Capstone C3 Pacific Garbage Patch Cleanup

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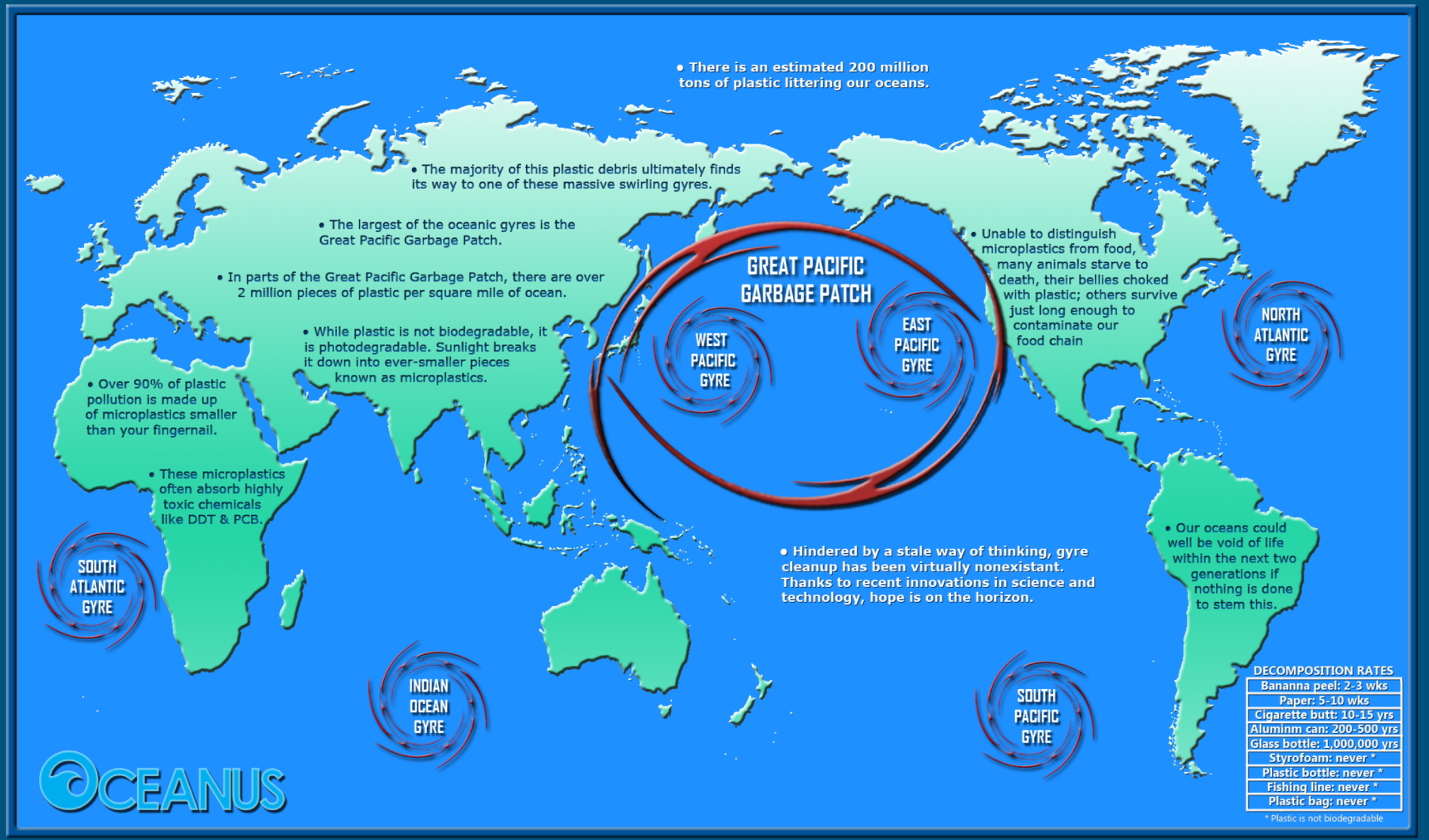
Project Description

Due to increase in trash collecting in oceans, the team is tasked with designing a barge containing a recycling plant in order to clean up the Pacific Garbage Patch (while could be used for any ocean). This could include a facility to turn the plastic into fuel. The idea is to remove all the trash in the pacific garbage patch which will make the ocean cleaner.

Perry Wood is our initial client.


• There is an estimated 200 million tons of plastic littering our oceans.
• The majority of this plastic debris ultimately finds its way to one of these massive swirling gyres.
• The largest of the oceanic gyres is the Great Pacific Garbage Patch.
• In parts of the Great Pacific Garbage Patch, there are over 2 million pieces of plastic per square mile of ocean.
• While plastic is not biodegradable, it is photodegradable. Sunlight breaks it down into ever-smaller pieces known as microplastics.
• Over 90% of plastic pollution is made up of microplastics smaller than your fingernail.
• These microplastics often absorb highly toxic chemicals like DDT & PCB.
GREAT PACIFIC GARBAGE PATCH
WEST PACIFIC GYRE
EAST PACIFIC GYRE
• Unable to distinguish microplastics from food, many animals starve to death, their bellies choked with plastic; others survive just long enough to contaminate our food chain
NORTH ATLANTIC GYRE
SOUTH ATLANTIC GYRE
INDIAN OCEAN GYRE
SOUTH PACIFIC GYRE
• Hindered by a stale way of thinking, gyre cleanup has been virtually nonexistant. Thanks to recent innovations in science and technology, hope is on the horizon.
• Our oceans could well be void of life within the next two generations if nothing is done to stem this.
DECOMPOSITION RATES
Bananna peel: 2-3 wks
Paper: 5-10 wks
Cigarette butt: 10-15 yrs
Aluminm can: 200-500 yrs
Glass bottle: 1,000,000 yrs
Styrofoam: never *
Plastic bottle: never *
Fishing line: never *
Plastic bag: never *
* Plastic is not biodegradable
OCEANUS

12.7 million metric tons of new trash enter the ocean each year.

Plastics are degraded into microplastics, down to 5 mm in length, due to heat and UV radiation.

Background and Benchmarking

- The Ocean Cleanup
  - Boyan Slat - founder
  - Clean up 50% of trash in 5 years
  - 90% by 2040
  - Solar powered
    - Uses wind currents
  - Launched a few weeks ago from San Francisco
  - GPS and WIFI
  - 600m long and 3m deep

Design Requirements

- Design requirements are based off of groups decisions
- Safe for the environment
- Energy efficient
- Autonomous
- Effective in cleaning garbage

Customer Requirements

- Doesn’t damage ecosystem
- Durable
- Portable
- Picks up trash down to 5 mm in length
- Waterproof
- Solar Powered
- Sensors
- Cheap
- Fast
- Safety
- Effectiveness
- Easy operation

Engineering Requirements

- Length (2ft)
- Weight (50lbs)
- Plastic Removal (90%)
- Power (200 W)
- Sorts Plastic by Type (90% accuracy)
- Velocity (10 m/s)
- Plastic Collection (350 lb/day)
- Useful Life (5 years)

House of Quality

House of Quality (HoQ)										
Customer Requirement	**Weight**	**Engineering Requirement**	Length (ft)	Weight (lb)	Plastic removal (%)	Power (W)	Sorts plastic by type (% accuracy)	Velocity (m/s)	Plastic collection (lb/day)	Useful life (years)
1. Doesn't damage ecosystems	25				9	1	3		9	
2. Durable	5									9
3. Portable	5		9	9						
4. Picks up trash down to 5 mm in length	5				9		3		3	
5. Waterproof	10									9
6. Solar powered	10					9		3		
7. Sensors	10			1	3	3	9		9	
8. Cheap	5		1	1		3		1		
9. Fast	5			1	1	3	1	9	1	
10. Safety	5				1					
11. Effectiveness	10				3		9		3	1
12. Easy operation	5					1	3	1	1	
Absolute Technical Importance (ATI)			50	55	340	180	290	85	370	145
Relative Technical Importance (RTI)			8	7	2	4	3	6	1	5
Target(s)			2	50	90	200	90	10	350	5
Tolerances(s)			0.5	10	5	25	5	2	25	1
Testing Procedure (TP#)			1	2	5	3	6	4	8	7

Schedule

- Talk to Perry during his office hours on Fridays
- The team is behind schedule as the team did not have a client until recently. Perry has recently responded to our group.

Schedule Continued

- Week 6
  - Peer eval 1
  - Staff/team meeting
- Week 7
  - Analyses team memo
- Week 8
  - Presentation 2: concept generation and evaluation
  - Preliminary report
- Week 10
  - Website check 2
  - Staff/team meeting
- Week 11
  - Analytical reports
  - Staff/team meeting

Schedule Continue

- Week 12
  - Peer eval 2
  - Presentation 3: Final presentation
- Week 13
  - Final report
  - staff/team meeting
- Week 14
  - Staff/team meeting
- Week 15
  - Prototype and CAD demo
  - Full prototype
  - CAD package due

Budget

- Total Budget
  - $1000
- Anticipated expenses
  - $200 for RC boat
  - $25 for solar panels
  - $20 for sensors
  - other/unknowns
- Actual expenses to date
  - $0
- Resulting balance
  - $1000

References

[1] St. Louis Earth Day. (2018). great-pacific-garbage-patch | St. Louis Earth Day. [online] Available at: https://stlouisearthday.org/plastic-soup-anyone/great-pacific-garbage-patch/ [Accessed 21 Sep. 2018].

[2] Ocean cleanup, “The Ocean Cleanup Technology” Online At https://www.theoceancleanup.com/technology/ [Accessed: 21-Sep-2018].

[3] E. Weise, “6 things you can do to stop plastic pollution today,” USA Today, 07-Sep-2018. [Online]. Available: https://www.usatoday.com/story/tech/science/2018/09/07/great-pacific-garbage-patch-6-things-you-can-do-stop-plastic-pollution/1146682002/. [Accessed: 21-Sep-2018].

Comments and Questions