Observing The Growth Of Breathable O_2 Producer In High And Low Pressure And Light Conditions

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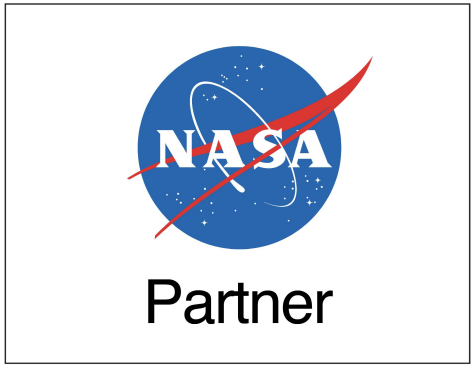
Accompanied by Marisa Gonzalez



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The Goal: To form a better understanding of the botanical potential of extraterrestrial planets, with the hope of furthering interstellar exploration and sustainability.

Hypothesis

It is predicted that low light and low pressure environments will yield a higher increase in the growth of duckweed and therefore production of O_2 and consumption of CO_2.

Hypothesis support

In their research exploring reduced atmospheric pressure on radish growth, those at CERSF concluded that reduced partial pressures of oxygen had a greater effect on inhibiting radish growth than hypobaric levels alone (Wehkamp, C.-A., et. al., 2008).

Additionally, in a 2019 study titled, “Effect of Light Intensity on the Photosynthetic Parameters for Plants from the Lamiaceae Family”, the authors explored the effects of periodic measurements at different photosynthesis activity on plants from the *Lamiaceae* family. Their results correlated relationships between light intensity, stomatal conductance, net assimilation values, and intracellular CO2 processes. The leaves with higher pigmentation are more efficient in absorbing light per unit of leaf biomass, allowing the plant to balance carbon uptake under lower light conditions (Moisa, C., Copolovici, L., Lupitu, A., Copolovici, D., Imbrea, I., & Pop, G., 2019).

The work being done at The Controlled Environment Systems Research Facility (CESRF), which currently represents an extensive collection of variable pressure plant growth chambers devoted to the study of biological systems including plants and microbes, specifically in the service of life support roles for space exploration. From this study, they have discovered that in order to simplify the engineering requirements for plant growth structures on the Moon or Mars, lower power, cost, material needs and lower pressures are required (Wehkamp, C.-A., Stasiak, M., Wheeler, R. & Dixon, M., 2008).

In their academic journal posted in 1997, Dr. Salisbury and Dr. Gitelson highlight the needs of furthering space expeditions. Waste recycling as it applies to space exploration can be defined as the means of utilizing cycles within the “biome” of a space exploration structure. The process of waste recycling could take place via the aid of plants to help yield carbon dioxide from the atmosphere, produce oxygen, provide potential food, and transpire water vapor to be condensed and reused as well as provide an option for crew waste to be utilized for nutrition of the plants.

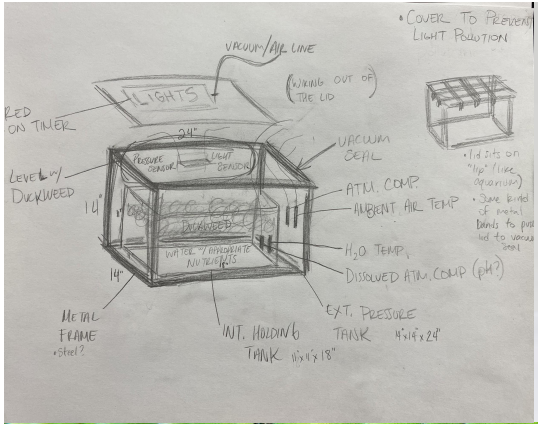
The Experiment

Key Materials

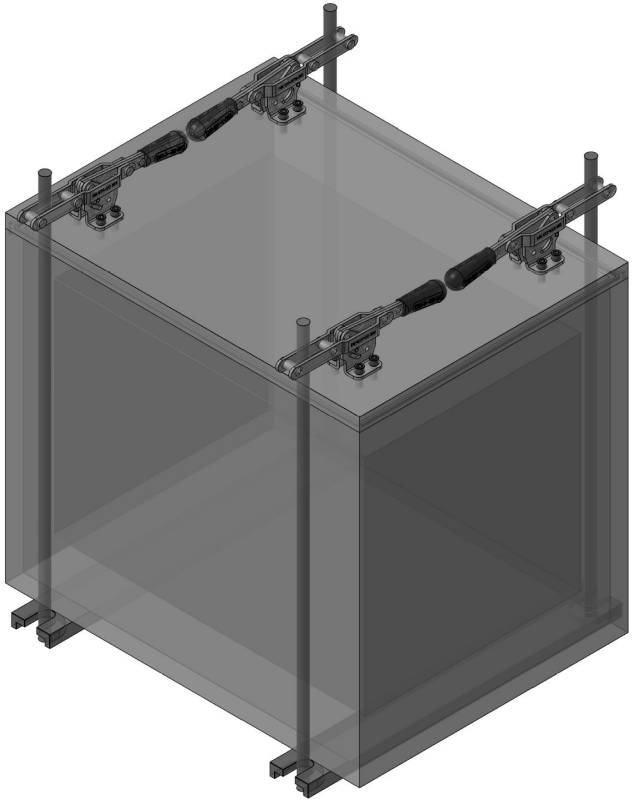
- *Lemna Minor* (Common Duckweed)
- Pressure Chamber
- Light System

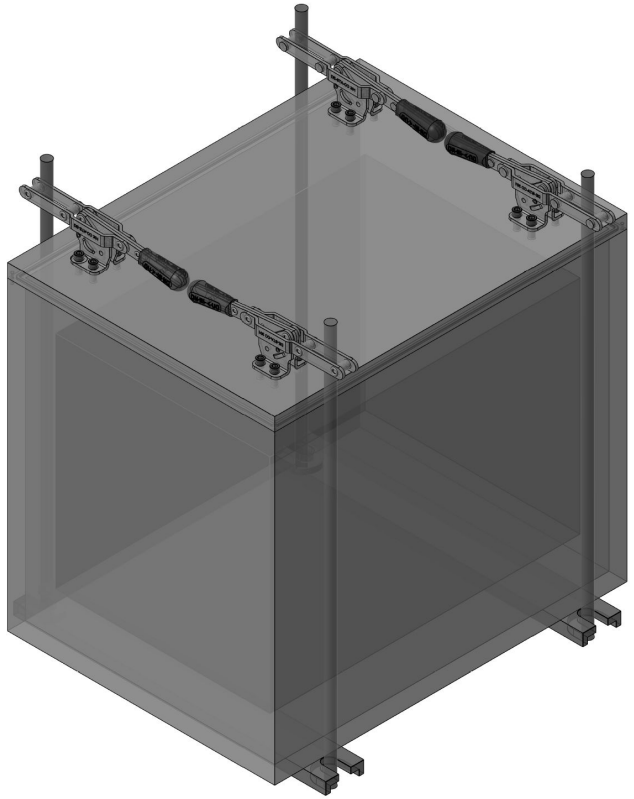
Essential Procedure

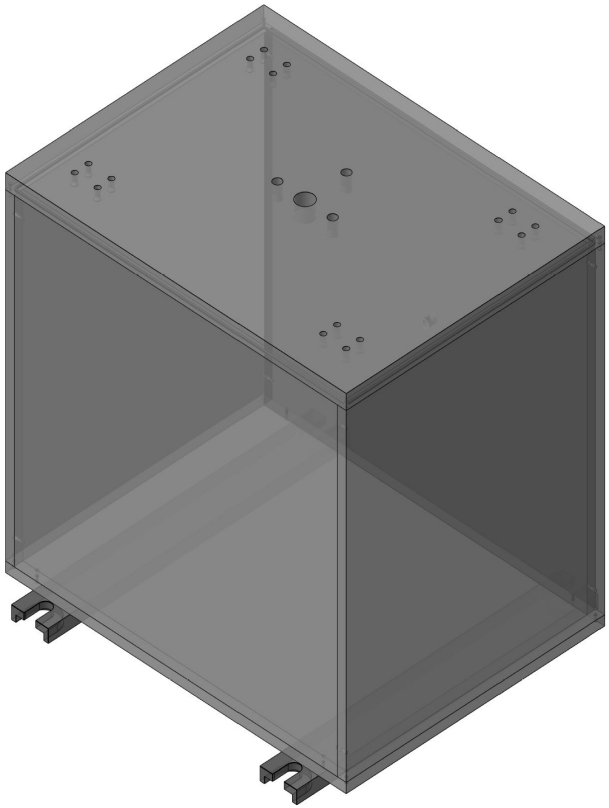
1. One week of normal (Earth) pressure and lighting.
2. One week of high pressure and high lighting.
3. One week of low pressure low lighting.
4. Test air samples and observe plant growth and record data and analyze.

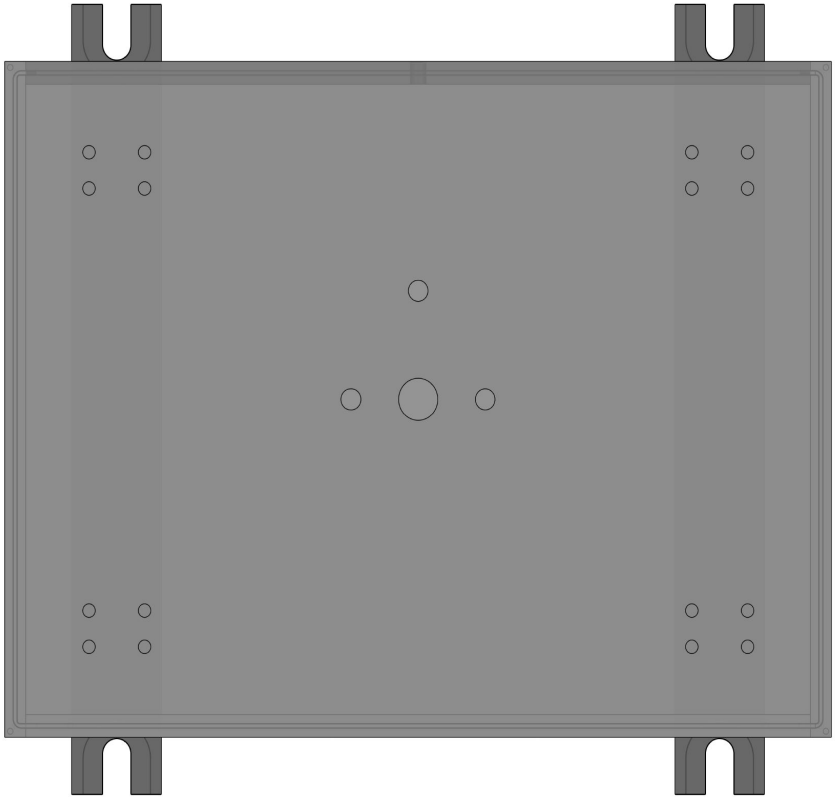


THE CONTAINMENT DESIGN









CONTAINMENT GOALS

- Reusable for future student experiments
- Designed to withstand both high pressure and near vacuum conditions
- Fully transparent to allow the observation of the experiment without disturbing interior environment

Conclusion

Unfortunately due to COVID-19 we were unable to complete our experiment past the experimental design stage.

We hope in the future we can provide further intel for any individuals looking to pick up where we have left off to complete the experiment.

Overall this opportunity, though short lived, provided many new experiences including experimental design, scientific planning, group organization, resource exploring and educational expansion on new topics.

Acknowledgments

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