Polar Bear Sea Ice Platform and Retreat

I. ABSTRACT

There are many animals which rely on sea ice. Polar bears are one of them. Without sea ice, polar bears cannot live. They need sea ice to hunt seals and to breed. When the sea ice is gone, they starve. Sometimes, they drown from exhaustion in their search for sea ice. Unfortunately, global warming is causing the sea ice to melt, making it difficult for polar bears to survive.

While the world is working on stopping global warming, we have come up with a temporary solution to help the polar bears. We are designing a floating sea ice platform. The platform is going to be 3D printed with solar energy to power a cooling system in the platform. We are hoping the world continues to keep caring for this planet.

II. PROJECT DESCRIPTION

1. PRESENT TECHNOLOGY

Polar bears live in sea ice regions across the Arctic. Water is frozen when it's 32 degrees Fahrenheit (°F) or lower. The temperatures in the Artic allows for sea ice to freeze, melt and freeze again. Sea ice is needed for the Arctic ecosystem. The salt in the ice creates bubbles in the ice where micro-organisms grow. These small organisms play a role in the arctic food chain. As temperatures are rising, sea ice is melting but not freezing like before. We are losing ice.

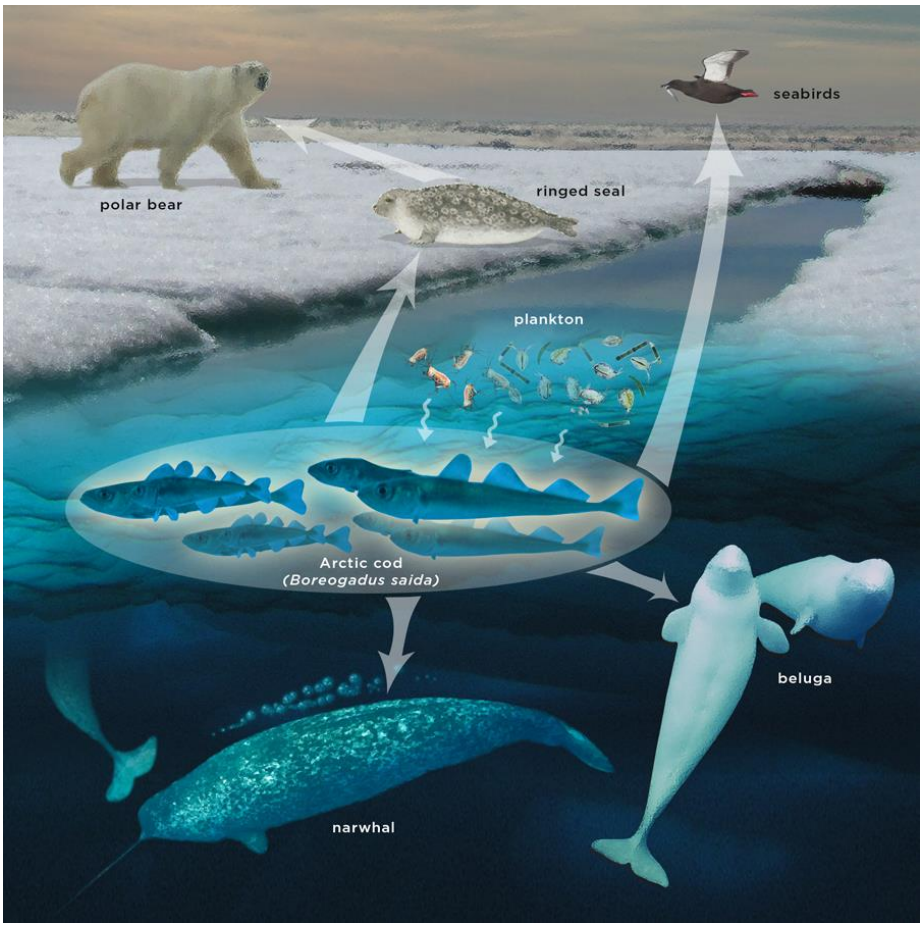

Photo by: © Oceans North, The Pew Charitable Trusts

Fig 1. Arctic Oceanic Food Web

By using different present technologies, we can create a future technology to make a polar bear ice platform that will not melt. We will use a very large 3D printer to print a platform made out of plastic. The size of the open water is also an issue for our platform but we will use an anchor to make sure the platform does not drift out to sea.

Sea ice around the platform is very important. We will use solar energy to freeze the salt water to create bubbles where the micro-organisms grow. Solar panels will be mounted on the platform. Solar panels convert solar energy to electricity. A transformer converts low voltage from the solar panels to the high voltage required for the refrigeration unit. The refrigeration unit cools the fluid that is circulating through the platform to freeze water in to ice and keep it frozen.

Computer Aided Design tool (CAD and 3D Printer)

Computer Aided Design tool (CAD) is used to create a 3D file to send to a 3D printer. The 3D printer takes the plastic and melts it. The melted plastic comes from the nozzle and is placed on the print plate in the shape of the bottom of the object. More layers are printed in the shape of the middle and top of the object resulting in a 3D model.

We used our 3D printer to print a small scale model. Today, 3D printers cannot print a very large platform. We would need to design and build a large 3D printer or print smaller parts of the platform and connect them together.

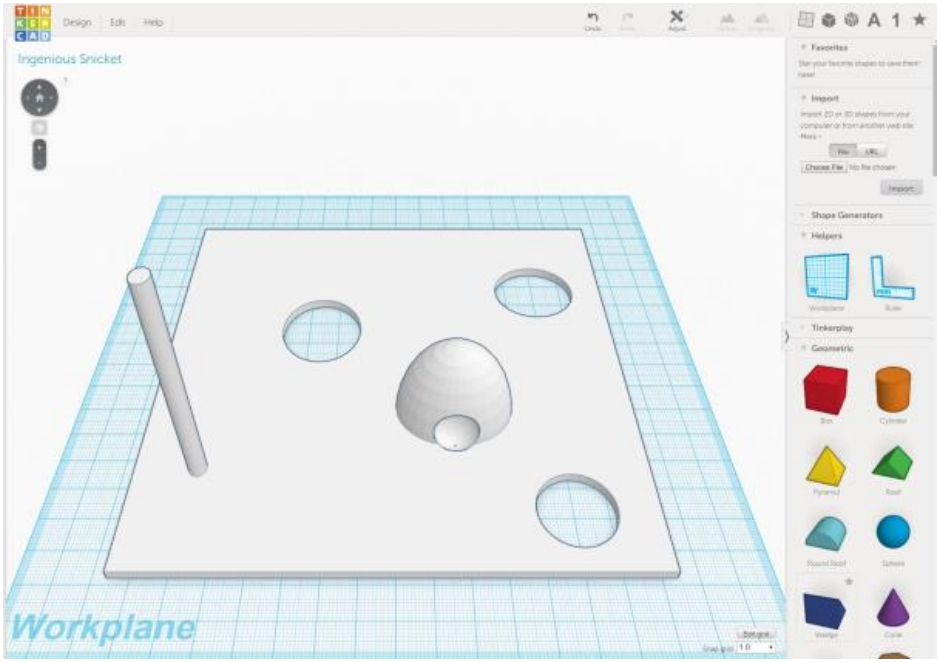

Fig 2. Tinkercad application and Sea Ice Platform Design Screen Capture

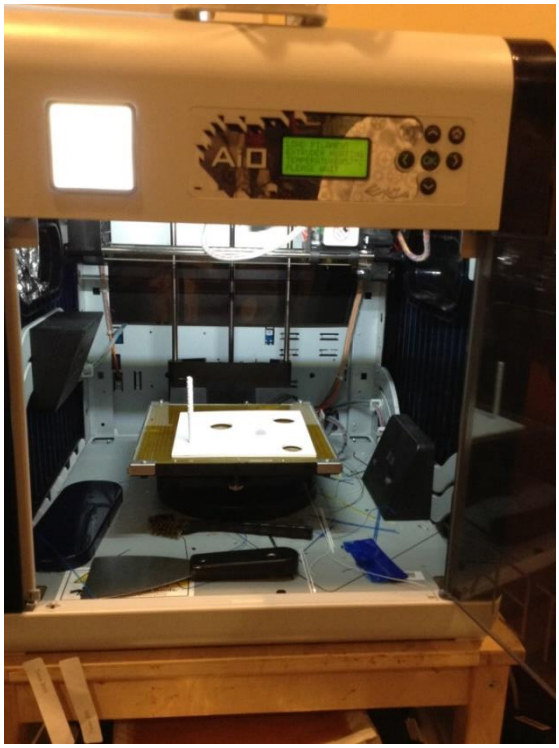

Fig 3. Printing Small Scale Model with a 3D Printer

Solar Cells

Sunlight hits the solar panels and is absorbed. Sunlight excites electrons inside the atoms of the solar panel. The sunlight from the excited electrons is released as heat or travels out of the cell as electricity. Groups of solar cells convert solar energy into DC electricity. Inverter coverts the DC power to AC. We are going to use solar panels and use the solar energy to power the refrigeration unit to keep the ice cold. The only limitation would be if the units break and needs to be repaired in the middle of the Artic. We need to design and build a sturdy and strong platform.

Refrigeration Unit

The refrigeration unit uses the changing states of matter. The liquid turns to a gas and back to a liquid and this repeats in the compartment. The refrigerator works like the following:

- The liquid is pumped from the condenser to the coils within the platform.
- It absorbs the heat and evaporates into a gas.
- The gas vapor is pumped back to the condenser.
- The heat goes into the air, cooling the gas back to a liquid.

The only limitation would be if the unit breaks and needs to be repaired in the middle of the Artic.

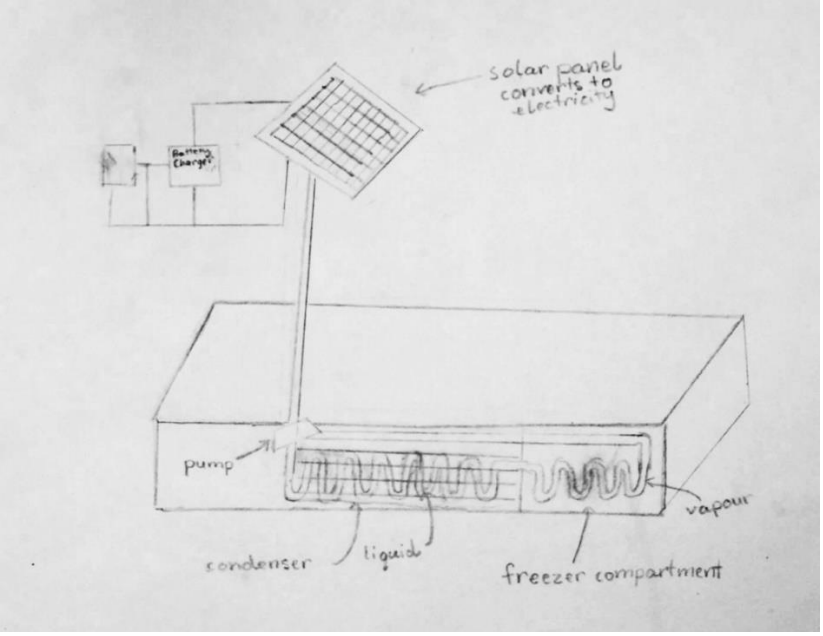

Figure 4. Platform Design Sketch

2. HISTORY

Computer Aided Design tool (CAD and 3D Printer)

The Tinkercad CAD application was used to design the platform. Tinkercad was founded by Kai Backman and Mikko Mononen in 2011. It lets people use a browser-based 3D design platform to create their 3D designs. Hideo Kodama invented the 3D printer in 1981. He invented it at the Nagoya Municipal Industrial Research Institute. We were able to make a small scale model using the CAD program and 3D printer. 3D CAD applications are used by people who need parts and people who want to have fun making parts for other people. 3D printers can be used to make toys and supplies for windows, locks, models etc.

Solar Cells

Solar cells were first invented by French physicist Edmond Becquerel. In 1839 he built the world's first solar cell. He built it in his father's laboratory. Solar energy is used today to power homes, cars and anything that may need electricity.

Refrigeration Cooling Unit

The Chinese, Indians and Egyptians have been trying to keep things cold and frozen since as early as 1000 BC. Later, the Scottish professor William Cullen made a small refrigeration machine in 1775. Many scientists made changes and improvements over time like Benjamin Franklin, John Hadley and Michael Faraday. In 1927, GE introduced refrigeration units for commercial use and refrigeration units continued to improve throughout the years. We use refrigerators to keep things cold like food and ice rinks. Refrigerators are used in homes and railroad cars.

3. FUTURE TECHNOLOGY

Our future technology will allows us to have ice even when temperatures are not below freezing in areas where animals can go extinct without ice. We have designed a platform with ice on it to replace the melting sea ice in the Polar Regions. The platform is going to be 3D printed with a refrigeration cooling system powered by solar energy. The cooling system is going to keep the ice on the platform cold and solid so the polar bears can breed.

The platform can be designed to meet the needs of the polar bear. We will have holes so they can hunt seals. The holes are also going to be breathing holes for the seals which is also the

way polar bears catch the seals. We are also going to have little snow dens where the cubs and adult polar bears can sleep. We hope this technology is going to help polar bears and their loss of sea ice.

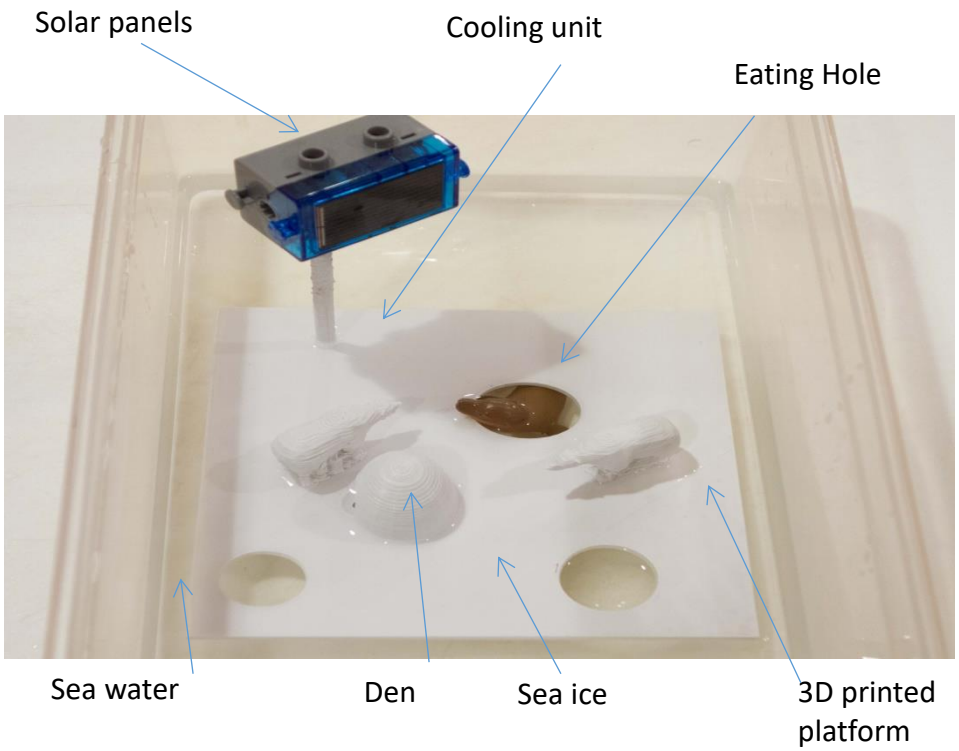

Figure 5. 3D-Printed Model of the Platform

In the future, we would like to use tracking devices and Global Positioning System (GPS) technology instead of anchor to move the platform as polar bears move around. GPS was developed in the USA by the Department of Defense in 1973. In 2000, the government allowed others to use the GPS technology. Now we have a navigation system in our phone or car that helps us navigate. The tracking device is a small electronic device that can be attached to an

animal. GPS allows us to use satellites to find a location. The location from the tracking devices can be used with the GPS system to give us the location of the polar bears.

There are many types of tracking devices; we often track birds using them. In the 1800s, they put rings on bird's legs. When you capture a bird with a ring, you can look at the information on the ring to find out where it came from and how far it had travelled. Later radio frequency was used and developed into a GPS system in mid-1990. GPS technology, allows scientist to know where the animals are. We would also need a waterjet propulsion mechanism linked to the GPS and tracking devices to move the platform once they have a signal and know where the polar bears are located.

4. BREAKTHROUGHS

The future technology requires larger 3D printers to print our large platform and it could be used for larger things like houses for the homeless. Our future idea of adding GPS, tracking and waterjet propulsion to the platform is complicated and need systems to work together. If the GPS, tracking and waterjet propulsion worked together and was being used by many people, the cost would be cheaper. Today, we don't see the three technologies being used at the same time. We would need a system to link the tracking, GPS and waterjet propulsion to work together.

We need to do studies and look at how many polar bears are living today and how many platforms we would need to build. We need to understand the polar bears weight and size for us to build a platform. If we don't understand it might tip over, break or be too small. We can put trackers on polar bears to see where they are and decide where we want to put the platforms. We can also see if they move around and if the platform should move or can stay anchored.

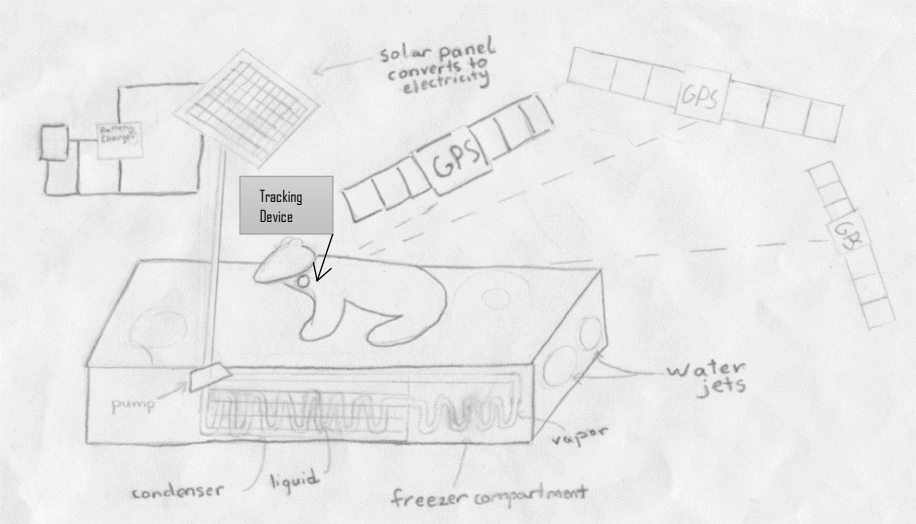

Figure 6. Design Sketch with Future Technology

5. DESIGN PROCESS

We went through steps in the design process. We created a diagram to show the steps.

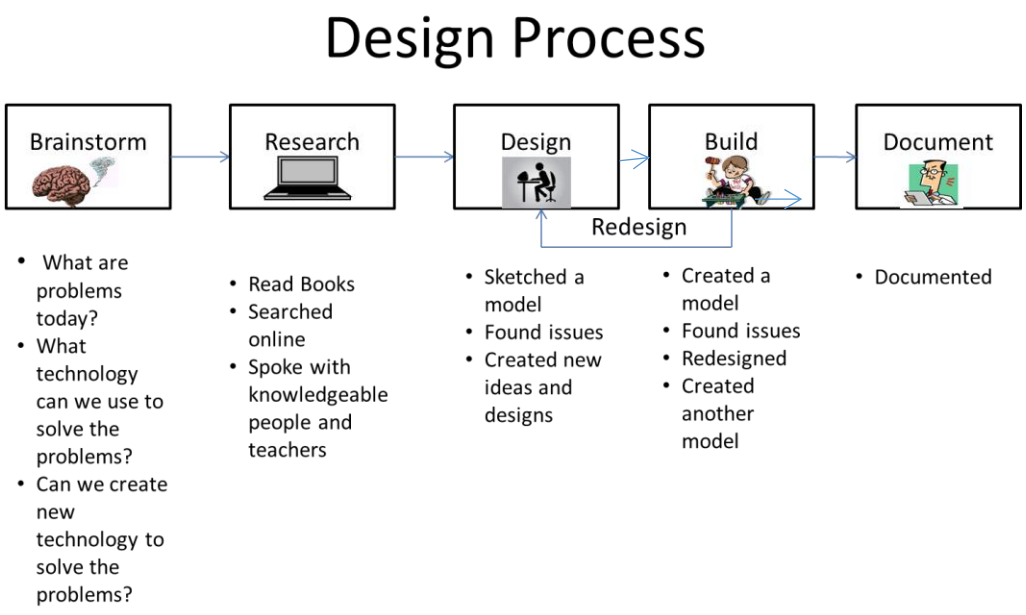

Figure 7. Design Process Diagram

We decided we wanted to create a 3D platform for the polar bears to use if the ice continues to melt and we have no more ice in the Artic. After researching, we rejected a plastic platform without ice because it didn't solve the problem of the ecosystem.

After we designed an ice platform using solar energy to make electricity to power a cooling unit to freeze the water, we realized our platform would just float away into the Arctic Ocean. We reviewed three possible solutions. The first idea was to add a compass and power propeller to move the platform and make sure it doesn't float away. We rejected this idea because the propeller could hurt the polar bears and it would not know where the polar bears were located.

The second idea of using tracking device on polar bears, GPS and a waterjet propulsion system was discussed and decided it should be a future technology capability. We thought the tracking device; GPS and waterjet propulsion system added a lot of complexity and would cost lots of money. The last idea of using an anchor seemed the best because we would know where the platform was located and so would the polar bears.

6. CONSEQUENCES

We have several advantages for creating this new ice 3D printed platform for the polar bears. The platform provides habitat and hunting ground for the polar bears.

- The platform doesn't melt like natural sea ice.
- The cooling system is powered by solar energy which doesn't pollute the environment like fossil fuels.
- The platform can be unanchored so you can move it with a tug boat to where the polar bears are.

We also have thought about disadvantages to our platform.

- One disadvantage is that the polar bears might try to knock down the pole holding the solar cells and might succeed.
- In the winter there is less sunlight to power the solar panels which powers the cooling system which keeps the ice cold, but in the winter it is cold, and if it is not cold we will have a battery.
- If the wire that connects the platform to the anchor rips the platform will float away.
- The materials may be expensive and it may be hard to get money to build the platforms.
- The 3D printer technology might not be a big enough printer to print one platform. We may need to make smaller ones and connect them.

We also don't want our ice platform to make people around the world to stop coming up with ideas to prevent global warming and help save the ice and polar bears.

III. BIBLOGRAPHY

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<http://www.pewtrusts.org/~/media/legacy/oceans_north_legacy/private_images/imagedb/arcticcodfoodweb_webversion.png?la=en >

IV. SAMPLE WEB PAGES

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Homepage

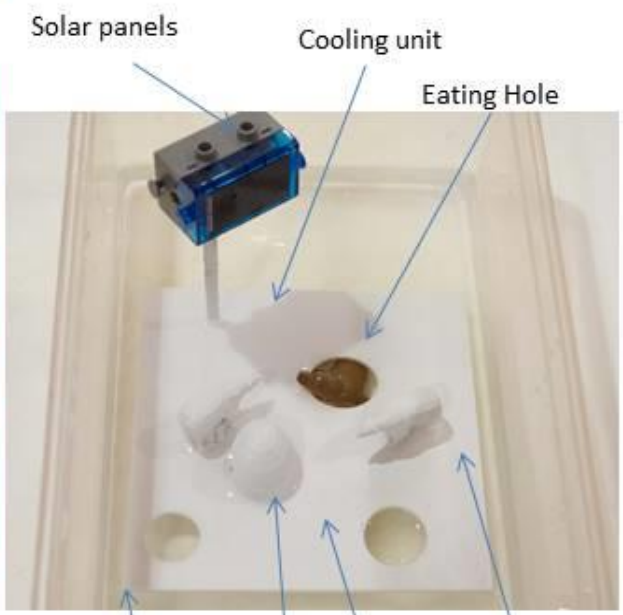
Polar Bears and Sea Ice

Technology - Platform

Technology – Creating Sea Ice

Future

Polar Bear Sea Ice Platform and Retreat



While the world is working on stopping global warming, we have come up with a solution to help the polar bears. We are designing a floating sea ice platform. We are hoping the world continues to keep caring for this planet.

Video - Team discussing polar bears and ice platform.

In the space below, please describe any special effects that might be applied to your web page.

Click on left boxes, it will take you the page.
Click on the ▶ in the video box, it will play a video of the team discussing the project.

Sample Web Page # __1__ of 5 (must include 5 forms)

Polar Bear Sea Ice Platform and Retreat

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Homepage

Polar Bears and Sea Ice

Technology - Platform

Technology – Creating Sea Ice

Future

Polar Bears and Sea Ice

Polar Bears live in the arctic region; Canada, Alaska, Greenland, Russia and Norway. When global warming melts the sea ice, it causes issues with the **Arctic ecosystem.** It's harder for polar bears to hunt and find food. When there is less sea ice, polar bears have to swim farther to find sea ice. Some polar bears drown of exhaustion.

They also use snow for denning, and taking care of their cubs. Without sea ice, it is harder for them to find a place to make a den.

Global warming is threatening the polar bears survival!

Oceans North, The Pew Charitable Trusts. ArcticCodFoodWeb_webversion.png

Untamed Science. "Are Polar Bears Really Going Extinct?" Youtube. 25 Feb 2015. Web. 30 Dec 2015. https://www.youtube.com/watch?v=MzhTovSH6OQ

In the space below, please describe any special effects that might be applied to your web page.

Click on left boxes, it will take you the page.
Click on blue box, it will play a video of Polar Bears
Click on the bold (Arctic Ecosystem) and the photo from Ocean North, Pew Charitable Trusts pulls up the Arctic Ecosystem picture.

Sample Web Page # __2__ of 5 (must include 5 forms)

Click on and it will play the video listed in the box.

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Homepage

Polar Bears and Sea Ice

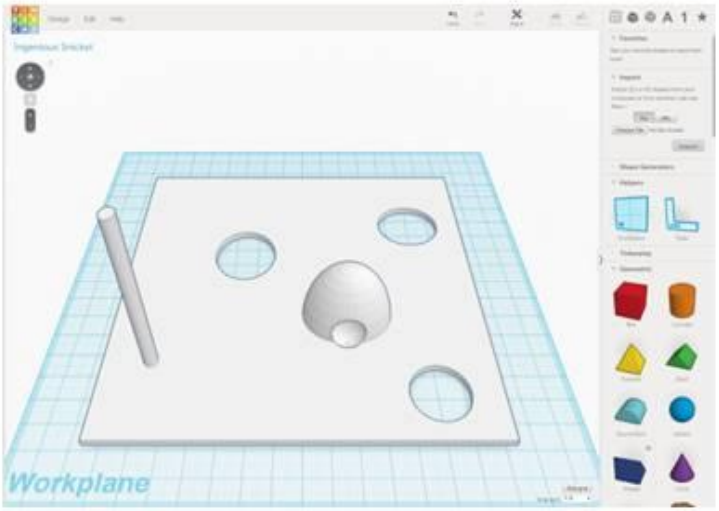
Technology - Platform

Technology – Creating Sea Ice

Future

Technology – 3D Platform

The 3D Printer use a Computer Aided Design tool (CAD) to create a 3D file to send to a 3D printer. The 3D printer takes plastic and melts it. The melted plastic comes from the nozzle and is placed on the print plate in the shape of the bottom of the object. More layers are printed in the shape of the middle and top of the object resulting in a 3D object.



Time Lapse Video

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Click on left boxes, it will take you the page.

Sample Web Page # __3__ of 5 (must include 5 forms)

Click on  in the 3D printer, it will play a video of the 3D model in time lapse.

Polar Bear Sea Ice Platform and Retreat

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Homepage

Polar Bears and Sea Ice

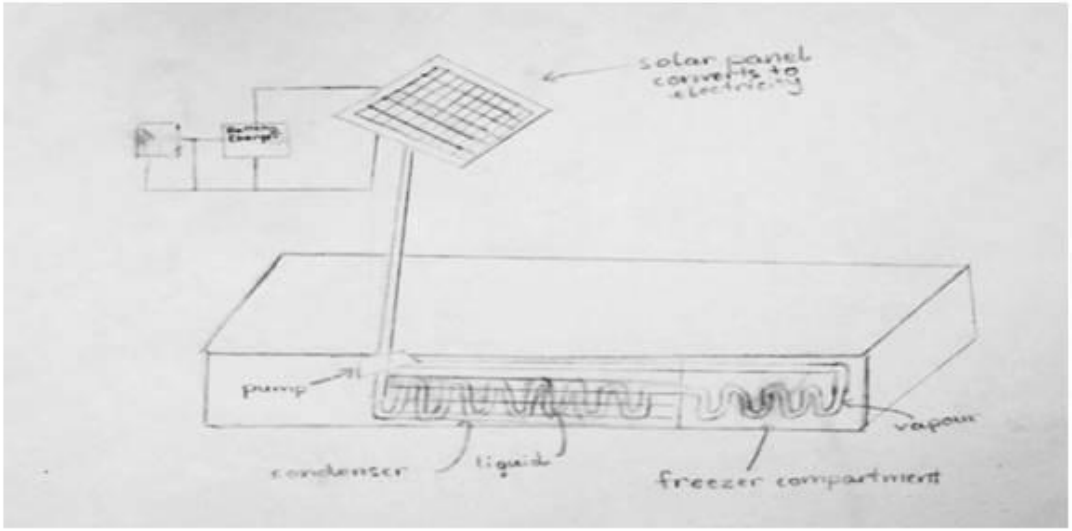
Technology - Platform

Technology – Creating Sea Ice

Future

Technology – Creating Sea Ice

Solar energy is used to power a refrigeration unit to make sea ice on and around the platform. Sunlight hits the solar panels and is absorbed. Sunlight excites electrons inside the atoms of the solar panel. The sunlight from the excited electrons is released as heat or travels out of the cell as electricity. The electricity will power the refrigeration unit to keep the ice frozen.



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Polar Bear Sea Ice Platform and Retreat

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Homepage

Polar Bears and Sea Ice

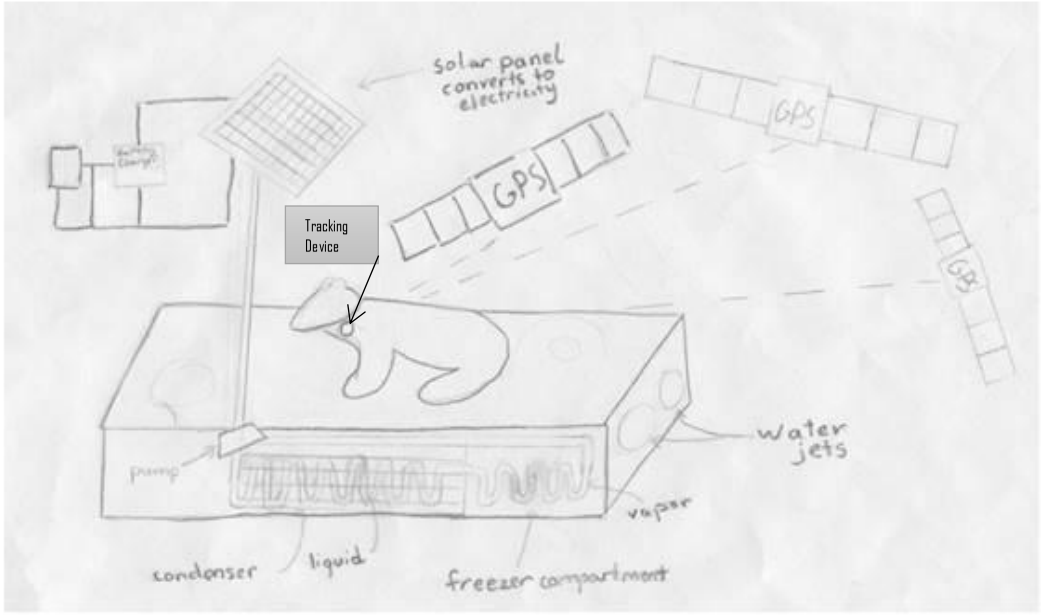
Technology - Platform

Technology – Creating Sea Ice

Future

FUTURE IDEA

We can use GPS, tracking devices and waterjet propulsion to move the sea ice platform.



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