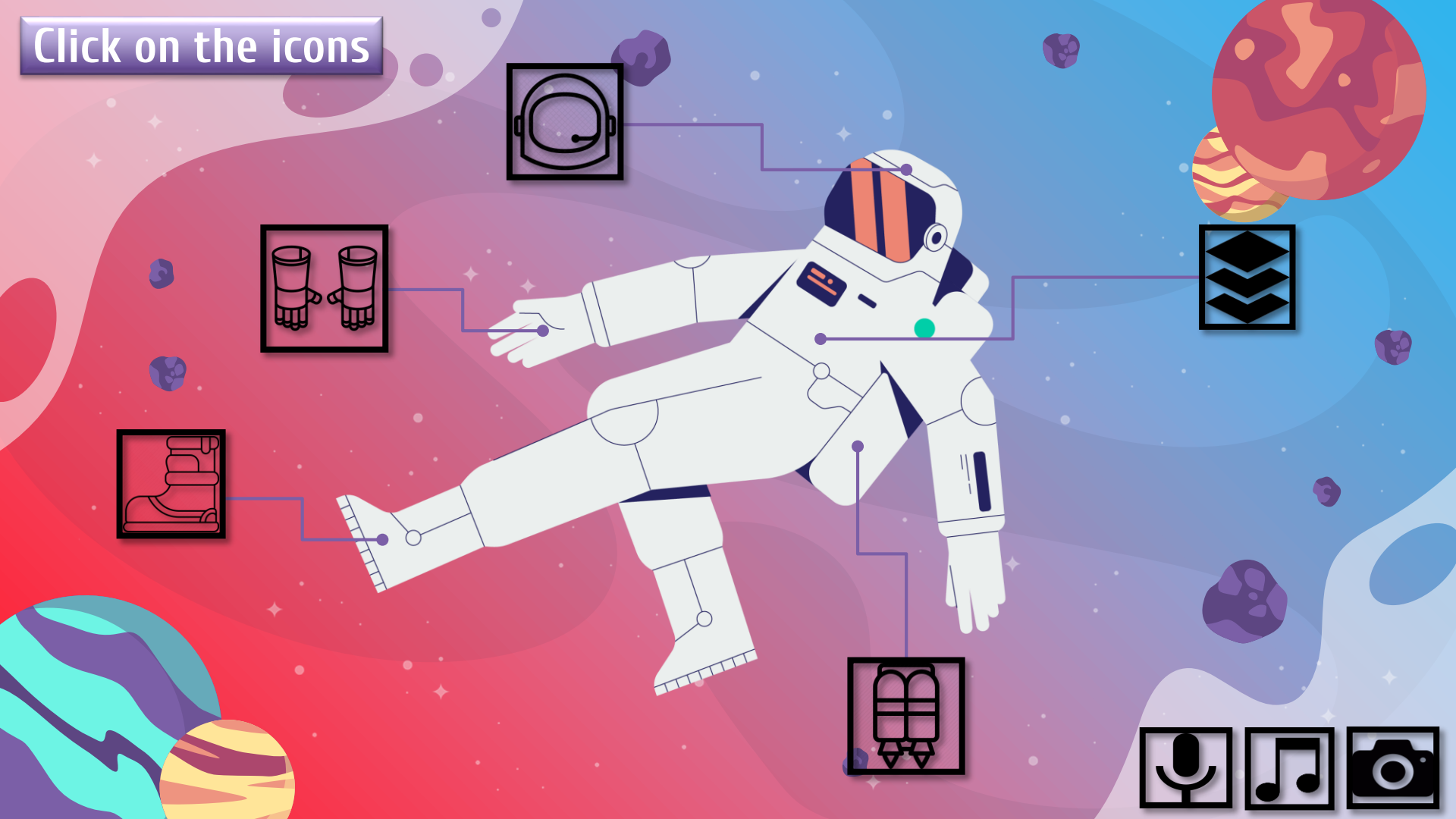
MARS EXPEDITION TO THE POLAR ICE CAPS

Gatti Santina, Romero Micaela, Alba Posse Petra

Smithsonian Air and Space Museum

COLEGIO PORTEZUELO

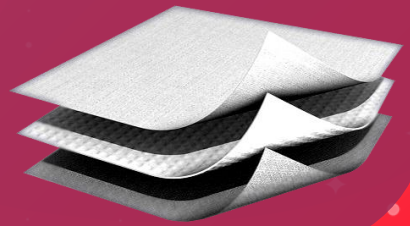
Click on the icons



SUIT LAYERS

While early space suits were made entirely of soft fabrics, ***today's Spacesuit for Mars*** will have a combination of soft and hard components to provide support, mobility and comfort, since the suit will be designed to actually walk and not to “space-walk” as in previous missions to the moon. The suit itself has 13 layers of material, including an inner cooling garment (two layers), pressure garment (two layers), thermal micrometeoroid garment (eight layers) and outer cover (one layer). Materials include:

- ***Nylon tricot***
- ***Spandex***
- **Urethane-coated Nylon**
- **Dacron**
- **Neoprene-coated Nylon**
- **Mylar**
- ***Gore Tex***
- ***Kevlar***
- **Nomex**



HELMET

The astronaut's helmet protects its wearer from micrometeoroids, solar ultraviolet rays as well as infrared radiation. It is made up of a protective shell, neck ring, vent pad and feed port. Protection from radiation is actually provided by the Extravehicular Visor Assembly, which is fitted over the helmet.

One particular aspect that we considered at the moment of creating the suit was the "Albedo effect". Albedo is a measure of how much light that hits a white surface is reflected without being absorbed. Something that appears white (as it is the case of the snow) reflects most of the light that hits it and has a high albedo, while something that looks dark absorbs most of the light that hits it, indicating a low albedo. Since our space suit will be designed to explore the Polar Ice Caps on Mars, the astronaut will need to be highly equipped with a visor that protects him from the sun.

SMART GLOVES

"The smart glove uses a microcontroller to read different kinds of sensors," says NTNU student Sondre Tagestad. "The sensors capture even subtle motions of the hand and fingers and wirelessly transfer them to a mobile device that controls the drone or any other robot. The Devon Island testing team evaluated the "Astronaut Smart Glove" technology through a series of field trials involving remote drone operations. Astronauts on Mars could use drones for mapping, to collect samples that are out of reach of the astronauts, or to assist in search and rescue operations.

Since the suit will be designed to explore the Polar Ice Caps, we consider it necessary to include some extra features for cold temperatures; the gloves' interior will have some heating cables in the glove fingers, that are connected to a power supply that heats the fingertips.

VIBROTACTILE BOOTS

"The boots have built-in sensors and vibration motors, all connected to a small microcontroller that processes the sensor data and determines which cue to send to the user." The front of each boot contains an ultrasonic range-finder, a proximity sensor and a six degree-of-freedom Inertial Measurement Unit. The vibratory feedback delivered to the feet is supplemented with an augmented reality visual display that also indicates the location and proximity of approaching obstacles.

Characteristics of the boots for exploring the Polar Ice Caps:

- The boots contain a ***SNOW GAITER***
- The boots will have a ***considerable HEIGHT***
- The boots will have a ***RUBEBR BOTTOM***
- The boots will be made to be ***WARM***

Portable Life Support System

Oxygen Supply

Cooling Garment

Feedwater

Two-way communication

Artificial Leaves

Oxygen supply

Oxygen, which is stored in a small tank, is pumped into the helmet automatically, which maintains the pressure necessary for the astronauts. For the removal of carbon dioxide and humidity, oxygen is circulated through the subsystem and purified. This happens in the following way: oxygen passes a lithium hydroxide cartridge, which filters the carbon dioxide exhaled. There is also an activated charcoal bed that removes other contaminants, such as body odors. Once this is done, oxygen is already purified and ready to be recirculated to the helmet.

Liquid Cooling and Ventilation Garment

This subsystem cools the astronaut by circulating chilled water through tubes integrated into the suit. To control cooling, the astronaut uses a valve that allows him to choose which temperature he desires.

Portable Life Support System

Portable Life Support System

Feedwater

Expendable water is stored in a rubber bladder reservoir. Around 11 pounds of water are provided: 5 to 8 pounds stored in the main reservoir, and the remaining pounds in an auxiliary tank.

Two-Way Communication

The main problem astronauts have in space is that, since atoms are so far apart from each other, sound does not ‘’bounce” and it doesn't reach the eardrums. That's why they communicate through radio waves, which belong to the Electromagnetic Spectrum, and thus they are light waves. Light does not need a medium to travel (that's why sun rays travel through space and reach earth!), so communication is made possible this way.

Portable Life Support System

ARTIFICIAL LEAVES

ARTIFICIAL LEAVES are capable of going through the process of photosynthesis using only carbon dioxide and modified water, these leaves release oxygen for breathing and methane, which can be stored for energy purposes.

Portable Life Support System

“Music to my ears”

It is not a mission without some music, and movies can testify that. Hence, we have put together a playlist of what we deem as an enrichment to the astronauts’ auditory sensations. For obvious reasons, the expeditors can link their own playlists to the suit, regardless of the named viable alternative, we have created a playlist of our own, which we concede it as an iconic selection that would delight the astronauts.

ARTIFICIAL VOICE ASSISTANT

In order to facilitate and ease the astronauts' jobs we plan to acquire an intelligent voice assistant. It would be just like a Siri to Apple, or an Alexa to Amazon. The astronaut could ask several practical questions or others such as:

- How much O2 do I have left?
- What is the temperature outside?
- Can you contact me with the headquarters/base?
- What time is it?
- Give me the directions to the ice caps base
- Open the voice notes
- Take a picture of what I am currently seeing

THIS IS OUR TEAM