Proceedings of the 2020 Annual General Donald R. Keith Memorial Capstone Conference
West Point, New York, USA
April 30, 2020
A Regional Conference of the Society for Industrial and Systems Engineering

Modeling Performance of an Adaptive Drone Swarm for Post-Nuclear Response

Sophie Parker[1], Victor Rutledge[1], Edward Londner[1], and Andrew Kopeikin[2]

[1]Department of Systems Engineering
[2]Department of Civil and Mechanical Engineering
United States Military Academy, West Point, NY

Corresponding Author: sophie.parker@westpoint.edu

Author Note: Sophie Parker and Victor Rutledge are cadets at the United States Military Academy studying Systems Engineering and are two of eleven cadets working on the West Point Radiation and Tracking Hive. Edward Londner and Andrew Kopeikin are visiting professors in the Systems Engineering and Civil and Mechanical Engineering departments on assignment from MIT Lincoln Laboratory and are advisors and mentors to the cadets on the project.

Abstract: An adaptive swarm of small unmanned quadrotors has been built to support first responders responding to nuclear attacks. The swarm's objective is to minimize time needed to conduct a forensic assessment following an attack while limiting radiation exposure of first responders. The swarm has two primary functions: radiation surveying and route reconnaissance. The objective of the survey function is to map the radiation field resulting from the attack, while the objective of the reconnaissance function is to identify obstacles that might hinder responder movement. In both functions, a distributed control framework enables the swarm to autonomously divide tasks, share data, and adaptively optimize its plan. Performance models have been created that estimate *time to complete assessment*—a critical system measure of effectiveness—from environmental factors and measures of performance. These models allow the system designers to optimize system parameters in order to reduce time.

Keywords: WRATH, UAS, Swarm, Adaptive, Reconnaissance, Radiation, Nuclear Attack, Performance Models