

Thesis Portfolio

**Hydroponic Crop Cultivation (HCC) for Food Security in Small Island
Developing States**
(Technical Report)

Mission to Mars: Sustaining Human Life Through Food
(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science in Systems Engineering

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Table of Contents

SocioTechnical Synthesis	3
Mission to Mars: Sustaining Human Life Through Food	6
References.....	16
Hydroponic Crop Cultivation (HCC) for Food Security in Small Island Developing States	19
Hydroponic Crop Cultivation (HCC) for Food Security in Small Island Developing States	20
Mission to Mars: Sustaining Human Life Through Food	25
Mission to Mars: Sustaining Human Life Through Food	26
References.....	43

SocioTechnical Synthesis

Sending human explorers to Mars is a daunting task. While there are many logistical issues to be tackled on a long-distance space flight, one of the most urgent is the question of food. There are two possible methods that may be used to feed astronauts throughout a deep space voyage. First, they could consume pre-packaged meals from a set menu devised on Earth. Alternatively, they may rely on a hydroponic agriculture system to grow the crops in space.

It is important to consider the human and social dimensions of this technology as food and diet have a large effect on one's job performance. This effect can be either positive or negative – in the case of an astronaut crew going to Mars, it is imperative that they be operating at the best of their abilities during the long and dangerous journey. Therefore, the chosen method of feeding the astronauts must produce large amounts of high-quality food. The Social Construction of Technology (SCOT) theory will be useful in analyzing the two methods proposed to feed deep space astronauts. SCOT argues that it is people who dictate the terms of how technology is designed, built, and implemented rather than the technology itself. This methodology will show how the human needs of the astronaut are of paramount importance when choosing between pre-packaged food and hydroponic crops.

Essentially all space expeditions up to this point can be considered case studies for the pre-packaged meals method. A number of experiments have been conducted that involved humans living solely off of bioregenerative systems for a period of time. These trials, combined with existing supplemental research on hydroponic systems, will make up the case studies for growing crops in space and on Mars. Once adequate evidence has been collected, the material will be analyzed using the case comparisons method. I expect to find that hydroponics is the

astronaut sustainment method of the future, with pre-packaged food serving as a temporary solution while mankind perfects hydroponic technology for use in space. When considering this technology within the SCOT framework, one will see how a hydroponic system needs to be tailored to the unique human physiological and psychological needs during a deep space mission.