



Teknisk rapport
Designa en rymdstation - Tekniktävlingen 2024-25
Chalmers universitet

Av
MYP 1 (åk 6) elever
Och
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1. Idébeskrivning

Our vision was to build a space station that enhances the living and working environment of the astronauts on board and is a better version of the International Space Station (ISS). We wanted to improve their living experiences inside the space station where they get a feeling of their own homes, have less stress, have exposure to nature, get chances to socialize and exercise, grow their own food, create oxygen and drinkable water. We further decided to reuse as many everyday materials as possible to build our future space station. Our focus was on building a more efficient, sustainable space station constructed around a dome filled with greenery to mimic earth. The space station would be launched in the orbit of the moon to be able to use the resources from the moon and also serve as a station for fuel recharge for interplanetary travel and deep space explorations.



A central dome would serve as a living room for all of the astronauts to socialise, meet each other, and celebrate. The living room mimics a residential living room on earth. Under a microgravity situation, we decided to stick the furniture to the ground using strong, good-quality industrial velcro. The furniture also has straps for astronauts to tie over themselves. Using the dome, you could go around in a circle, which would serve as a path to all of the rooms, such as the laboratory, bedrooms, a gym, and a kitchen.

The laboratory would be used to research and carry out experiments and would also act as a control room for the robotic arm. A section in the lab would be having a greenhouse to grow plants using various spectrums of lights to understand if photosynthesis can happen under various light conditions. Another section would be used to create water using the ilmenite mineral that is collected from the moon to extract oxygen and combine it with hydrogen. The

lab would also be used to convert water vapour into water, ice caps from moon into water and also have a recycling unit converting urine and waste into water and compost for plants.

Our four bedrooms would be similar to bedrooms in a house on earth, This was done so that the astronauts get a feeling of knowing where to go to sleep and relax when they are not working. Each bedroom has a pillow, bed, mattress which are stuck with velcros. The beds have straps to have the astronaut feel in one place. Each bedroom would be separate, and the astronauts could customise it to their liking, e.g., hanging photos of loved ones on the walls, flowers, books on the wall, a wall-mounted toilet in each bedroom. The toilets are connected to recycling units that help in converting urine and body waste into usable things. Velcros have been used extensively in the bedrooms. The kitchen would have cabinets that would have dehydrated food (made on the space station and on earth), and there would also be a place to grow fresh food and dehydrate it for later use.

We decided to include a gym to have the astronauts exercise and maintain good health of their bones and muscles. The gym would have a harness treadmill and exercise bands.

This way, the vision was to create a closed sustainable ecosystem and good living and working conditions in the space station.

2. Målgruppsanalys

We discussed with students, teachers and we all agree that having good teamwork means being respectful, open-minded, and accepting different perspectives. Always understanding where someone's opinion is coming from is one of the key factors. Being able to support your teammates will always lead to good outcomes. The Space station should be inclusive regardless of religion, country and should encourage collaboration. While working on our version of the space station, we decided to include the flags of all countries of the students who worked on the project. We embrace different identities and abilities and we demonstrated them through the pride flag and the disability flag on our space station.



In addition, Astronauts should set aside some time every day to assemble in the living room to socialize with one another, play puzzles and games together that will help them to feel relaxed. We think that in the International Space station (ISS), the stress levels for astronauts can be quite high as everywhere they see electronic equipments, wires and machines which is so different from an everyday life on Earth. Astronauts should also exchange their daily jobs for variety and learn from one another. Every astronaut should be encouraged to do house cleaning and grow food and be in nature. There should be mutual understanding and commitment.

3. Design

We started off with sketches on paper. With the help of our teacher, we divided ourselves into groups and we came up with our version of what could be a future space station design. Then, we shortlisted the design based on the Criteria from Chalmers University and then through voting, selected the best design. We then moved on to designing the space station in Tinker CAD. Once this was done, we collaborated with BTH (Blekinge Tekniska högskolan) to 3D print our design from Tinker CAD (but maybe the PLA was of poor quality and few parts of our 3d model came apart). Below are the Prototypes.



On Paper



Tinker CAD

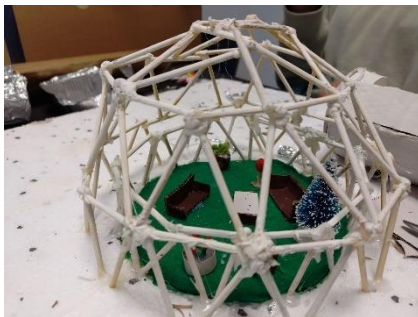


3 D Print



Final product

The design of the space station revolves around comfort, functionality, and psychological well-being for astronauts. At its core is a geodesic dome designed as a central living space to mimic a “living room” environment. This open, communal area allows astronauts to gather, relax, and socialise, providing a sense of normalcy and comfort despite the isolation of space. During the construction of the project, we realized that some aspects that we considered to be simple during prototype making was difficult for us to construct considering we did not have much experience and also lack of time. Hence our resulting product is not exactly the same as our Tinker CAD prototype but we are proud of our final product.



The central Dome (Living room):

The central dome serves as meeting point for all the four astronauts to meet, socialize, celebrate. It is similar to a living room in a house / apartment on the Earth. We have made the base green in colour as it symbolizes nature. We have placed furniture that are stuck on velcros on the floor.

There are some flower vases and also a Christmas tree as the four astronauts would celebrate Christmas at the Space station in December.

Module 1 (Bedrooms):

Each of our four rooms has paintings, plants, and tables connected by velcro, which is extremely useful in the space station because it can hold anything with a firm grip. There are no drawers; instead, we have used velcro on the walls to hold all of the belongings.



Module 2 (Kitchen):

Instead of cabinets, we have velcroed all of the pots with plants and dehydrated food, and all of the plastic will be recycled and reused for the next batch of food (made in space and on



Earth).

All of the plants and food growing in the kitchen would be at the same optimised temperature as those on Earth for efficient growing, but also experimented to see the impact of different environmental conditions. Photosynthesis helps in producing oxygen. Waste would be recycled and reused to support plant growth.

Module 3 (Laboratory):

Our lab would have a wall-mounted set of buttons that would be used to control everything in the lab. Examples include the plant's light, robotic arm controls, and the docking port. The chairs of the table would have straps on them to ensure the astronauts could stay in place and be comfortable. In the laboratory, experiments and research can be carried out to grow plants under different artificial light conditions. There would be green houses. The plants can produce Oxygen using Carbondioxide, water and light. There are also chambers that help in converting water vapour to water. The astronauts can exhale into bags and these bags with water vapour and carbondioxide can be stuck into those chambers that helps in converting water vapour to water. Carbondioxide will be used in photosynthesis. There are also going to be recycling units that help in converting urine, and waste into drinkable water and compost for plants.



Module 4 (Gym):

Inside the gym, you shall see a harness treadmill, parallel bars and water to drink.

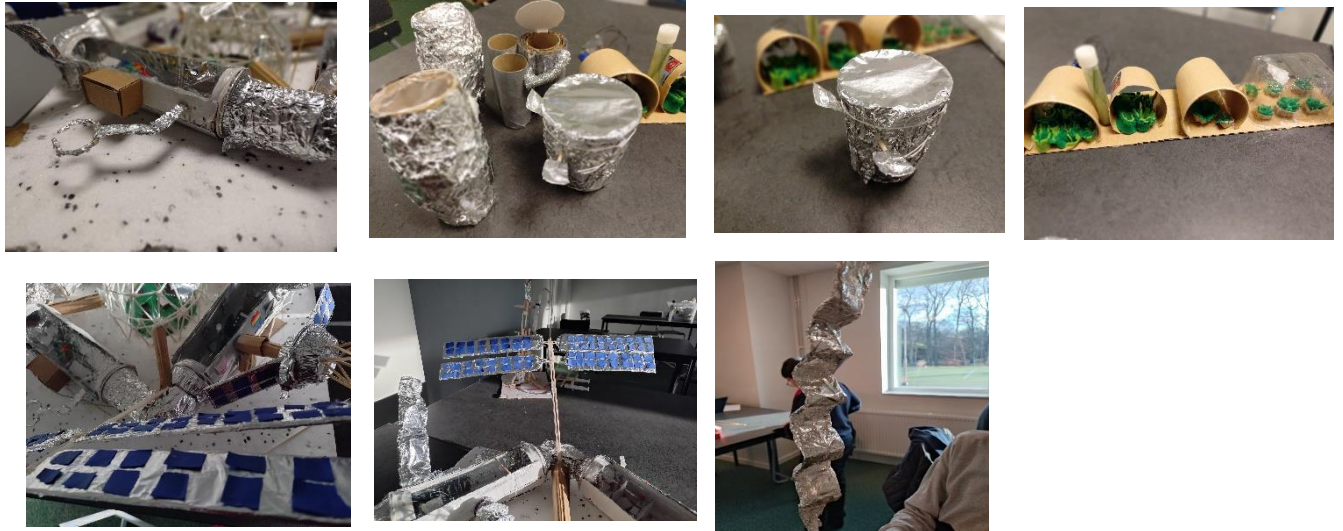


4. Tekniska lösningar

Since our vision was to design a closed sustainable ecosystem at the space station, we thought to create features and functionality that will help the space station to sustain itself – Be it energy, water, Oxygen or food.

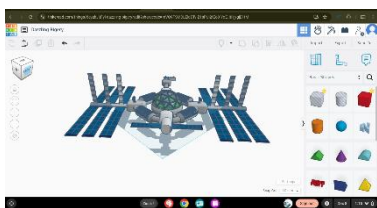
- To create energy, Solar panels are used. These solar panels will use natural sun light to produce energy required to run the space station. There are radiators also at the space station that will help release the excess heat energy back into the space.
- To create Oxygen, we decided to have green houses with plants that will help the plants to do photosynthesis, this way there is oxygen produced. There is also experiments done to see if plants can grow under various artificial lights.
- To create water, We decided several mechanisms. Firstly to bring Ice caps from moon, melt them into water. Secondly, to use bags where in astronauts would exhale into the bags using straws. The water vapour that is collected in the bags would be put into a chamber that would convert water vapour into water. Thirdly, urine could be converted into water through a recycling system. Toilets are going to be there in every bedroom, which are connected to recycling systems that finally ends in a central recycling system, through the process of filtration, evaporation water is collected.
- Body waste is also fed into the recycling system to use it as compost for the plants.
- Waste would be managed by separating it into wet and dry bags, and if the wet bag ran low on water, it would be filtered into the water. We would send the dry bags into the atmosphere to burn sustainably. Robotic arms would help with material collection and repair by eliminating the need for astronauts to go outside.

- Inside the kitchen, you may notice plants growing on the walls and the floor. Growing crops in space would involve first placing special dirt with enough fertiliser to allow the plants to grow healthily. We would then place a plastic sheet with holes for the plants over the dirt to keep it from floating away. Following that, we would plant genetically modified seeds capable of surviving zero gravity and space conditions.

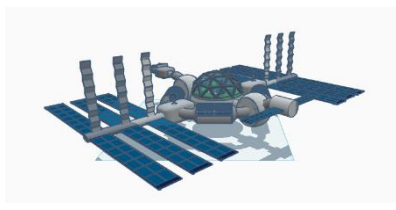


5. Måtsatta skisser

You can view our space station's CAD model by clicking this [link](#).



Front view



Side view



Top view

6. Reflektion

We are new to Middle years program (grade 6) and worked very hard on the project along with juggling our other summative exams in different subjects. We got access to a classroom to start our construction activity only on the 25th November. Our teacher smartly converted this task

of building a future space station into our summative so that everyone takes the assignment seriously and works on the project. It also coincided with our Winter show which took away our lessons. So our teacher borrowed time from non-graded subjects such as ICT and Wellbeing and used that time for our lessons. Apart from tough deadlines, we also had other challenges and conflicts. But we realized that most conflicts can be resolved by getting to hear both sides of the argument, finding a mutual agreement, and respecting each other's opinions. Everyone can be respected in some way, such as by listening, understanding, and cooperating with them. You may try to ask questions and listen to them. Setting rules for your work, like don't bring up ethnicity, politics, religion, controversy, or uncomfortable topics, helps.

While we were making our project, we had separated everyone into groups with people they work well with. But then we had some conflicts about the bed's design, but then we had found an agreement. Later on, some students had said that they did not want to do their part, but we had re-allocated them according to their needs:

- A person refused to participate in the crafts, so we used the Pomodoro Technique, which involves working for 25 minutes and taking a 5-minute break, and paired them with someone they get along with.
- A few people struggled to concentrate, so we advised them to listen to music through headphones and paired them with people with whom they work well.
- A person did not get along with their group, so we moved them to work with someone else.

This way, through continuous understanding and support, we helped each other learn and grow and completed our project. We also understood to never give up however hard it is.

We had lots of fun working on our modules, assembling them together, filming our space station in Swedish and also naming our space station THE OASIS, as our space station is a sign of greenery and good life in the orbit around the moon's white desert.