Developing Robotic Sea Turtle Swarms to Collect Upper-Ocean Observations

1 Overview/Abstract

Marine robots play a crucial role in collecting ocean observations that inform weather and climate models, hurricane forecasting, naval strategy, and the advancement of scientific knowledge about how and why water in the ocean moves as it does. Ocean observing technology has advanced significantly in recent decades, but there are still big gaps in capability that would be valuable to advance. Expanding capabilities of marine robots to observe the upper layers of the ocean requires new tools. By its very nature, developing these tools is a multidisciplinary project, requiring expertise in oceanography, robotics, and undersea acoustic communication technology. As such, we've assembled a uniquely qualified Stony Brook team to tackle this challenge.

Specifically, we aim to develop flippered robots inspired by sea turtles to be deployed as a fleet in the New York Bight. Current flippered robots remain as prototypes and mostly take fish form factors. Fish use oscillations along their entire body to swim, making them ill-suited for mounting rigid sensors to. With a sea turtle, we avoid the oscillations with a rigid body while maintaining the high degrees of freedom and flexibility that are desirable characteristics of flippers. Having a fleet of robots will allow for a wider latitude in possible observations. The fleet will be able to cover more ground or spend more time at sea than a single robot would be able to and do so more robustly.

In addition to facing the challenges in the development of the robots themselves, there exists a need for new communications methods that go beyond point-to-point modems and into a more complex network. Once a network of communications has been established, enabling collective intelligence and decision making distributed across multiple robots will be needed.

In this project we will advance three broad fields of science, physical oceanography, robotics, and undersea communications. Because of this broad range of topics, there are many avenues of funding to pursue, such as the offshore wind and oil industry, NSF, and ONR. However, to successfully propose, we need to demonstrate that we have a feasible, saltwater-capable robot design, that we can communicate and control robots through the air-water interface, and that we can work as a team and have experience cooperating out in the field as well as in the lab.

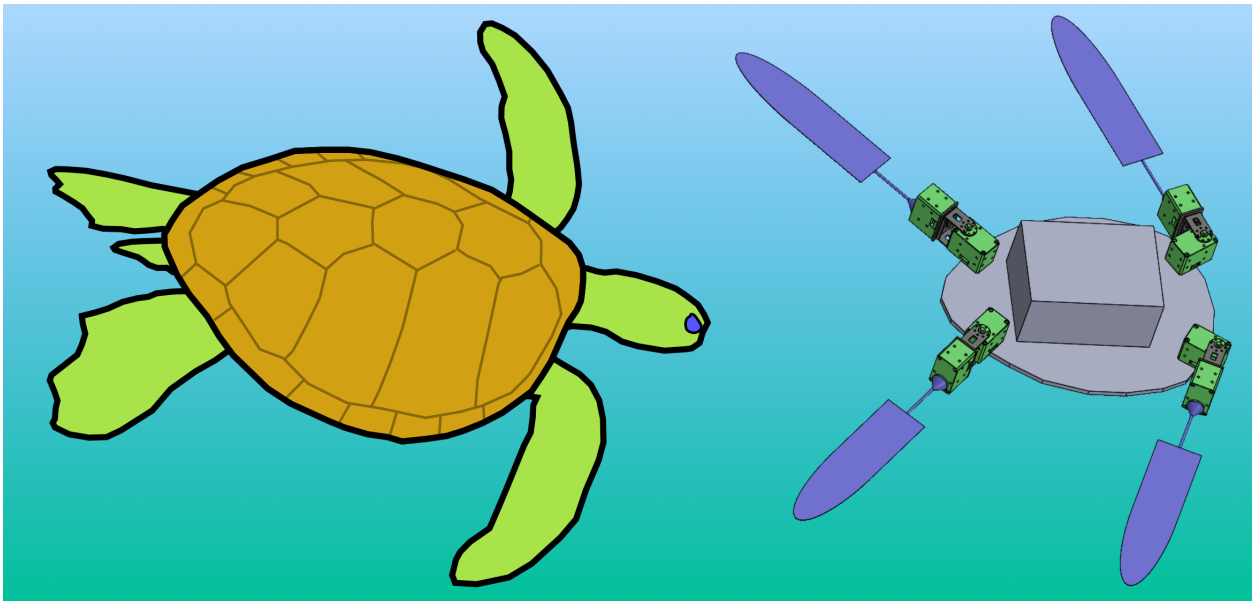

Figure 1: A sea turtle chasing down its robotic counterpart.