

NRI: Coordinated Detection and Tracking of Hazardous Agents with Aerial and Aquatic Robots to Inform Emergency Responders #1637915

(10/2006-09/2020)



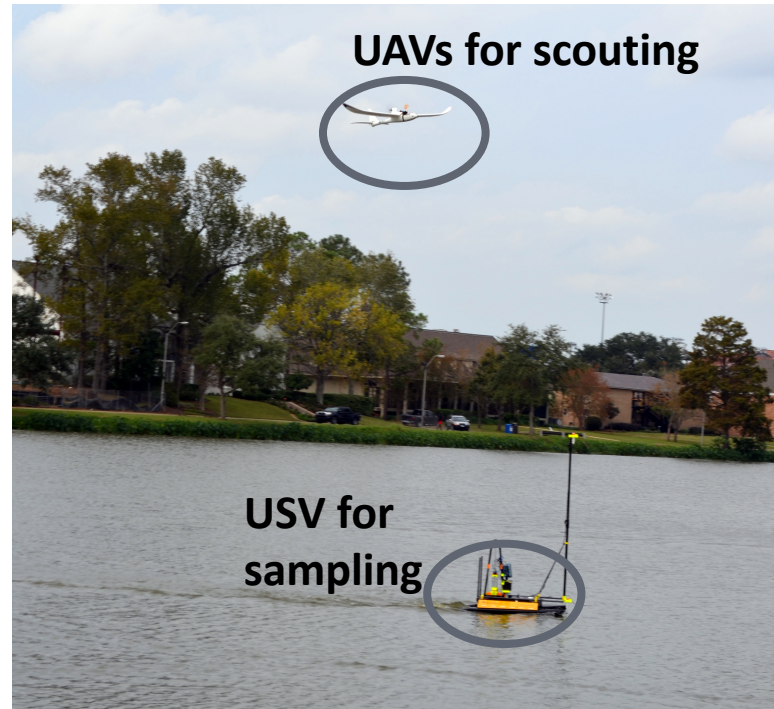
PI: Pratap Tokekar (Virginia Tech/Univ. of Maryland), David Schmale (Virginia Tech)

Goal

Enable emergency responders to effectively **detect** and **diagnose** hazardous agents that may be rapidly **dispersing in aquatic** environments.

Solution

- Team of **UAV scouts**: **map** the **unknown** extent of plume and find **hotspots**
- Coordinating with a **USV** that **collects physical samples** at hotspots



Scientific Impact

- **3D planning** algorithms for **aerial mapping** of unknown shapes and **hotspot identification** with **comms. limitations**

Broader Impact

- Search & rescue (partnered with the VT Rescue Squad)
- K-12 outreach with 60 middle-school, high-school students (per year), six undergrads from 3 partnering HBCUs, girls engineering change workshop
- 2 PhD students graduated, 1 about to, research associate, and many MS students

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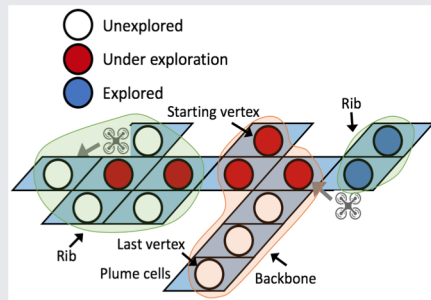
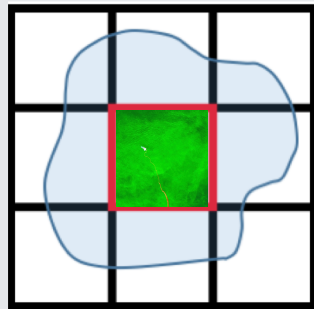
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Aerial Mapping (*Battleship model*)

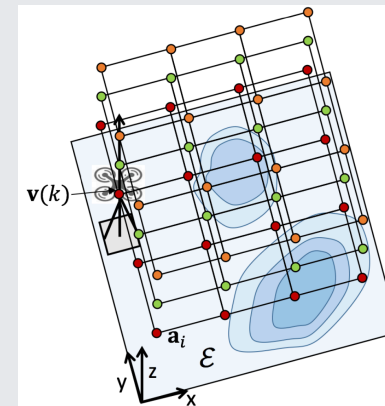
UAV has to fly over the area to know if that is inside or outside the plume



Constant-competitive ratio algorithm
[ICRA '19, *IJRR under review*]

Finding Hotspot with Gaussian Processes

Higher-altitude \rightarrow More coverage but more noise



New Multi-Armed Bandit with heterogeneous sensing

~10% improvement in locating hotspots over baseline

[*IROS '20 to be submitted*]