Project ASTERIA- *Advanced Satellite Technology Exploring Radiation in Aerospace*

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Abstract: Long duration spaceflight and manned missions to other planets are in humanity's foreseeable future. For scientists and engineers, this means finding better methods at protecting everything on board and preserving human life. The purpose of Project ASTERIA (Advanced Satellite Technology Exploring Radiation in Aerospace) is to find ways to mitigate radiation exposure to living organisms. Research has shown that the use of inflatable layering is an effective way of reducing radiation damage by diminishing the particles in each layer. Another mitigation technique is a water wall. The properties of water (H20) has proved to be effective in deflecting radiation molecules. We will implement the use of water walls and inflatable layers to test radiation absorption and deflection.Through this project, we hope to find supporting evidence that technologies such as these could be used for long duration spaceflight. The use of inflatables and water housing to encapsulate the habitat could provide adequate radiation protection to living organisms. Our end goal is to create a CubeSat that will house a living organism with our protection techniques to measure the amount of radiation it receives. Until then, we will simulate the mission in a software system that is capable in managing the orbit and radiation to the spacecraft.

Existing Technologies

After 6 months on the ISS, an astronaut receives around 80mSv of radiation. In comparison, during a 6 month trip to Mars an astronaut will receive around 450mSv of radiation. This dosage proves to be extremely risky to a long duration mission. In regards to deep space travel, various technologies have been implemented in order to reduce the radiation load inflicted upon astronauts and any other biological life on board a vehicle. Some of these technologies include:

- Water Walls:
- Inflatable layers:

Applications of the Technology

The applications for the current technology are limited, as there are many tests being conducted on the reliability of the technology. Water walls (WW) are designed to enhance and provide life support on long-duration missions to other planetary bodies. Currently, that is the most popular application of water walls, next to interior design and aesthetics, such as modern house construction. Water walls have several functions including water filtration and storage, radiation protection in space, and cooling or warming capabilities. The biological dependency on water (H2O) is a crucial detail to take into consideration, especially with long-duration spaceflight. The resources on these missions will be extremely limited and water walls are just one way to help provide structural support, storage, and radiation protection for the crew aboard the spacecraft. Currently, water walls are being tested but have not been applied to any missions or spacecraft yet. We expect to see the application of water walls increase over the next few decades, and even be an active component of the first manned mission to Mars.

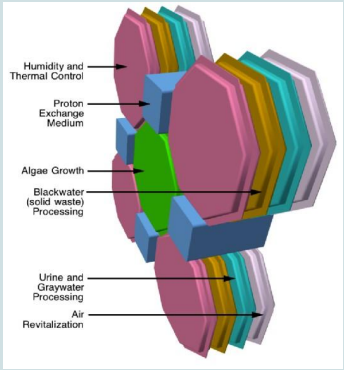
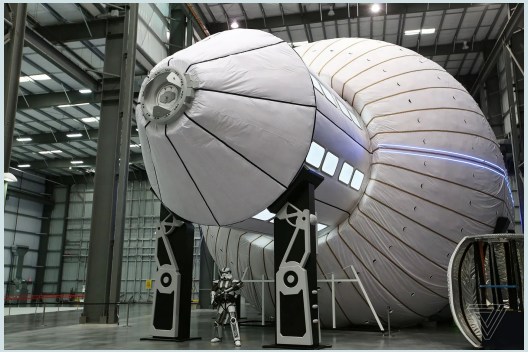


Figure 1

Figure 2



Future Applications

In the beginning stages, Project ASTERIA will simulate the effects of radiation on biological life while accounting for water walls and inflatable layering through a simulation software. Project ASTERIA aims to implement the use of water walls as well as inflatables into a CubeSat in order to demonstrate the effectiveness of these radiation mitigation techniques respective to the biological life, in this case a plant, on board. A water filtration system will act as a radiation shield and to resupply clean water to the living organism. The inflatable system will encapsulate the living organism to act as an added shield. It is important to study the progression of growth within the plant with a control and dependent variables. There will be a plant without protection (control group), a plant with only an inflatable wall, a plant with only water walls, and a plant with both inflatable and water walls. This will give us a sense of how radiation impacts living organisms and what protective measures can be taken to mitigate it.

References

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