



PLTW Engineering

# 12/Design Challenge – Marine Debris collection vehicle

May 12, 2020



12/EDD

Lesson: 5/12/2020

**Objective/Learning Target: Students will apply the design process to solve the problem of marine debris collection.**



## What sources of debris are in our ecosystem?

Plastic debris is the most abundant type of marine debris in our ocean, waterways, and Great Lakes.

The word “plastic” is used to describe a collection of synthetic or manmade organic compounds (polymers), often derived from petroleum.

Plastic polymers can be altered to come in many shapes, sizes, colors, and densities.



## What sources of debris are in our ecosystem?

Plastic marine debris found in our ocean or waterways is often consumer items such as food wrappers, plastic beverage bottles, plastic bottle caps, plastic/foam carryout containers, drinking straws, and grocery bags.

Plastic marine debris also includes items such as lost/discarded fishing gear or plastic sheeting.



## What sources of debris are in our ecosystem?

All of these plastic items can enter the marine environment in a variety of ways, including ineffective or improper waste management, intentional or accidental dumping or littering, or through storm water runoff.

Once in the environment, plastics will remain there indefinitely, which is why preventing these items from entering our waters in the first place is especially important.



## Lifespans of debris in the ecosystem

If plastics never really go away, why don't we see more large plastic debris items in the ocean? There are several reasons.

Since plastics have different densities, not all plastic debris remains at the surface and some items sink very quickly.

Plastics can also break apart into smaller and smaller pieces, called "microplastics" (plastics < 5mm in size).



## Lifespans of debris in the ecosystem

Most commonly used plastics can break into these small pieces, but may never fully degrade in marine environments with colder temperatures and reduced sunlight.

Even plastics labeled as “bio-based” or “biodegradable” that may break down in industrial composting facilities, are not designed to quickly degrade in ordinary compost piles, soil, or in the marine environment.

Therefore, plastics of all types have the potential to remain in the marine environment indefinitely.



## Environmental Impacts of debris in the ecosystem

The health of marine ecosystems are strongly affected by marine debris.

Plastic marine debris can damage habitats, entangle wildlife, cause injury via ingestion, impair vessel engines, create navigation hazards, inflict economic loss, and transport non-native species.





## Environmental Impacts of debris in the ecosystem

Researchers are actively examining the physical and chemical effects of ingesting microplastics on organisms and how those chemicals may travel through the food web.

Though we know marine debris can impact individual organisms, it is still not clear how it affects populations and communities.

This is a data gap that researchers are beginning to explore.



# Environmental Impacts of debris in the ecosystem

Take a look at the video below before we get started on potential a solution to this problem.

[Spin Cycle](#)

[Where does marine debris come from?](#)



## Define the problem

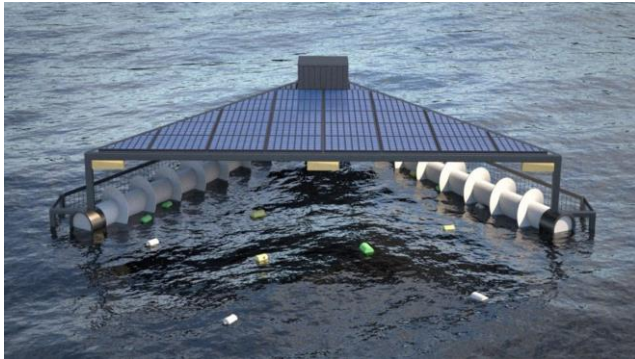
To research and design a potential solution to the problem of marine debris, we will follow the design process to fully explore all ideas.

In your own words: What is marine debris? Why is it a problem?

# Brainstorming

What is already being done to collect and eradicate marine debris?

Turn to the internet and find as many ideas as possible and record them for the design step which is next.





## Design a solution

Design your solution:

What is the name and basic description of your solution?  
(This can be a product or process.)

Try to make detailed sketches to clearly indicate the parts of your design, where possible.

How does your solution address the criteria that you listed above?



## Design a solution

Describe the end user (who will use or do this).

Try to define the end user as much as possible (age, use case, context of use, etc.).

What are the constraints of your solution?

Describe any restrictions or limitations that your solution will face.

Consider social and environmental impacts, limits on size and weight, etc.



## Self evaluation

What did you come up with? Give it an honest critique.

What can it do well? What are its limitations?

Why is it a good idea to keep testing a design?

What do you think are the best features of your design? Why?

What was the hardest part of the problem to solve?



## Helpful links

[Fact sheets about marine debris](#)

[The great Pacific garbage patch](#)