



PROTEI

Protei is the open
hardware, shape-shifting
sailing robot to explore and
clean up the oceans.

www.Protei.org
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The Problem: Plastic Trash Polluting our Oceans

The Great Pacific Garbage Patch is an anthropogenic accumulation of millions of tons of microplastic. Research on the photodegradation of the trash has found increasing levels of toxins throughout ecosystems and food chains, highlighting the need to removing this detritus. Measuring and collecting this debris poses many challenges as it is spread unevenly across large areas and mixed amongst marine life.



The trajectory of microplastics as they travel through the oceanic gyres



Photo by Gabriella Levine Protei COO of Cesar Harada Protei CEO, collecting plastic trash on Kamilo Beach, HI, January 2013

The Solution: 1. Sensing, 2. Cleaning

Protei is a fleet of open hardware shape-shifting sailing robots developed to sense and clean the oceans. Using image particle profiling cameras for plastic detection and analysis, Protei aims to sustainably and autonomously map, and eventually collect the plastic debris contaminating our oceans. Instead of using fossil fuels, Protei will leverage wind power to transport collection nets to and from remote ocean treatment plants and capture the value from the plastic pollution.



Before Protei



After Protei



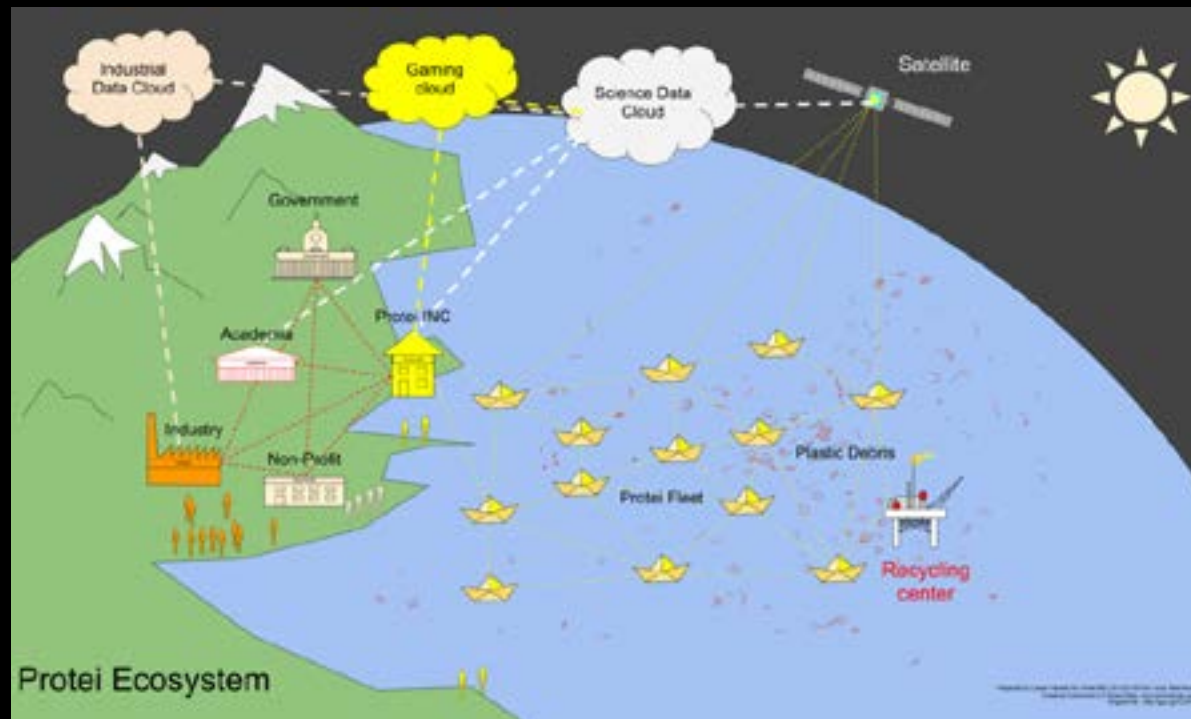
One Unit: \$3,500,000 USD	Fleets of Sailing Drones: \$50,000 USD
Manned, High-Risk for Workers	Unmanned, Autonomous, No-Risk
Proprietary	Open-Source Hardware
Low Resolution of Data	High Resolution of Data
One Institution	Crowd-sourced funded and operated
Delayed Data Distribution to Public	Real-Time Data Transmission

Our Business Model: Financial Ecosystem



We are creating a market developing and distributing our core open-source, affordable technology. Our revenue streams include:

- Sales of boats or boat kits
- Rental of vessels, or fleets of vessels
- Sales of sensors such as plankton counters for detecting microplastics through our website
- Sales of environmental data
- Corporate sponsorship
- Subscription to gamified online platform
- Contracts, plastic trash cleanup
- Sales of captured and recycled plastic debris (for example, for tee-shirts, water bottles, furniture items, plastic composites)



The Protei Ecosystem:

We aim to develop a core data aggregation framework and a software platform, an app market upon which developers can create new tools and applications. The community website will become the centralized hub of collaboration, through which we will leverage the community to build new markets, and we will profit from a commission on internal transactions. We will also profit from the integration and distribution of new environmental sensors which we will sell through our website to corporations, academic institutions, non-profits, and governments (see figure left).

Protei is an open source hardware and relies on the community to:

- use
- modify
- distribute

In return, they must:

- credit the name, Protei
- contribute innovations back to the community, via the website

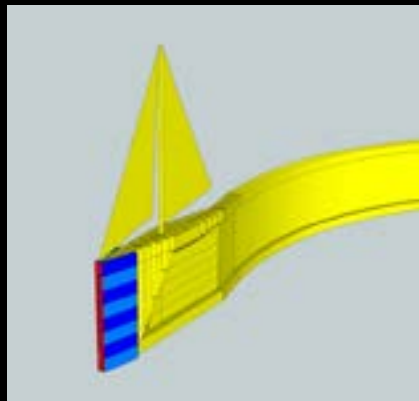
The Technology: a Fleet of Shape-Shifting Sailing Robots

Revolutionary hull design

Protei has neither a centerboard nor a rudder. Instead, the entire boat changes shape, bending to control its trajectory. This gives Protei vessels the capacity to pull long and heavy payload on the ocean for long distances. The autonomous vessel is self-righting, unsinkable, collision-safe and hurricane-ready. The shape-shifting hull provides superior mechanical control and steering efficiency, maintaining momentum while making tight turns to tack back and forth across the wind.

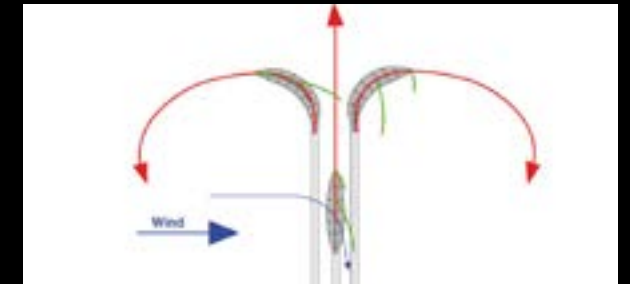
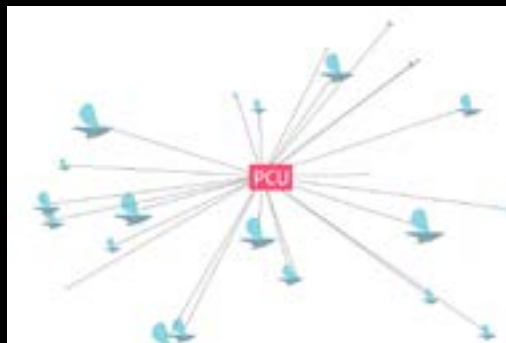
Innovative sensor to map microplastic in the ocean

Harada and Levine travelled to University of Hawaii, Hilo to meet with Marcus Eriksen (5 Gyres), Anna Cummins (Algalita), and Dr. Hank Carson (Marine Science Department, University of Hawaii, Hilo). Together, they brainstormed the best way to employ optical plankton counters such as the SIPPER (shadowed image particle profiling evaluation recorder) on the robots in order to provide an unmanned solution to mapping plastic trash distribution in the 5 oceanic gyres. Eventually, we aim to deploy Protei vessels with trash-collecting nets.

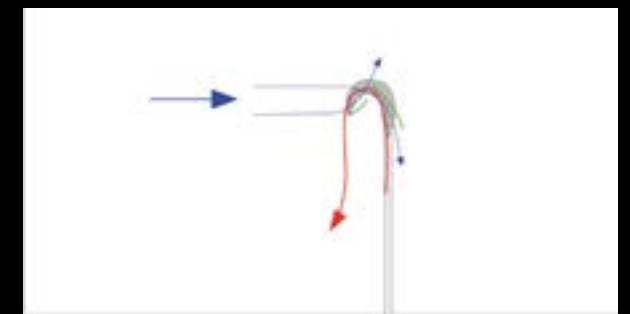


Customized plastic sensor

- Accurate counting of microplastics : water tunnel at the bow to prevent flow disturbance
- Measures size of microplastics
- Vertical stack of tunnels to measure “slices” of pollution at varied depths



Better Trajectory Control



Improved Tacking



Less Resistance



More Energy Efficient


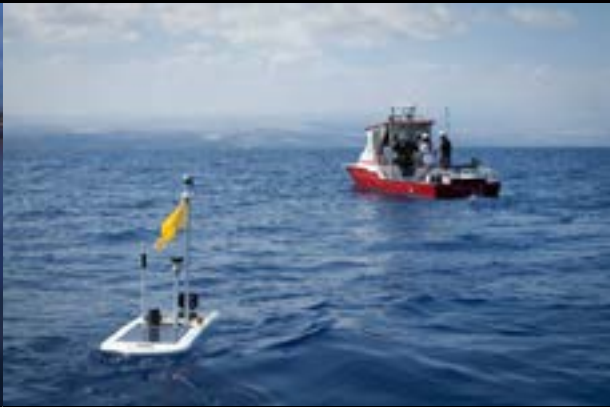

Swarm of sailing robots

In order to meet the scale of the global challenge of plastic trash accumulation in the oceans, we aim to develop fleets of vessels operating as swarms on the water to sense and collect the plastic trash.

Web interface and control

We aspire to create a user interface like marinetraffic.org, where people can share real-time environmental data and navigate the boats through their smartphone or tablet.

Our Competitors: Hundreds of Times Cheaper. Hundreds of Times Higher Resolution of Data.

		
Protei (1m, sensing)	Liquid Robotic Wave Glider	Small Oceanographic Research Vessel
Low cost (\$160 - 700)	High cost (\$250,000)	Super high cost (\$3,500,000)
1.4 tonnes payload capacity	0.1 tonnes payload capacity	27 tonnes payload capacity
Open Hardware	Proprietary design	Proprietary design
Uses renewable energy	Uses renewable energy	Not sustainable, environmentally destructive
Unmanned, operable during a storm	Unmanned, operable during a storm	Cannot be operated during
Avg. speed 3 knots	Max speed 2.5 knots	Cruising speed 11 knots

There are other organizations developing unmanned robotic seafaring surface vessels to collect oceanographic data; However, none that we know are working to embed such vessel with a particle profiling camera to detect and map plastic trash. According to Marcus Eriksen of 5 Gyres Institute, one trans-oceanic journey to map plastic trash in the Pacific gyre takes 10 people 3 weeks, and renting typical oceanographic vessels cost \$15,000 per day.

Compared to small oceanographic research vessels, Protei provides a platform for such data at fractions of the cost and greatly increases the resolution of data. The majority of unmanned surface vessels developed to gather marine data and/or trash are proprietary organizations (Liquid Robotics WaveGlider) or governmentally funded ventures (re-purposed fishing vessels). These products are not as affordable, adaptable, or replicable as Protei. This makes Protei much more economically accessible to corporations and local communities, and thus gives us a competitive edge as we enter the marketplace.

The Team



Cesar Harada, Protei Inc. CEO & Founder
Nominated as “Figure of Progress” by IBM and GOOD, Harada is an inventor and environmentalist, with an entrepreneurial heritage from France and Japan. After graduating from the Royal College of the Arts in London, Harada worked as project leader at MIT and led environmental clean efforts up in the Gulf of Mexico. He is currently a TED Senior Fellow and visiting tutor at Goldsmiths University, London.

Cesar Harada is a visionary entrepreneur, recipient of the Ars Electronica Golden Nica 2009 leading a research team of forty people to develop the International Ocean Station. Harada has the leadership capability to foster the community to establish Protei technology in international markets.



Gabriella Levine, Protei Inc. COO
Named 2011 “top 24 women in tech” (*Adafruit.com*), Levine is an open-source hardware designer interested in the relationship between technology and ecology. She holds a Master’s Degree in Art and Technology from ITP, Tisch School of the Arts. She is the President of Open-H2O, a global community and US-based

non-profit. Former startups include Weels, a transport solutions i-phone app, and Starlab (Social Transit Research Lab).

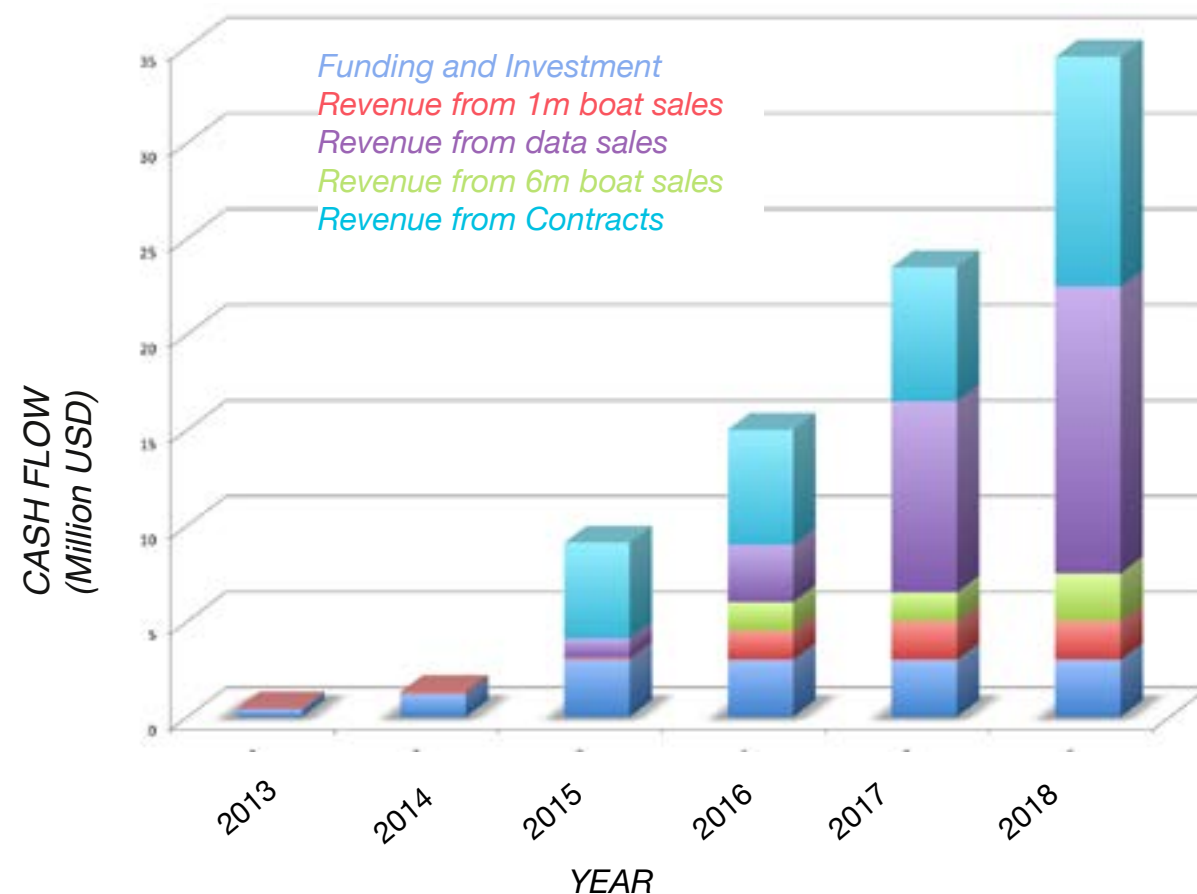
Since 2010, the Protei team is a growing international community of designers, engineers, marine biologists, naval architects, academics, business experts, all working towards developing open-source technologies to explore, study and preserve the ocean.



Financials: Cash Flow, Sustainable Growth

Market Capacity	Units produced and sold per year	Cost per unit (USD)	Turnover GBP (USD)
Protei 1m Remote Controlled	100,000	250	25,000,000
Protei 1m Autonomous, Ocean Sensing	500	20,000	1,000,000
6m Autonomous, Ocean Cleaning	200	100,000	20,000,000

Based on our costs for developing a one-meter remote-control boat, we have developed a five year plan with estimated figures of profit margin that come from sales of boats. Our financial model implies that by 2016 we will be able to significantly lower our manufacturing costs, allowing for the sale of over 100,000 boats/year at \$250 each, and generate 25,000,000 turnover at market capacity. However, we will generate more revenue from conducting marine cleanup operations. Our most scalable source of revenue will be generated by aggregating and selling ocean data.



2010: \$40,000 Personal investments:

2011: \$77,000 Over 300 individuals and organizations on Kickstarte (\$37,000), Institutional support (\$40,000)

2012: \$400,000 Personal Investment & Grants (Gulfstream Navigator Award: \$100,000)

2013: \$425,000 in Sponsorship & Sales

2014: \$1.3 Million in Sales (1m vessel) & Sponsorship

2015: \$3.1 Million in Sales (1m & 6m) Marine Cleanup, data aggregation

2016: \$15 Million in Sales (1m & 6m) Marine Cleanup, data aggregation

2017: \$23.5 Million in Sales (1m & 6m) Marine Cleanup, data aggregation

2018: \$34.5 Million in Sales (1m & 6m) Marine Cleanup, data aggregation

Our Market

Protei's mission is to explore and protect the ocean with a global community that can take immediate action to solve local and global environmental issues. Protei's markets are comprised of the following three target consumer bases.

We reach market through:

- Website : videos, full documentation, forum, and wiki
- Print : 100 page handbook, pamphlets, posters
- Media & Social Media Outreach
- Talks, Workshops & Symposia
- Exhibitions, Regattas, and Demo Events
- Strategic Partnerships
- Marine Cleanup Operations



Play: Technologists and hardware enthusiasts

2013: The 1 meter remote control boat (\$250 USD) is developed for technologists and hardware enthusiasts. Communities and individuals can work together to build their own or buy pre-assembled kits to operate the shape-shifting drones in ponds, lakes and bays worldwide. Through partnerships with academic institutions, we aim to raise awareness of global marine environmental issues.



Plastic Sensing: Ocean sciences market

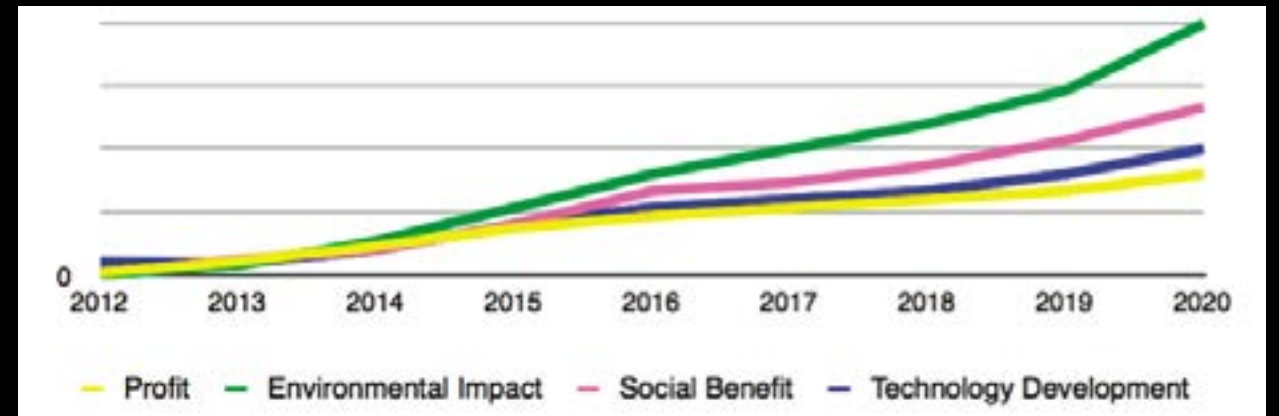
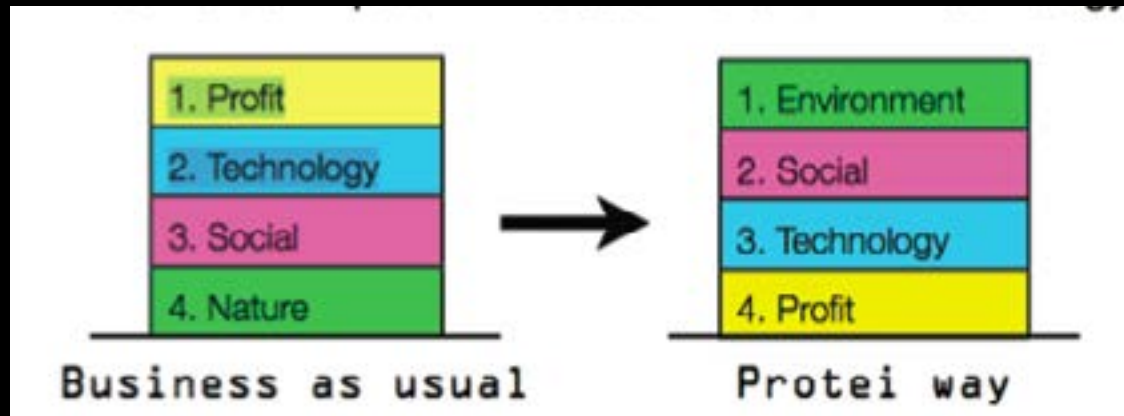
2014: The 1 meter autonomous version (\$700 USD) aims to embed Protei technology within the ocean sciences market, representing the most viable long-term revenue stream for Protei as academic, private and governmental research programs can leverage the technology for a variety of sensing initiatives and collection of biological samples. Profits will be made from selling and aggregating data.



Ocean Cleaning: Environmental NGOs, Gov't & Corporations

2016: The 6 meter autonomous drone (\$20,000 USD) can be used by environmentalists, corporations, and governmental entities to collect data, map plastic trash in the ocean, and eventually collect plastic debris and other marine pollutants. Eventually, Protei can recycle the collected plastic into reusable plastic material to sell back to the industry.

Long-Term Sustainability: Core Values



Inverting Business-as-Usual

To maximize environmental impact, we proliferate our open source technology by accelerating the growth of the community and nourishing competition. Ocean research and clean up are our long term goals, and to achieve these we flip conventional “Business as usual” bottom up.

This is an experiment : we want to prove that we can use capitalism for the benefit of the environment. Protei INC has in its corporate DNA the potential to bring human and nature closer to technology.

Environmental impact: Our top priority is to serve the environment by detecting, mapping, collecting, and recycling plastic trash from the ocean.

Social impact: We bring together a diverse community to have a positive impact on the ocean. Life comes from the oceans, and is the future of our food, energy, transport, communication and security.

Technological development: We focus on community-generated technology, and we are eager to diversify our range of services and products.

Financial sustainability: To ensure global environment impact, cashflow is necessary.

Current Status

Past

Traction and achievements

Technology

Developed over 10 generations of prototypes. Testing, field work: Hawaii collecting plastic debris from Kamilo beach, New Orleans during BP Oil spill, measuring radioactivity in Fukushima, testing in Natural Reserve in Vietnam.

Community traction

Crowd fund-raised the support of over 300 backers, exceeding our goal by 24% on Kickstarter.com. Community-generated technology in over 15 countries.

Collaboration with Academia

Protei has collaborated with scientists from Georgia Tech, MIT, NYU, Goldsmiths University, DNV, Syddansk, Stanford University.

Awards

Winner of the Savannah Ocean Exchange Gulf-stream Navigator \$100,000 Award, the Vida Art and Artificial Intelligence Award.

Media

Over 300,000 viewers on TED.com. Identified by BBC, CNN, Fast Company, GOOD.is, WIRED, Scientific American, New Scientist, featured by BBC Horizon (millions of viewers February 2013).

Present

From prototype to product

It is time to turn our prototype into a product, to distribute research and cleaning capacity building a greater community.

In June 2013, we are moving our headquarters, prototyping and manufacturing to Shenzhen China, where we will have access to the world largest electronics market, access to water for testing and scalable manufacturing.

If we receive the \$50,000 First Prize of the Think Beyond Plastic Innovation Competition, we will:

1. Manufacture

Accelerate the adoption Protei into the hands of many, by increasing the number of vessels we manufacture in our first round of manufacturing.

2. Plastic sensors

Developing the plastic sensing hardware and software from a modified plankton counter.

3. Website

Robust database for aggregating measurements of plastic trash in the ocean.

Future

How we transform oceanography and drive ocean cleanup

By the end of 2013, Protei Inc plans to manufacture and distribute our first batch of 150-1000 vessels to our community and users. We will sell our first round of boats to people interested in mapping marine plastic pollution, including scientists and environmentalists working with Algalita, 5 Gyres, and Kaisei, all of whom we have been in communication with and have shown interest. We will put all profit towards:

1. Field development: conduct plastic trash mapping using on-board optical plankton counters on Protei.
2. R&D towards a more robust fleet of high performance vessels.
3. Design the large, 6m vessels that will eventually be deployed for tons of plastic collection.
4. Community: Incentivize collaboration through the development of an online gamified platform on the website. Development of a rich app market for Protei.
5. 6m Fully autonomous ocean-cleaning fleet of sailing robots. Fully integrated chain of plastic debris treatment with recycling partners.

