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COMPARING THE OPERATIONAL PERFORMANCE OF UNMANNED AERIAL VEHICLES, TRADITIONAL AIRCRAFT, AND SATELLITES FOR CONTINENTAL SEARCH & RESCUE MISSIONS

Abstract

Traditional continental Search and Rescue (SaR) operations rely on satellite imagery, manned helicopters or airplanes, and ground crews to systematically sweep areas. Rough terrain and inclement weather are major factors in delaying detection, and in cases where a last-known location is unavailable, it can take days to weeks to cover an entire site of interest. Space-based detection methods, though capable of offering adequate resolution, are susceptible to cloud occlusion, other weather phenomena, and canopy coverage. Traditional aircraft are also logistically complex and expensive to operate. Unmanned Aerial Vehicles (UAVs) are a potential tool to incorporate with or replace existing search and rescue systems, due to their operational versatility and relatively low cost without placing human pilots at risk. Recent attempts to use UAVs in missing person scenarios, in British Columbia and across the United States, demonstrate government and industry interest, however systems-level studies with sensitivity analyses and mission architecture analyses are lacking. At the same time, privacy concerns and emerging Beyond Visual Line of Sight (BVLOS) legislation are rapidly changing the industry dynamic. In this paper, we develop and test computer models and simulations for a hypothetical SaR detection and tracking system, incorporating satellites, UAVs, and field crews. UAV endurance, flight range, communication distance, sensor capability, in addition to the capabilities of ground crews and satellites are considered for their impact on the cost and time to rescue. The result is a set of systems simulations, operational recommendations, and sensitivity analyses which may lead to controlled experiments and eventual change in the way continental or other SaR infrastructure is designed and implemented.