QSC Case Competition 2025

Background Info

As space travel and extra-terrestrial planet occupation become increasingly accessible, creating an environment which allow plants and animals to thrive is vital. These biological systems are integral to life-support mechanisms, including food production, waste recycling, and atmospheric regulation. On top of the sustainability related benefits, plants and animals would likely reduce psychological stress for astronauts. The presence of plants and small animals in the habitat can provide comfort and reduce feelings of isolation. Urban green spaces on Earth have been shown to offer similar benefits, improving mental health and fostering a sense of community. However, the unique conditions of space present significant challenges that require innovative and sustainable solutions. You are a group of scientists working with the European Space Agency (ESA) on a project to bring sustainable life to space.

Space radiation poses a significant threat to biological organisms. DNA damage, mutations, and cancer are a few of the likely risks if proper safeguards aren't put into place. Earth's primary protections from radiation comes from its magnetic field and atmosphere [1]. Depending on the planet chosen for the task, systems must be implemented to ensure a minimal dose of radiation affecting plants, animals, and people. By doing this, the likelihood of adverse effects in space goes down allowing for a more sustainable environment.

Creating a sustainable habitat in space necessitates the efficient use of limited resources like water, energy, and nutrients. Additionally, the animals and plants chosen for the project are important as some species may be more resistant to the harsh conditions that the planets may bring [2].

Another consideration to be made is the effects of microgravity during the space travel. In plants, microgravity can alter cell structure, disrupt nutrient transport, and affect growth patterns [3]. In animals, muscle atrophy and bone density loss in microgravity environments are common [4]. Solutions to this may include shorter space travel or artificial gravity, but it is up to your group to research and solve these problems.

Your Task

You are tasked with designing a sustainable solution for creating and maintaining a successful habitat for biological life on a real extra-terrestrial planet of your choice. Ensure survival and productivity for biological life that supports long-term human missions in space. Assume government funding is provided for your solution but aim for resource efficiency and long-term sustainability.

Consider the following:

- Selection of biological life (plants and animals)
- Plans for cultivation, maintenance, and reproduction for a stable ecosystem
- Effects of microgravity/radiation, resource limitations, and space constraints
- The distance from Earth to the extraterrestrial planet of your choosing
- The conditions that would allow life to thrive on the planet
- The more creative the better!!!

Upon further assessment, your team has the resources to travel to one planet only. The European Space Agency has provided your team with a selection of extraterrestrial planets; it is your decision of what biological life to bring and habituate to the area. The future of exploration depends on your approach!

Presentation

Through a PowerPoint/PowerPoint equivalent presentation, each group has 5-6 minutes to demonstrate to the judges why their solution is the most practical and efficient. With the available resources, you are open to making your presentation as creative as possible. Use the marking scale on the next page as a guideline to feature any key points. Ensure you include references (APA Format) on a slide in your presentation.

FAQ

1. How do presentations work?

Information for your presentation is given at 12:00 PM and have from 12:00 PM to 1:30 PM to work on your presentation. Keep in mind that lunch starts at 12:30 PM, but you can use this time to collaborate with your group. The case competition presentations start at 2:15 PM and will be judged to determine the winner.

2. Are there any limits on creativity?

Your solution can be as creative as you want and what you think fits best.

Marking Scale

Team Name:

Practicality

Is the proposed system likely to work effectively and sustain a habitat for biological life in space?

1 2 3 4 5 6 7 8 9 10

Does not meet criteria Exceeds Expectations

Creativity

Taking an alternative approach to the problem. Developing a new solution that may have practical applications.

1 2 3 4 5 6 7 8 9 10

Does not meet criteria Exceeds Expectations

Economic Viability

Does the project seem to be within a reasonable budget? The solution should attempt to be as economically feasible as possible.

1 2 3 4 5 6 7 8 9 10

Does not meet criteria Exceeds Expectations

Presentation

Were the speakers engaging and informative? Did the presenters clearly define their solution? Was the total presentation time 6 minutes or under?

1 2 3 4 5 6 7 8 9 10

Does not meet criteria Exceeds Expectations

Total Score /40

References

[1] O. US EPA, “Cosmic Radiation,” *US EPA*, Nov. 27, 2018. https://www.epa.gov/radtown/cosmic-radiation

[2] “Plant Native | NWF Native Plant Habitats,” *National Wildlife Federation*, 2024. https://www.nwf.org/Native-Plant-Habitats/Plant-Native

[3] NASA, “Growing Plants in Space - NASA,” *NASA*, Jun. 09, 2023. https://www.nasa.gov/exploration-research-and-technology/growing-plants-in-space/

[4] J. McHarg, “Building a growable habitat for sustainable life in space,” *tees.tamu.edu*, Feb. 06, 2019. https://tees.tamu.edu/news/2019/02/building-a-growable-habitat-for-sustainable-life-in-space.html