

The AquaSkimmer

Created by 10D Exothermic Synergy

The Problem

Every year there are 20,000 reported oil spills in the United States, along with many that go unreported, which devastate our natural environment, and can only be dealt with in four main ways:

1. Leave the oil alone so that it breaks down by natural means when there is no possibility of the oil polluting coastal regions or marine industries
2. Contain the spill with brooms and collect it from the water surface using skimmer equipment
3. Use dispersants to break up the oil and speed its natural biodegradation
4. Introduce biological agents to the spill to hasten biodegradation

Unfortunately, methods one, three, and four are not safe for marine life in the vicinity and method three is ineffective when used in high winds and high seas (where the majority of the oil spills occur).

Our Solution

The AquaSkimmer is the a new safe, autonomous, and efficient oil spill cleanup tool with the following main features:

- Autonomous
- Safe jet stream propulsion
- Rotating drums
- Solar Cells and Lithium-Ion Battery

Autonomous

The AquaSkimmer is an autonomous vehicle, which can work in tandem with other boats. The AquaSkimmer has a variety of sensors such as accelerometers, GPS revivers, compass, depth radar, which track its position, allowing it to maintain its course in high winds and rough seas.

Safe Jet Stream Propulsion

The AquaSkimmer uses jet stream propulsion to move precisely and safely through the water, unlike many of today's skimmers, which use propellers. Propellers can disturb the film of oil that has developed (making the cleanup process longer and harder) and is also very harmful to sea life.

Rotating Drums

To extract the oil, the AquaSkimmer features six rotating drums. The belts are made of superoleophilic materials that attract oil. As the drums rotate through the water, the oil adheres to the belt, which is continually cycled through a scraper, scraping off the oil and pumping it into holding tanks. Research from the State University of New York at Stony Brook suggests that superoleophilic materials can be made through an affordable one-step binding process, use abundant and safe materials, and can remove up to 95% of oil in the vicinity.

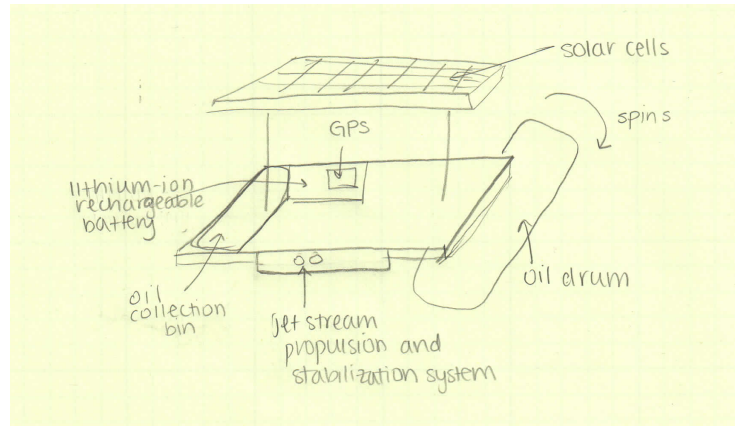
Solar Power and Lithium-Ion Battery

The AquaSkimmer is powered by an array of solar cells, mounted on hydraulic cylinders. This allows the panels to tilt towards sun while in different orientations. The solar panels charge a lithium-ion battery, which can power the craft when solar energy is not present.

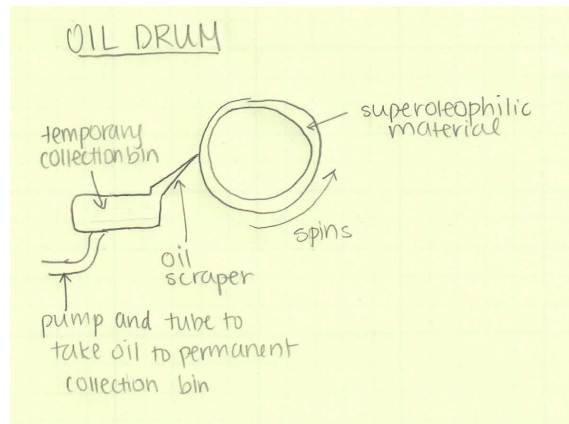
The Design Process

Brainstorming

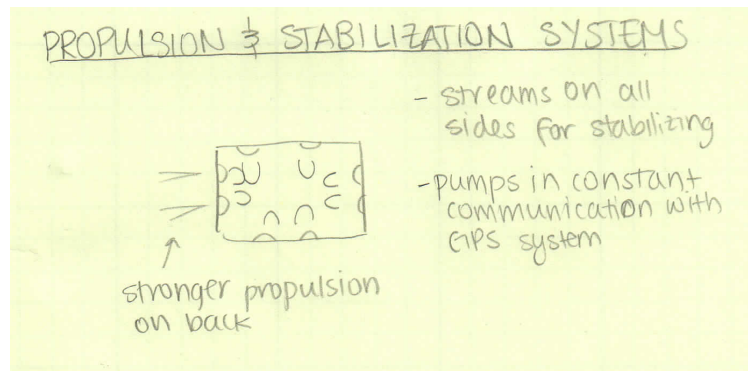
We wanted to address the problems with the current oil spill cleanup techniques and brainstormed the systems that would do so.



We then looked at the individual components to determine how the AquaSkimmer would perform its designated job.

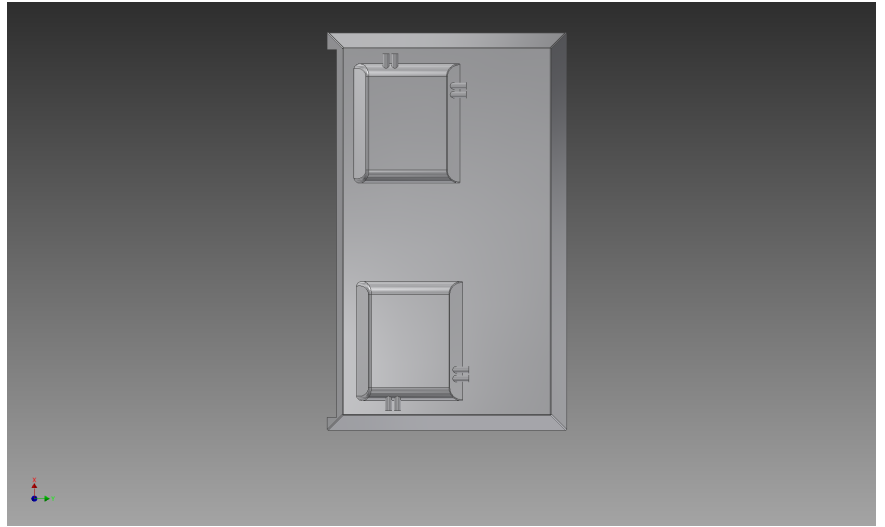


Since the AquaSkimmer is autonomous, the propulsion and stabilization systems are particularly important.

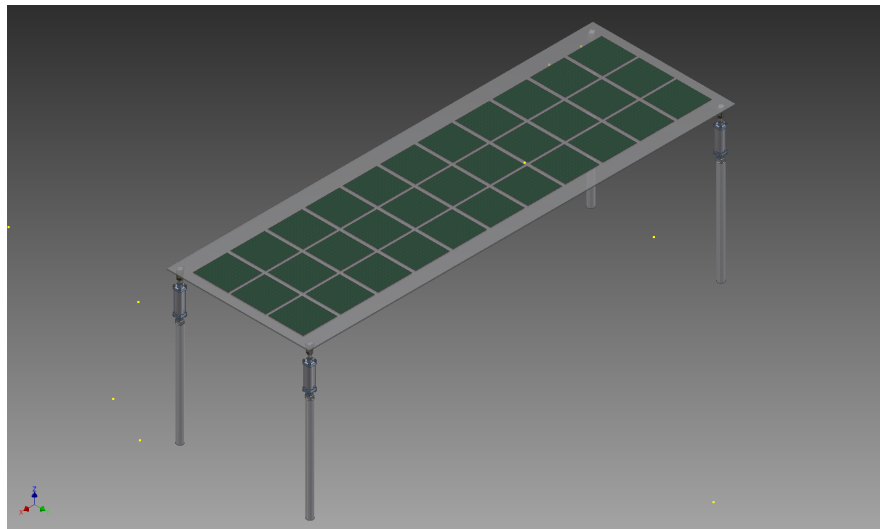


Creating

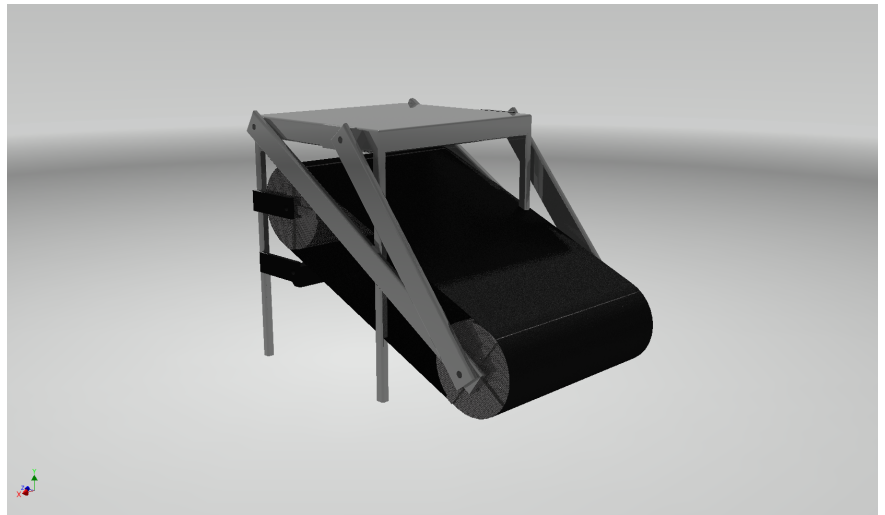
First, we created the base of the machine: a modified boat. It includes the propulsion and stabilization systems.



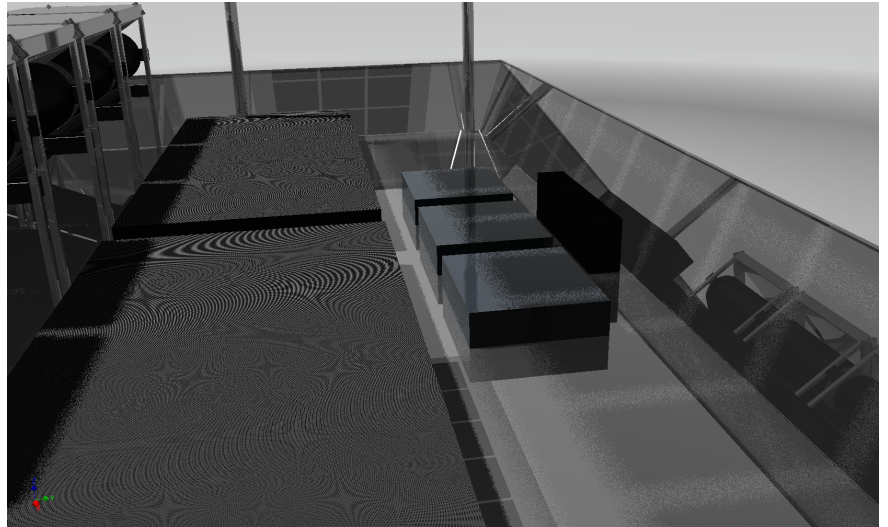
Next, we created the solar arrays that are used to power the boat. The tops of the posts include the tilt-control system.



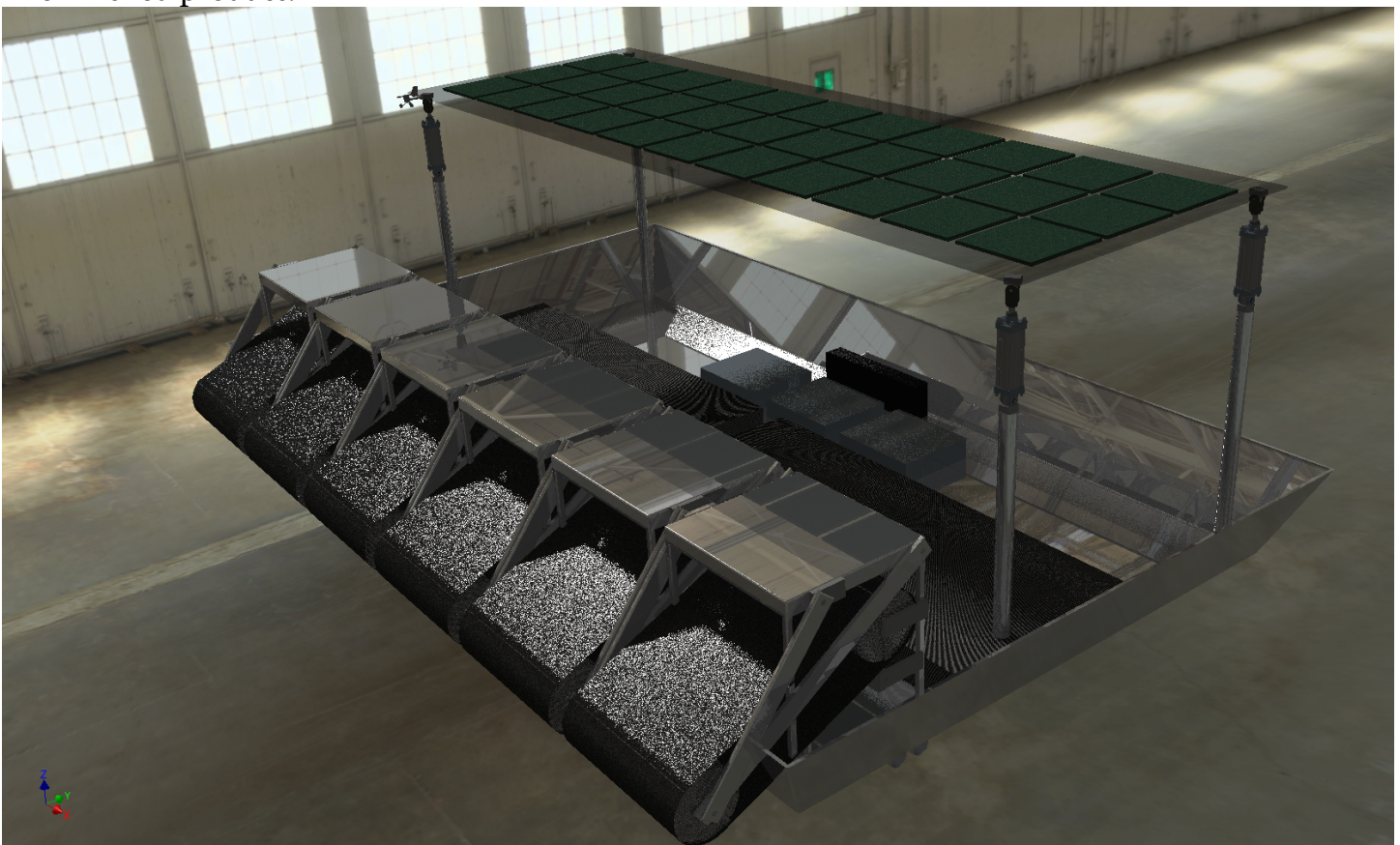
After the solar arrays, we made the rollers that are used to remove the oil from the water, with the scrapers.



Finally, we added the computer/GPS system and lithium-ion batteries.



The finished product:



Program and Features Used

We utilized Autodesk's carefully designed workflow, allowing us to design parts within an assembly and keep all of the components organized. Inventor's part modelling tools are straightforward and intuitive, and the constraint mechanism fits these parts together neatly, allowing for adequate motion. We made use of the basic 2D and 3D sketching, extruding, and revolving tools to make individual components, and then numerous mate, flush, angle, and motion constraints to put everything together. In addition, we also used Inventor's Studio environment to render high-quality videos of the system.

The Autodesk Sustainability Workshop

The Product Design section of the Autodesk Sustainability Workshop played a significant role in our design of the AquaSkimmer. We learned how the products we use in our creation were made and how they will be disposed of. We also learned how to use various types of alternative energies and how they can be applied to specific situations. Finally, we learned the importance of lightweighting and how to choose materials that will weigh less, thereby requiring less power to be used to propel the AquaSkimmer. This factored into the decision to have the AquaSkimmer be made out of aluminum and have absolutely no humans on board.