Blog Post 5: From Theory to Practice: Aligning PANTHEON's Drone Swarms with Real-World Scenarios

In this blog series, we've explored the advanced swarming strategies developed for the PANTHEON project—from smart navigation and collision avoidance to two different kinds of coverage path planning.

But these methods aren't just a technical exercise. They were designed, modified, and refined in close collaboration with end-users to ensure they meet the practical needs of first responders in real-world disaster situations.

Our "demonstrator" deliverable (D6.1) culminated in aligning these specific methods with the PANTHEON use case scenarios.

Use Case 1: Attica Wildfire

- **Method:** Energy Aware Path Planning.
- **Why:** A wildfire is a large-scale event where the drones must monitor fire propagation and provide aerial imaging over a vast area. In this scenario, maximizing coverage while minimizing energy consumption is the single most important factor. Our energy-aware mCPP algorithm is perfectly suited for this task.

Use Cases 2 & 3: Attica Earthquake and Vienna Cyber-Attack

- **Method:** Area Decomposition and Optimized Path Planning.
- **Why:** These urban scenarios are operationally very different from a wildfire.
    - In the **earthquake** scenario, drones are needed to assess damage to specific buildings and infrastructure.
    - In the **cyber-attack** scenario, an explosion may create a complex debris field with no-fly zones, and drones must identify casualties and measure gas concentrations.
- For both, the ability of our "Optimized CPP" algorithm to handle complex, non-convex areas, account for "holes" (undamaged buildings) and "no-fly zones" , and divide the work based on drone capabilities is critical.

Conclusion

This work demonstrates significant advancements in the operational efficiency, adaptability, and resilience of UAV swarms. By tailoring our swarming schemes to specific disaster types, we are developing a powerful and practical tool to enhance disaster management. This will ultimately improve the speed, safety, and quality of information gathered by first responders, supporting both real-world operations and high-fidelity training.

To see these systems in action, the implementation demos are available on the PANTHEON Zenodo community page.