Oyster Monitoring Challenge

MISSION: The Challenge is a collaboration between Northrop Grumman and the Chesapeake Bay Foundation (CBF) to utilize the expertise and enthusiasm of engineers to develop an innovative method of remotely monitoring bay oyster reefs. Current methods of gathering reef data are labor-intensive, expensive, and limited by weather and water conditions. This system aims to overcome those challenges. The Challenge is a part of Northrop Grumman's Technology for Conservation (T4C) initiative, which pairs our engineers with conservation organizations to enable technological innovation to solve problems in the natural world.

GOALS

- Harness the best of our remote-sensing capabilities and apply them to low-cost commercial hardware to: map and image oyster sanctuary reefs, collect water chemistry data, and obtain oyster health and development status data.
- Use machine learning to process this data and train a system that can be provided to and easily used by the CBF.
- Provide the CBF with insights and training on how to deploy the system and collect additional data on an ongoing basis.
- Contribute to the goal of the Chesapeake Oyster Alliance to plant 10 billion new oysters in the bay by 2025.

ABOUT THE OYSTERS

System development and testing takes place on the Chesapeake Bay, where the oyster population has declined to less than 1% of the levels seen 100 years ago. Oysters filter water, sediment, and nitrogen, making them essential to the bay's ecosystem, which includes 3,600 species of plants and animals in 19 trillion gallons of water. At one time, the adult oyster population was so robust that they could filter the entire Chesapeake Bay twice a week, but now the oysters can manage that only once a year. Overdevelopment, pollution, overharvesting, a changing climate, and disease have diminished the bay's oyster population.

Oysters grow in dense clusters called reefs, with oyster larvae settling on hard surfaces, including the shells of other oysters. While current natural oyster reefs tend to be flat, the CBF is working to restore the more three-dimensional reefs that existed prior to habitat loss. Dense and mature oyster reefs attract and boost the populations of smaller marine animals that feed larger creatures, like striped bass and blue crabs. Reef restoration not only helps marine populations, it also helps improve commercial fish and shellfish harvests. It's these reefs that will be beneficiaries of this system.

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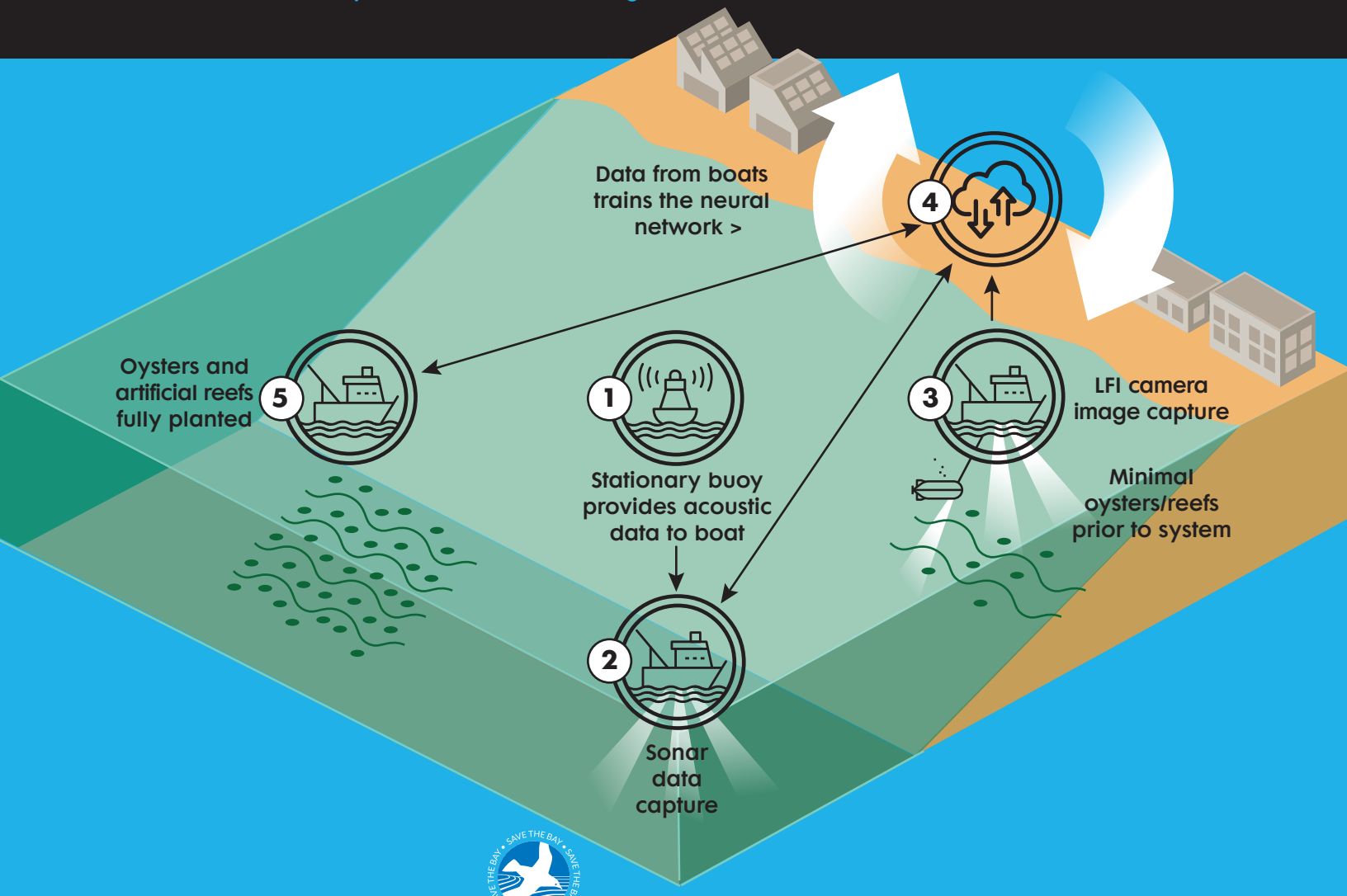
SYSTEM COMPONENTS: Multiple integrated subsystems combine to deliver sonar, visual and acoustic data. That data is then analyzed via machine learning to identify the health of current reefs and identify suitable locations for new reefs. The entire system is outlined in the steps below:

- Northrop Grumman manually surveys the sites with passive acoustic buoys (1) and sonar (2) deployed from boats.
- An underwater rover is deployed with attached light field imaging (LFI) camera (3) to gather visual data and measure chemical properties of water. This rover is also deployed from Northrop Grumman boat.
- Northrop Grumman uses sonar/acoustic buoy/LFI data from boat data collection to train a neural network (4).
- After the system is handed over from Northrop Grumman, CBF uses the neural network to identify reefs/reef sites for conservation efforts. Information continues to be fed back to the neural network over time by CBF to define and refine the system as conditions change (5).



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