Swarm Technology for Oceanic Rescue Missions (STORM)

Search and Rescue Operations are accredited for saving over 40 000 lives in the past 8 years in Europe alone. However, to achieve these numbers, workers and resources are heavily taxed. As technology advances and, boat travel and globalisation increases, there is an ever-growing need for safety and the feeling of safety in European and Mediterranean oceans. STORMS is a solution to this.

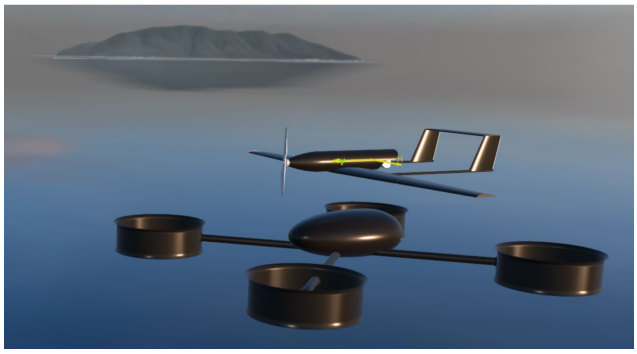
Mission Objective

The STORMS system is an autonomous drone swarm that can perform search and rescue operations despite stormy weather conditions. (This entails: wind force 7, and sea stead 5). To accomplish this task, the swarm utilizes three types of autonomous swarm nodes. The START system, the fixed-wing node, and the quadcopter node. This will allow for three unique flight stages that can be operated without a human even being present for the mission. The swarm is capable of adjusting optimised search patterns to a dynamic search area starting from an area as large as 20km x 20km, ensuring that despite oceanic drift and random factors, targets can be efficiently found.

System Design

The fixed-wing drone is launched through a catapult system capable of propelling the drone to its stall speed of 15 $[\frac{m}{s}]$ while subjected to a load factor of 5g. The deployment rate of the drone swarm stands at 5 drones per minute. Following deployment, each drone starts its autonomous search mission to locate the designated mission target(s). The algorithm governing the drone's behaviour entails that upon detecting something suspicious, the drone will call the three nearest drones to conduct a more thorough surveillance of the identified area. Through the examination of various simulations involving different search patterns, accounting for ocean drift, it has been determined that a zigzag pattern yields optimal results. Based on these simulations, it has been identified that a swarm consisting of 10 drones is optimal for executing the search mission.

Upon successfully locating the target, the drones start the landing procedure by returning to the ship. Once arrived at the ship, the quadcopter will capture the drone in mid-air with powerful magnets. Subsequently, the quadcopter is engineered to facilitate the autonomous landing of the coupled system comprising both drones, even in stormy conditions. The entire process, encompassing the quadcopter's takeoff, mid-air drone capture, and launch of both drones, is completed within a timeframe of 2 minutes. The battery is sized so that a single quadcopter can perform this sequence up to 5 times before requiring recharging. Consequently, to ensure the landing of the swarm, two of these drones are required.



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