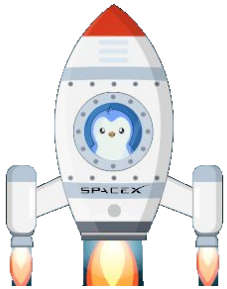
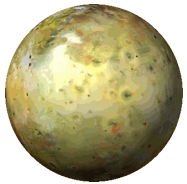
# Exploring the Final Frontier with our Sustainable Spacecraft

Essential Questions:
How can we design a sustainable life-support system for long-duration space travel?
How does international collaboration strengthen innovation?



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**Davis Middle School:** Compton Unified School District
Compton, California

# Engage:

We had several challenges that we wanted to look at:

1. Can aquaponics work in space to grow food?
2. How can we travel faster in space?
2. How can we travel through space while being safe and sustainable?
3. How can international partnerships help humans work together to explore space and create innovation?

We wanted to further explore the concept of aquaponics. From our aquaponics system in our classroom, to the aquatruck and last year's aquaship, we wanted to expand on our experiences. So now we want to explore using aquaponics in space to grow food

We began to do research on these topics and also invited the students from the Colegio Militar de Manaus Brazil to submit their ideas. We learn so much from each other and really had fun. We even submitted a proposal to present at the ITSE Conference 2026 that will be in Florida. We just found out that both of our groups were accepted, now we have to seek approval and funding to go!

In one of the videos Mr. Gonzalez show us we learned that Europa might have an ocean under its crust and perhaps life could be found there. Working with our other team members that were creating underwater vehicles (ROVs) we decided it would be our mission and destination

# Engage:

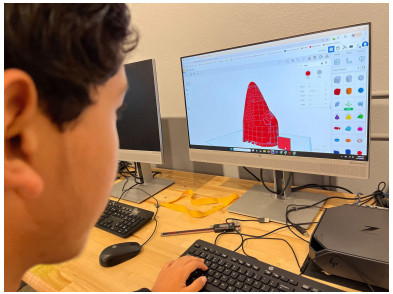
What we learn:

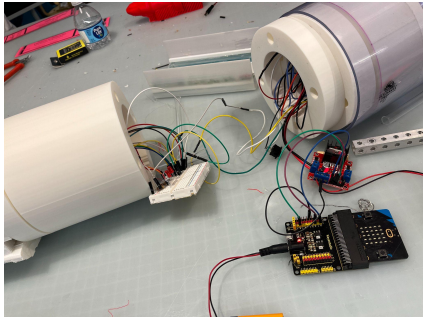
- We learned that many of the systems for our spacecraft could be used on earth and promote sustainability.
- We knew that all the green energy systems could be used on earth such as the solar panels and nuclear energy could be used in space
- We learned that our crew would have to recycle all of their water and we discovered that the international space station used those systems. We would like to explore their use on earth.
- We tested that aquaponics could grow food just about anywhere and that it would reduce poverty and starvation on earth.
- We learned from the students from brazil about the wonders of the Water Lettuce; a plant found in Amazon. It could remove toxins from the water and we could use its fibers to repair the ship. It was the basis of our spacecraft's sanitation system.
- We learn how dangerous space travel is to the human body such as atrophy and radiation. We also discovered that scientists are using the lessons learn from their studies to help find cures for cancer,  blood diseases, and other illnesses on earth.
- Finally we learned how important it is to collaborate with others, how working together we can make our planet a better place to live. We discovered that something that happens on one side of the world can affect the rest!

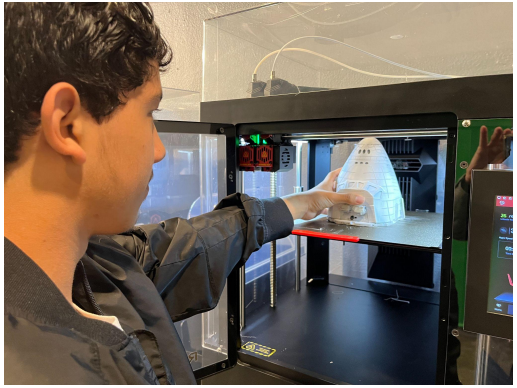
# Investigation:

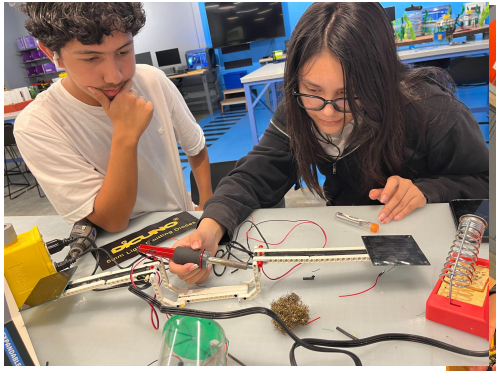
Aquaponics: With the help from Mr. Gonzalez, we started research on building an aquaponics system in space. We discovered that NASA was interested in using systems in Space.
Mr Gonzalez also showed us the Project Hyperion, where the winners of the contest also design an aquaponics system in space for a starship. Their design was too technical for our team so we decided on a simpler version.
It is from this site we got the ideas for the aquaponics system, gravity wheel (we did not have the technology to get our whole ship to rotate like theirs) and the nuclear propulsion system.
We also did research at the NASA website it had a lot of useful information.
It was at this NASA website that we learned about Nuclear Propulsion and how our ship could travel faster to Europa and limiting the harmful effects to the crew.
Finally we had the great opportunity to ask one of the Boeing engineers that volunteers to help our FTC Robotics team. He gave a lot of useful information and he was always there to answer our questions.
The rest of the information we received from visiting various website including the European Space Agency where we learned about the dangers of space travels to humans.
Mr. Gonzalez show us a lot videos such as these: What Happens To The Human Body In Space YouTube and Nuclear Electric Propulsion: How the US Space Force is Revolutionizing Space Travel YouTube

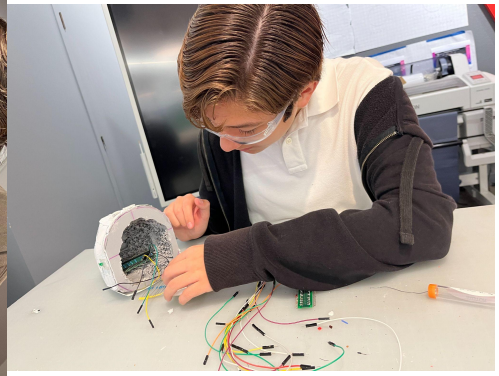
# Investigation: Our Team at work!









# Action:

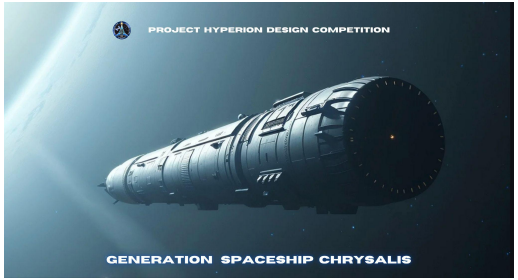
Each of us in the team were in charge of different sections:

- Elizabeth was in charge of building some of the compartments and painting them and all the miniature people. She also helped in soldering connections.
- Brando who is really good with Tinkercad did most of the design work and also using AI tools such as ChatGPT, Canva AI, and Craiyon. He also helped with soldering the wires.
- Caleb was really good with Arduino and MIcro: bit, he programmed all of the LEDs, sound effects, and the engine effects.
- Milton worked on the last project on Cospaces/Delightex creating virtual worlds. So he chose to create the interior of the ship virtually
- Finally, Valentino working on designing the gravity wheel, building the motors,and working on the wiring. Caleb helped him on the coding to get the gravity wheel to spin with DC motors and Micro: bit.

Mr. Gonzalez gave us the idea of using the plastic tube for the body and we began to design and 3d print all of the compartments. We spent 4 months working on the spaceship, staying after school and coming in on Saturdays!

# Action:

After our research we began to draw up some plans for our ship using the Project Hyperion as a guide: We sectioned off the ship in various compartments based on the Hyperion:
So we had:
Engineering and Repair Workshops
Medical: Surgical and Dentist for emergencies and everyday care
Cafeteria, food storage and food preparation facilities
Entertainment and a Gym
Sleeping Quarters
Gravity wheel for reducing muscle atrophy

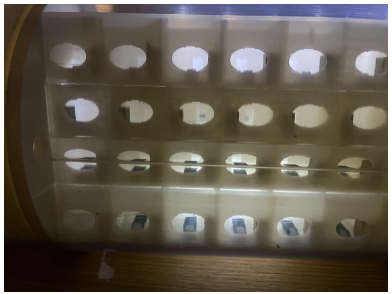


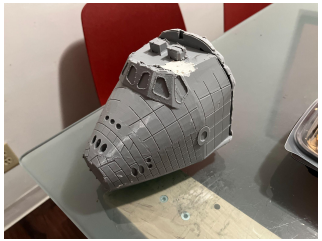

**From Project Hyperion Website**

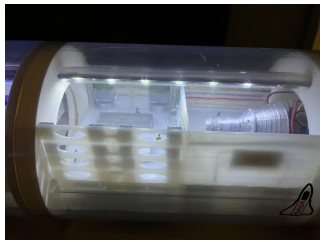
Here are the **UN Sustainable Development Goals** we selected:
SDG 2 – Zero Hunger (Aquaponics system)
SDG 6 – Clean Water & Sanitation (Water Lettuce sanitation design)
SDG 9 – Industry, Innovation & Infrastructure
SDG 12 – Responsible Consumption & Production
SDG 17 – Partnerships for the Goals

We discovered that many of the applications that we used are called dual purpose: they can be used in space and earth!

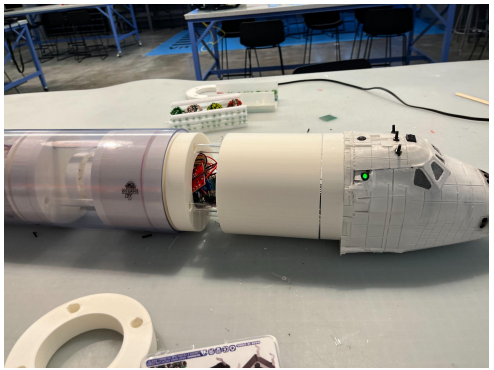
# Action: Images from our Spacecraft

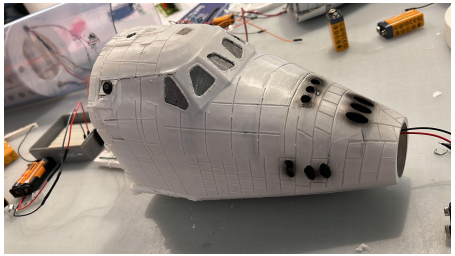


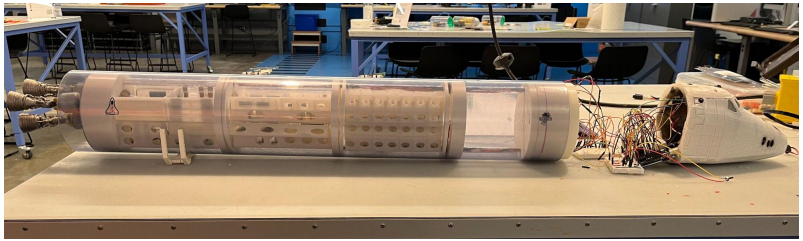




Link to video







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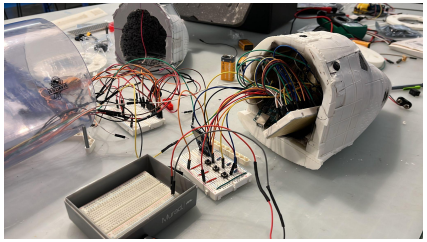

Engines Effects: turning on