Martian Aquaponics Module

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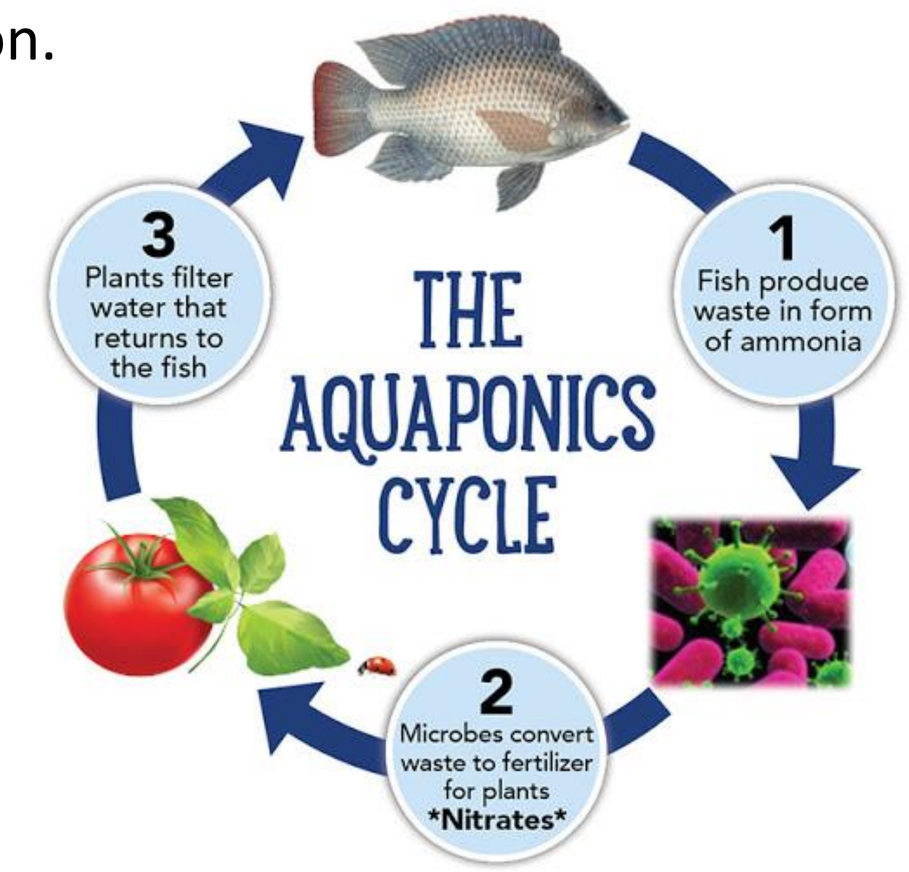
BACKGROUND

NASA has strong ambitions to establish Mars as the second planet for human survival by year 2030. To improve the quality of life for crew members during a planetary deployment in excess of 3 years, the implementation of an aquaponics system would fulfill the requirement for sustainable fresh food. The SUS consumes electrical power, maintaining an artificial ecosystem inhabited by both aquatic life and vegetation for the purpose of human consumption.



OBJECTIVE

- Design a novel sustainable food production module for crew members on Mars.
- Model a self-sustaining aquaponics system that produces nutrients for plants, fish and humans.
- Analyze the feasibility and efficiency of the module for the habitation of the Red Planet.

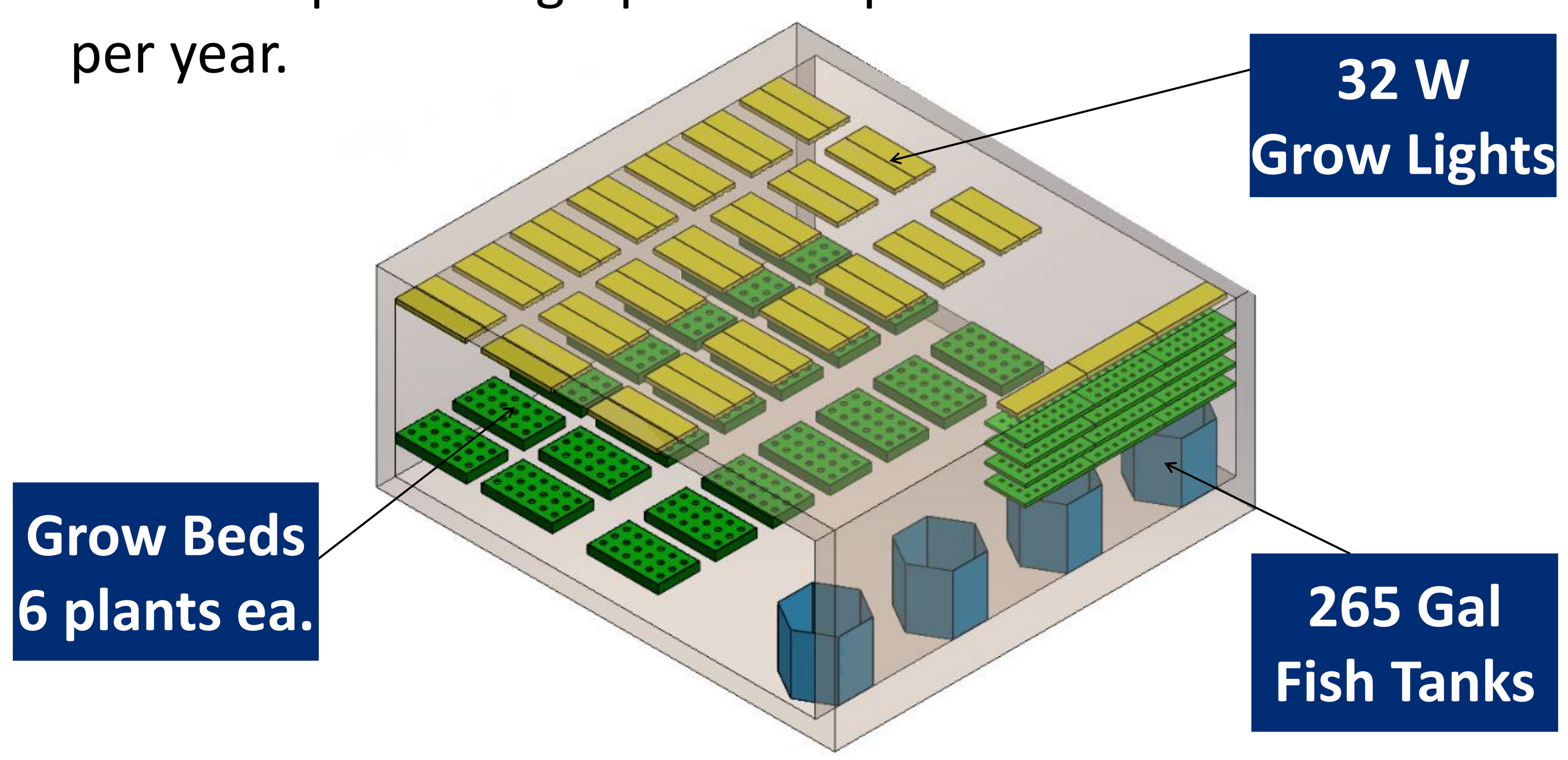
POWER CONSUMPTION

A 10-kW nuclear reactor will be available on the Mars mission. The module contains 4 – 265 gal. aquatic tanks, 21 grow beds, and 45 grow lights. The following components listed are required to keep vegetation and aquatic life healthy throughout our mission.

Components	Single Component Power (W)	Total Power in Module (W)
Grow Lights	33	5544
Water Pump	15	60
Aerator	8.5	34
Water Heater	250	2000
Total		7638

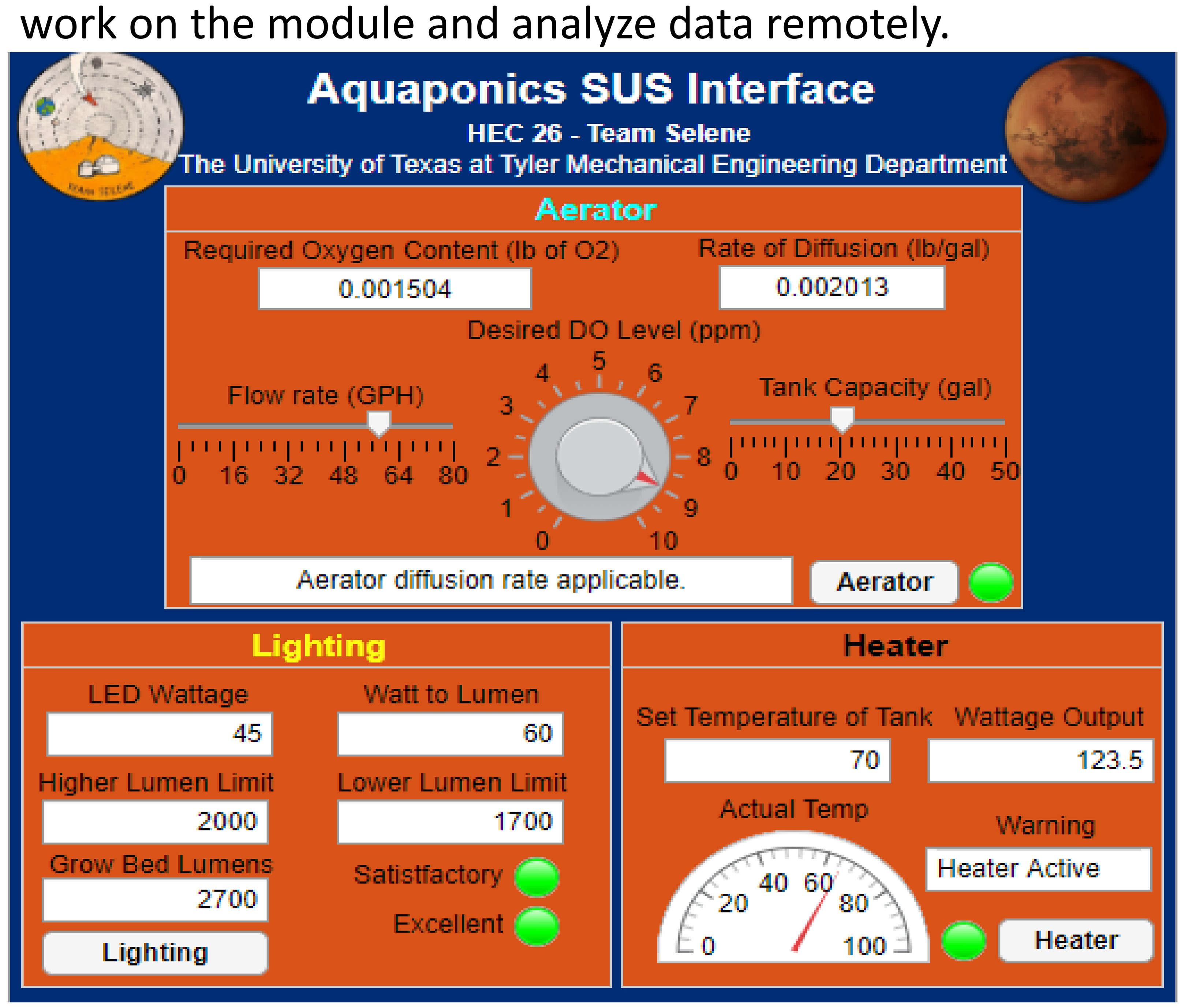
ABSTRACT

The Sustained Unified System (SUS) aquaponics module demonstrates a sustainable food production system for implementation in an initial Mars base by 2030. The module utilizes 8.5 kW of nuclear energy and 1,060 gallons of water producing up to 444 pounds of consumable fish per year.



USER INTERFACE

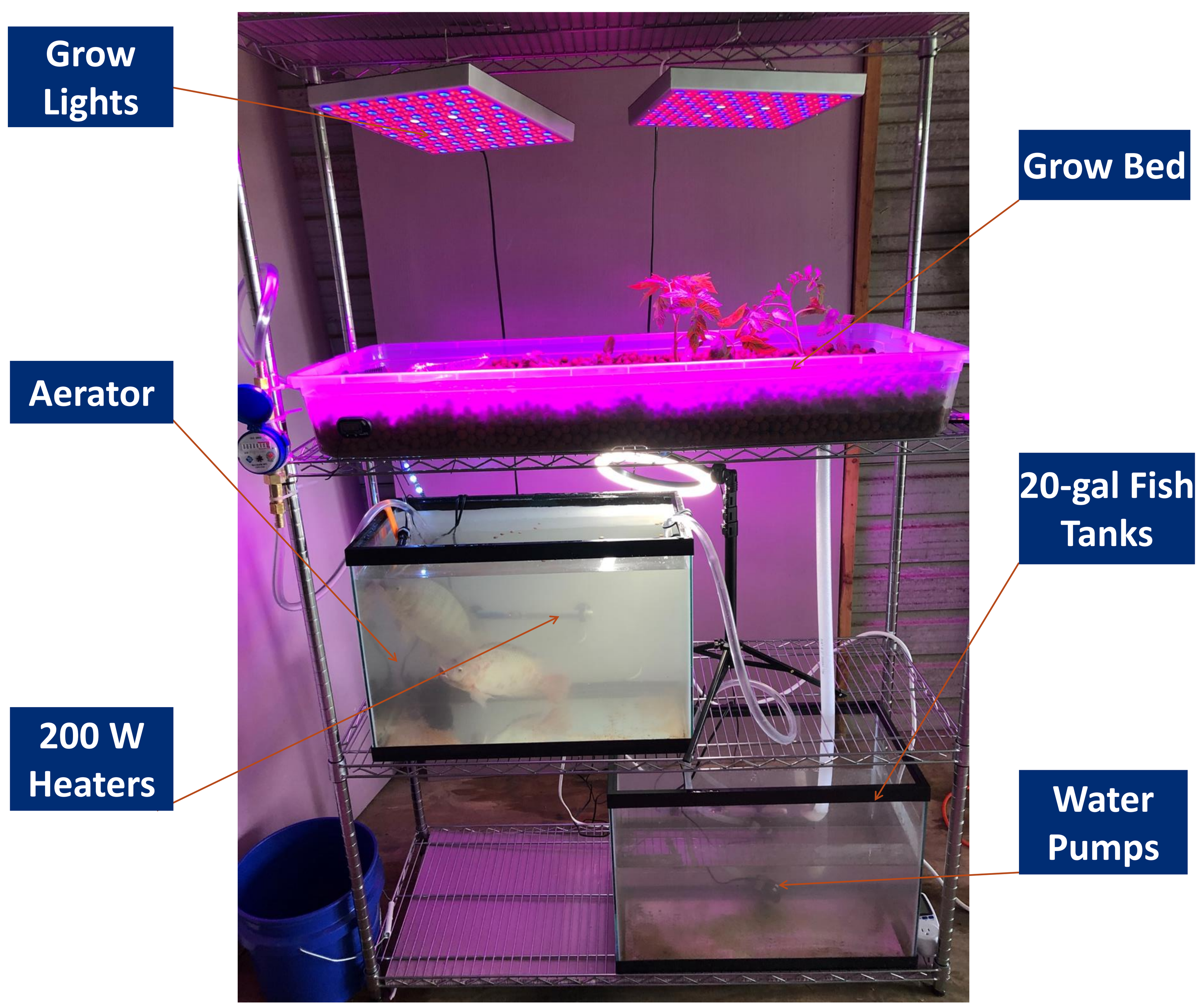
The module will benefit from the establishment of a controls system for the aquaponics module. This will allow for the reduction of energy consumption and the ability to work on the module and analyze data remotely.



SCENARIO

Maximizing module's potential, 37 tilapia would be harvestable per month for human consumption. Serving solely tilapia and steamed vegetation to the astronauts on a bi-weekly basis, the calorie consumption would be approximately 480 calories. Assuming the calorie intake per meal required for astronaut weight maintenance is 900 calories, this equates to 190 meals provided on a yearly basis.

EARTH BASED PROTOTYPE



CONCLUSION

- System utilizes only 7.6 kW of power.
- This system will greatly improve the quality of life for astronauts, providing a module in which crew members can observe the aquatic life and vegetation.
- The Earth-based prototype to the Martian module has a 1:25 Ratio which allows for feasibility analysis.

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