Thesis Project Portfolio

Student Researched and Developed High Power Rocket

(Technical Report)

An Exploration of Necessary Practices for Long Term Space Habitation

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Space exploration is a rapidly growing industry. However, full scale missions usually range upwards of hundreds of millions of dollars with added risk factors when implementing new technologies for space environments which makes them difficult to test. A solution to this is found in sounding rockets, which cost a few million dollars maximum and offer a cost-effective model for new technologies, techniques, and instrumentation. To showcase this, the capstone project focuses on the creation of a sounding rocket with my contributions focused on the aerostructural aspect of the nose cone. This was built in accordance with the guidelines set out by the Intercollegiate Rocket Engineering Competition (IREC). When dealing with sounding rockets, it is important to keep in mind the human and social dimensions. IREC allows people attending colleges and universities to get involved in rocketry, helping to encourage students to pursue careers in related fields and training the next generation of industry professionals. Additionally different safety measures and regulations must be abided by when designing a sounding rocket. Sounding rockets are a key technology to improve related fields such as space habitation. To understand the connections between technology and humans regarding space habitation, Star's concept of infrastructure can be used to explore both large and small scale impacts of space habitation.

The main method of research to examine how lessons learned from past experiences influence necessary practices for successful long-term space habitation were conducting case studies of the Apollo missions, Skylab, the ISS, CHAPEA, Mars500, and Biosphere 2. While analyzing these instances I collected the practices needed for successful long-term space habitation. The data analysis and interpretation approach were qualitatively focused with a case study approach. Through this research, the lessons learned from these experiments will be useful in determining necessary practices for expanding human space exploration that avoids previous mistakes and improves upon the overall experience. The data points towards needs to improve the physical and emotional well-being of astronauts and cooperation efforts in a space environment. Identified implementation strategies including physiological and psychological were used to make a conclusion that identifies several recommendations for practices that should be implemented when considering future long-term space habitations for mission success.

There are several implications of my capstone project and my STS research when considered in concert. A main implication is the use of educational competitions to incite interest in different industries such as the future of space endeavors. Another implication is that competitions where students gain hands-on experience allow students to become better prepared to tackle industry problems upon graduation. Without opportunities to gain experience, and ways to improve upon existing technologies, the necessary practices for long-term space habitation may not become visible.