

## Investigation of coordination algorithms for swarm robotics conducting area search

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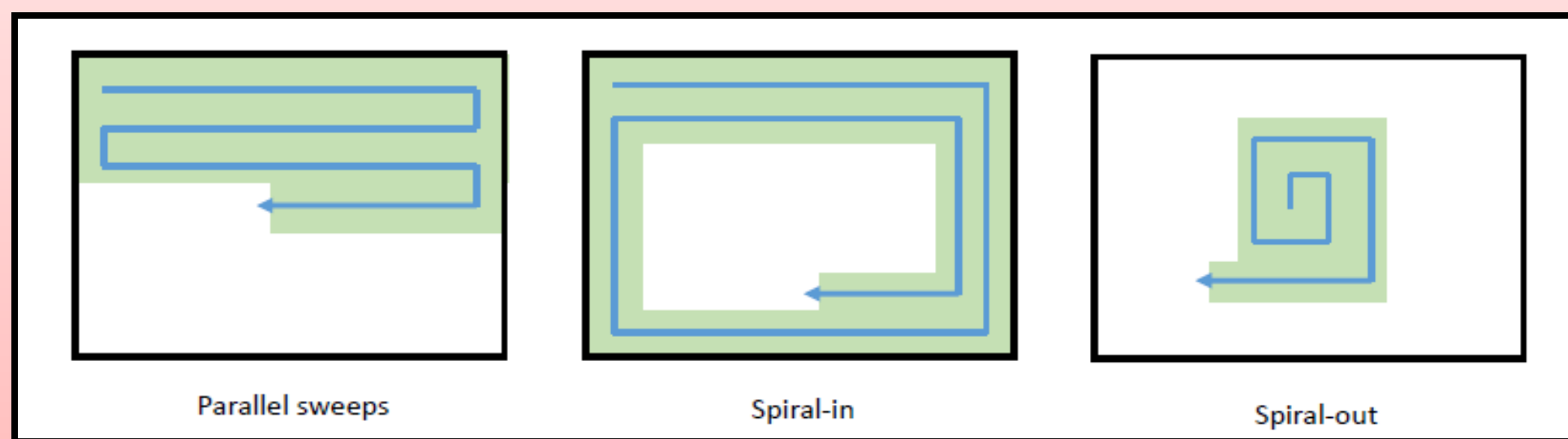
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Investigated and developed operational sensor-based coordination algorithms for large-scale swarm Unmanned Aerial Vehicles (UAV) conducting autonomous area search. The algorithms were validated by live-fly field experiments carried out on Naval Postgraduate School's field laboratory at McMillan Airfield, Camp Roberts.

### Traditional area search with a single UAV



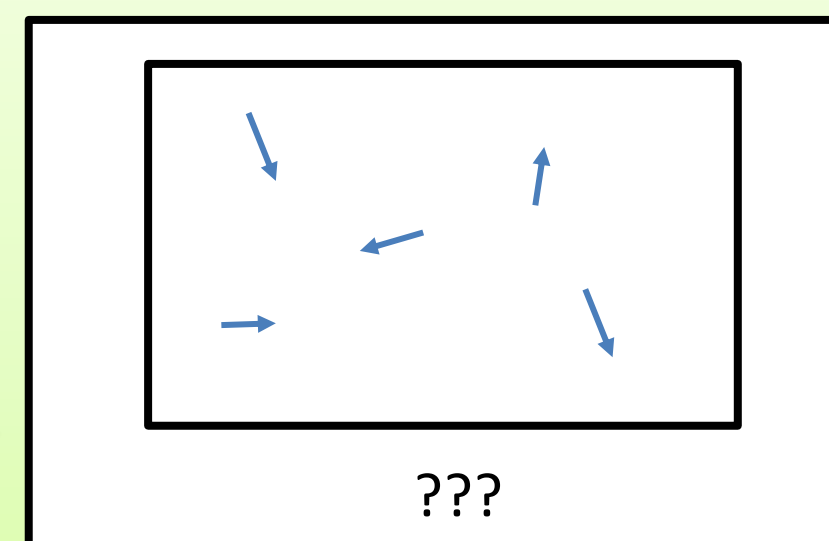
Ideal search time

$$T = \frac{A}{VW}$$

Search Area

UAV speed x Sensor sweep width

### Area search with swarm UAVs



$$T = \frac{A}{VWN}$$

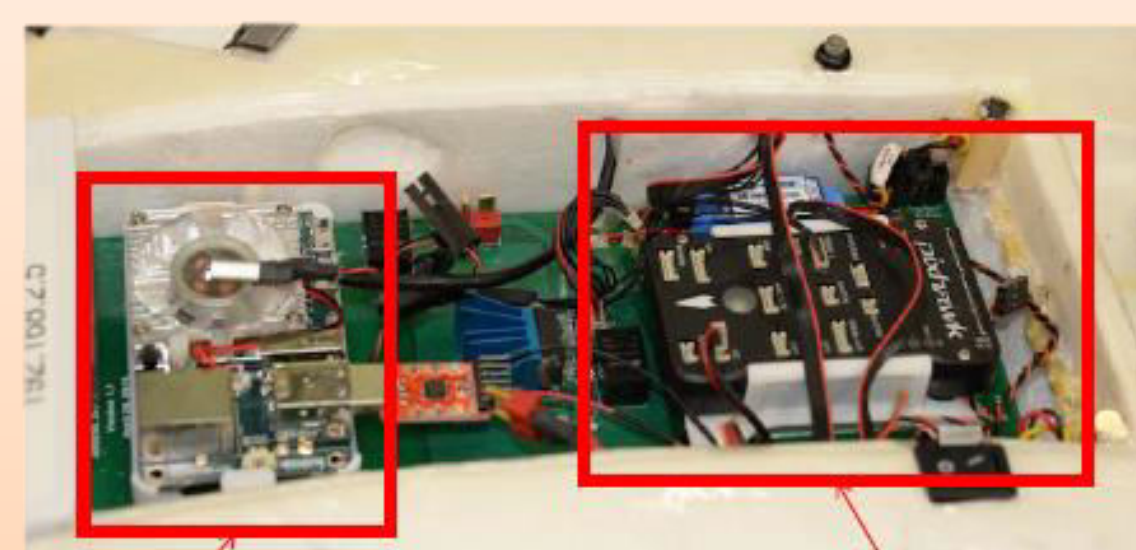
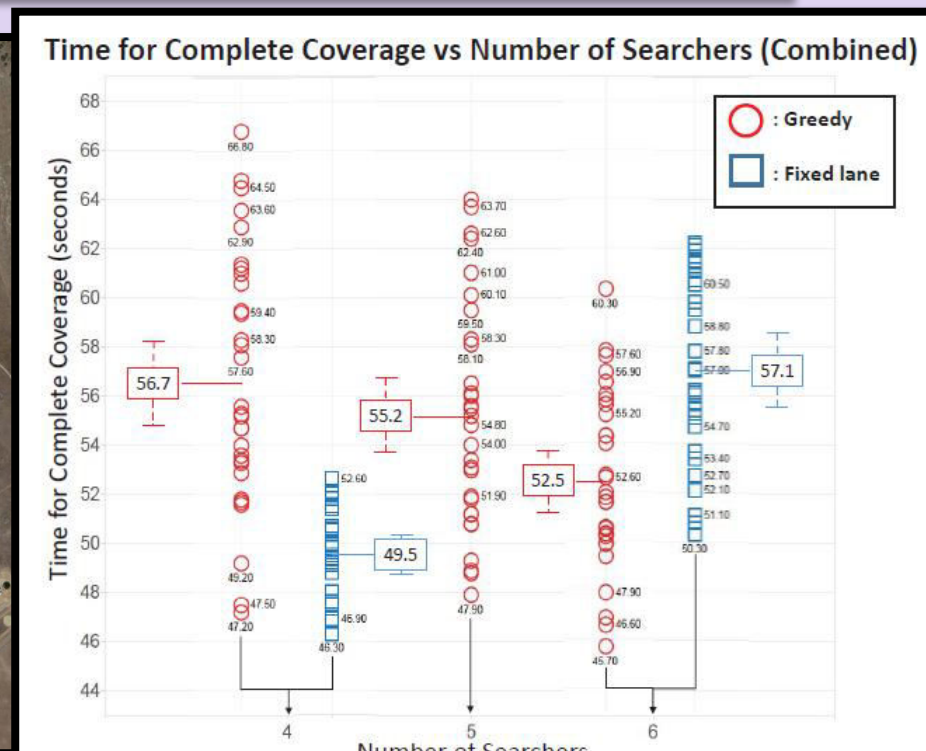
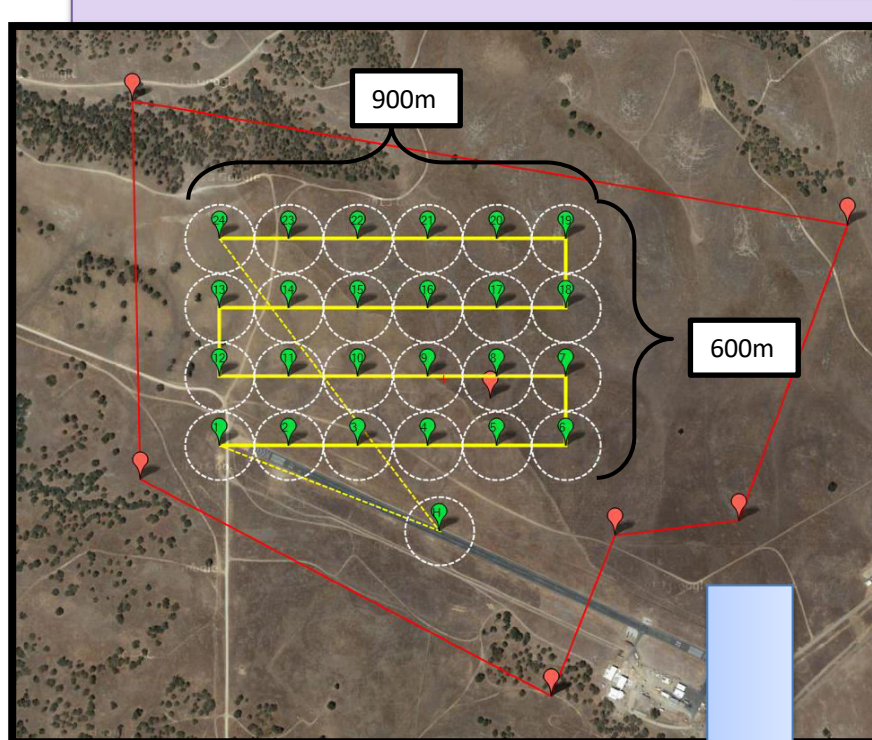
N: number of UAVs

### Research goals:

Swarm UAVs coordinates among themselves such that

- Sensor overlaps are minimized
- Search area is fully swept

### ARSENAL live-fly field experiments (15<sup>th</sup> July, 26<sup>th</sup> Aug 2015)



Autonomy payload

- Odroid U3
- ARM Cortex-A9 Quad-Core 1.7Ghz processor and 2GByte Ram
- Robot Operating System (Linux)

Open-source autopilot

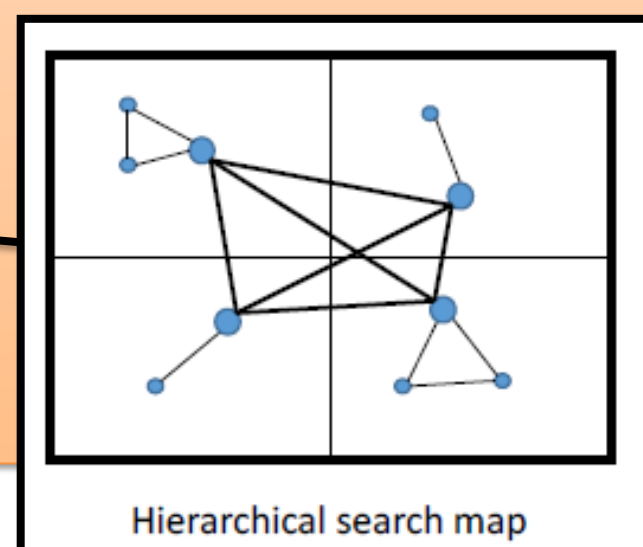
- 3DR Pixhawk
- ARM Cortex M4 Processor
- NuttX real-time operating system

Hierarchical Master and Slaves search concept implemented in the autonomy payload using python

- Greedy area coverage
- Fixed Lane area coverage (Prevents sensor overlaps)

Bitewing Zephyr II fixed-wing UAV

- 56 inch wide
- Speed of around 20 m/s
- Endurance of 45 minutes
- Communicates with other UAVs using Wi-Fi



### Future work:

- Integrate "smart" camera with Odroid U3 to search for targets
- Implement mesh network to extend communication range

