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Protecting Warfighters (and Civilians) During Wmd Attacks

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During large-scale natural or intentional health security threats, rescue and emergency response operations and logistics, medical countermeasure dispensing, as well as supply and resupply of essential materials that sustain and save lives are often carried out under strained conditions and with limited resources. Damaged roads and dangerous terrain, with potentially hazardous contamination (chemical, biological, radiation plumes) greatly complicate emergency response capabilities.

Unmanned systems hold unique promise in transforming emergency response logistics and mass dispensing. UAVs can identify affected areas, examine the terrain and blocked paths, scout usable facility sites, explore transportation paths, and transmit critical on-the-ground information; while UGVs can traverse affected areas, perform critical on-the-ground logistics, and carry out supply and resupply missions. They can deliver medical countermeasures to a much broader scope of demographics and landscapes more readily and safely than traditional human labor.

The crux of designing such a system involves determining the optimal deployment of fleets of unmanned vehicles (both aerial and ground) and system communication for effective response operations, mass dispensing logistics, and supply and resupply.

We describe a computational platform that can model unmanned aerial and ground fleets for effective emergency operations and supply/resupply in the face of uncertain road networks, conditions, and biological / radiological / chemical or hazardous conditions. The computational platform incorporates visualization, street networks, user-input location layout, mapping tools and crowd-sourcing data. It enables users to explore a mix of autonomous, semi-autonomous, and interactive mode operations. The model will return optimal fleets, associated paths, communication protocols, and dynamic resource allocation plans. Recommendations can be re-computed on-the-fly to adapt to evolving situations. Most importantly, the system allows exploration of the scalability of fleets to determine requirements to effectively protect the affected population within a given time horizon. For a sustained operation, deep learning and machine learning can be applied to uncover patterns of on-the-ground events to predict evolving affected populations, associated demand, and required response resources.