Bioinspired Submersible Dual Propulsion System: A Novel Approach to Ultra-Efficient Submarine Propulsion Utilizing Starting and Stopping Vortex Rings Mirroring Jellyfish Motion

Seevers, Rachel (School: Paul Laurence Dunbar High School)

The goal of hyper-efficient propulsion has already been reached within the animal kingdom as animals such as Jellyfish and Comb Jellies are able to sustain themselves with limited required caloric intake and travel longer relative distances with minimal energy consumption. However, mankind has yet to mimic this process of propulsion to its full effect. Transportation vehicles including ships and submarines have long focused on propulsion efficiency based on traditional methods such as the Froude number that involve high Reynolds Number turbulent flow. The ocean is one of the most difficult frontiers to explore and measure but the need for advancements in ultra-efficient submersible vehicles is becoming critical in order to search and monitor ocean temperatures and chemical composition. The novel dual-prop jet propulsion system presented in this research utilizes both starting and stopping vortices on a rigid platform, inspired by jellyfish propulsion methods, creating a more efficient impulse. In physical models, the results of this research indicate there is up to a 37% improvement in the total impulse and CFD models identify the potential for up to a 75% loss in available passive energy recapture, due to fluid dynamics when comparing the optimal design relative to the control case.

Awards Won:

Intel ISEF Best of Category Award of $5,000

First Award of $3,000

Intel Foundation Young Scientist Award

Shanghai STEM Cloud Center: STEMCloud Award of $1800 in Systems Software

National Aeronautics and Space Administration: Honorable Mention