

Young Aerospace Visionaries Contest – Topic Background (2024)

The American Institute of Aeronautics and Astronautics (AIAA) Northern Ohio Section (NOS) has announced its 2024 Young Aerospace Visionaries Contest. Two topics have been chosen, one for Kindergarteners through 4th graders and the other for 5th graders through 8th graders. Below is some background information on each of the topics. Teachers and parents who are introducing their students/children to this opportunity are highly encouraged to use this background information to teach them about the topics and to spark ideas for a vision. Ambitious and interested students may take the initiative to learn about the topics on their own. We also highly encourage additional research about the past, present, and future direction of these topics.

Grades K-4 Topic Background and Challenge: My Space House

On Earth we live in houses or apartments. They are a dwelling that we call home. They provide us with shelter and include amenities that are often taken for granted. In fact, our homes are more complex than you might think. Our homes protect us from the elements. They give us coverage from the wind, the rain, and the heat of the Sun. They even have systems to control the environment, so we don't get too hot in the summer or too cold in the winter. They have electrical power that runs various lights and devices such as computers, televisions, and home appliances. They have plumbing that provides water for drinking, watering plants, cooking, and washing; as well as plumbing for removing waste. Our homes have designated spaces for sleeping, bathing, storing and preparing food, eating, relaxing and interacting with others, storing tools, and more. Our homes are full of things that make our lives more convenient and allows us to share the space with the ones we love and depend on.

As complicated as our homes are, imagine living in space or on a distant extraterrestrial body such as the Moon or Mars. The surrounding environment is much harsher than the Earth. The atmosphere (if one exists) is not compatible with supporting human life. The very air we breathe must be formed through the extraction of resources and recycled as much as possible. The outside temperature can vary by several hundred degrees with much of that range being incompatible with human life and the growth of plants that we need for food. Without protection you are open to radiation from space, which if not blocked could impact one's health. The force of gravity acting on you is a small fraction of what your body is naturally accustomed to on Earth. You feel as light as a feather. The only problem is that without finding a way to exert more force on your body or putting your muscles to work, your body could wither, and your health could suffer. There's also the issue of what to do with garbage. What can be reused and how can you manage what can't be reused? How would you communicate with others? An emergency isn't as simple as dialing 9-1-1, so how do you deal with emergency scenarios such as personal injury, a fire, etc.? Do these issues impact house design? If this is a long-term destination for you, what else do you want or need to sustain yourself? Oh, and one more thing—it's very expensive to transport building materials from the Earth to your new extraterrestrial home. Only some of the building materials can be extracted from the surroundings. This means the house needs to be as efficient as possible with using materials and consuming resources.

So, what does your future Space House look like? As you form your vision, you might consider some of these questions: What challenges need to be addressed (there are certainly more challenges than what is mentioned above)? What features does the house need to have? What technologies are needed to make

your vision a reality? What are the most necessary features, and what are luxuries? How does the house operate and enable self-sufficiency?

Grades 5-8 Topic Background and Challenge: A Sustainable Future In-Space

The National Aeronautics and Space Administration (NASA) is leading an initiative to return to the Moon and put humans on Mars through the Artemis program. This will be the first human mission to the Moon since 1972 and this time we are going to stay. The purpose will be to learn how to sustain a human and robotic presence on the Moon before attempting to do the same on Mars. After all, the Moon is a 3-day journey from the Earth and maintains a roughly constant distance from the Earth. A trip to Mars will take about 7 months. Furthermore, the orbits of the Earth and Mars only aligns once every 26 months to enable the most energy-efficient trip. In other words, the trip is very long, and the duration of time spent on Mars could be long as well. Once the mission is committed, there will be very little that we on Earth can do to promptly help our astronauts. The Moon will be a training ground to make sure we get it right.

On the Moon we hope to learn a lot. Technologies for enabling a future mission to Mars will be validated, scientific experiments will be conducted, and we will learn how to extract resources from an extraterrestrial source and use them for our benefit. This will lessen dependence of our astronauts on the Earth. Examples could be the extraction of water or hydrogen from lunar ice, which can hydrate our astronauts, help grow plants, or be used as fuel. To survive on the Moon and conduct all the activities we desire, we will need to have power, mobility, food and water, shelter, and an effective way to communicate. We need power for the habit/living quarters, research equipment, and vehicles including rovers and the spaceship that will transport humans to and from the lunar surface. We will need mobility to enable efficient exploration of the lunar surface and gathering of lunar samples. We also have to meet basic survival needs such as food and water that sustains the astronauts, and shelter that protects them from the harsh lunar environment and radiation from the Sun. The Artemis program envisions a lunar network similar to the Internet on Earth. Communication is key, not only on the lunar surface, but also with an orbiting space station called “The Gateway” and with mission command on Earth. By 2028, NASA and its partners plan to have established a knowledge base and to have laid the foundation for a sustainable presence on the Moon, with a vision for reaching distant worlds starting with Mars.

As we build a presence on the Moon and expand upon the achievements of the Artemis program, what will a sustained presence on the Moon look like? As you form your vision, you might consider some of these questions: How will we use the Moon to benefit humankind? How will the resources on the Moon be utilized? What challenges will there be to maintaining our presence on the Moon? How will we sustain our presence there? How sophisticated will our presence on the Moon become? What technologies will we need to develop to enable your vision?