microgravity, is in Phase II of development through the NASA STTR program. Space Lab will test the  $\mu$ G-LilyPond™ water delivery system and harvesting concepts in microgravity on a suborbital flight in mid-2020. Recent drop tower tests have provided Space Lab with valuable information on how this floating plant may behave mechanically in microgravity. Finally, research funded by the Translational Research Institute for Space Health (TRISH) will inform development of lighting protocols to co-optimize plant yield, nutritional quality, and energy-use efficiency at space-relevant CO<sub>2</sub> concentrations (up to 1%).

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Christine is co-founder and Vice President of Space Lab Technologies, LLC. Her multi-disciplinary education spans systems engineering, bioastronautics, and life sciences, providing her with a unique combination of skills for space crop production technology development. She is currently a PhD student at the University of Colorado Boulder, studying the optimization of environmental conditions for duckweed yield and nutritional quality in space applications. Before coming to the University of Colorado, she was a Systems Engineer and Mission Manager for the NASA Sounding Rocket Operations Contract (NSROC). She co-founded Space Lab Technologies, LLC in 2016, with the mission of advancing technology for human exploration of deep space. At Space Lab, her responsibilities include project management, business development, systems engineering, integration and testing support, data analysis, technical writing, and research for all projects. She was also Principal Investigator for Space Lab's  $\mu$ G-LilyPond™ project, a floating plant cultivation system for microgravity, under NASA STTR Phase II contract.

