Researchers unveil large robotic jellyfish that one day could patrol oceans

Imagine a life-like, autonomous robotic jellyfish the size and weight of a grown man, 5 feet 7 inches and 170 pounds.

The prototype robot, nicknamed Cyro, is a larger model of a robotic jellyfish that a College of Engineering research team, headed by Shashank Priya, a professor of mechanical engineering at Virginia Tech, unveiled in 2012. The earlier robot, dubbed RoboJelly, is roughly the size of a man’s hand, typical of jellyfish found along beaches.

"A larger vehicle will allow for more payload, longer duration, and longer range of operation," said Alex Villanueva, of St. Jacques, New Brunswick, Canada, and a doctoral student in mechanical engineering working under Priya. "Biological and engineering results show that larger vehicles have a lower cost of transport, which is a metric used to determine how much energy is spent for traveling."

Both robots are part of a multi-university, nationwide $5 million project funded by the U.S. Naval Undersea Warfare Center and the Office of Naval Research. The goal is to place self-powered, autonomous machines in waters for the purposes of surveillance and monitoring the environment, in addition to other uses, such as studying aquatic life, mapping ocean floors, and monitoring ocean currents.

Jellyfish are attractive candidates to mimic because of their ability to consume little energy owing to a lower metabolic rate than other marine species. Additionally, they appear in wide variety of sizes, shapes, and colors, allowing for several designs.

They also inhabit every major ocean of the world and are capable of withstanding a wide range of temperatures in both fresh and salt waters. Most species are found in shallow coastal waters, but some have been found 7,000 meters below sea level.

Partner universities in the project are Providence College in Rhode Island, the University of California Los Angeles, the University of Texas at Dallas, and Stanford University. Priya’s team is building the jellyfish body models, integrating fluid mechanics, and developing control systems.

Cyro is modeled and named after the jellyfish cyanea capillata, Latin for "lion's mane jellyfish," with "Cyro" derived from "cyanea" and "robot." As with its predecessor, this robot is in the prototype stage, years away from use in waters. A new prototype model already is under construction at Virginia Tech’s Durham Hall, where Priya’s Center for Energy Harvesting Materials and Systems is based.
"We hope to improve on this robot and reduce power consumption and improve swimming performance as well as better mimic the morphology of the natural jellyfish," Villanueva said, adding that the project also allows researchers to better understand how aquatic creatures live. "Our hopes for Cyro's future is that it will help understand how the propulsion mechanism of such animal scales with size."

"Cyro showed its ability to swim autonomously while maintaining a similar physical appearance and kinematics as the natural species," Priya said, adding that the robot is simultaneously able to collect, store, analyze, and communicate sensory data. "This autonomous operation in shallow water conditions is already a big step towards demonstrating the use of these creatures."