

## ASSESSING THE EFFECTIVENESS OF A COMBAT UGV SWARM IN URBAN OPERATIONS

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### Objective

To develop and test swarming algorithms for combat UGVs to execute a search and destroy mission in an urban environment.

Phase I - Search (Area exploration)

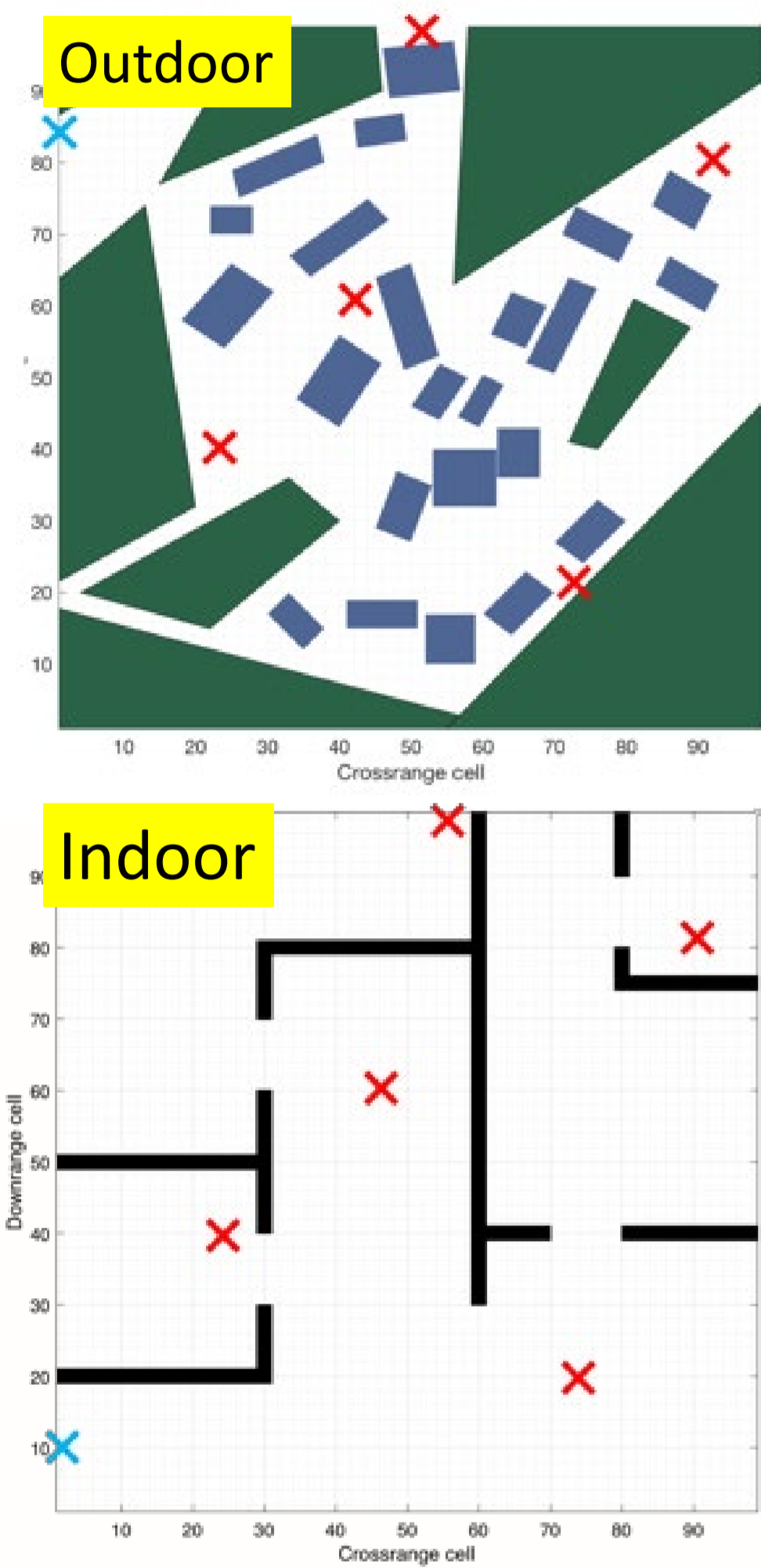
Phase 2 - Track and Engage (Elimination of threats)

Algorithm 1 - Least Visited Cell (LVC)

Algorithm 2 - Particle Swarm Optimization (PSO)

### Research questions

- Is the algorithm developed suitable for the swarm UGVs to achieve its mission? What are the strength and weakness of the algorithms used?
- What are the factors that affect the swarm UGVs ability to achieve its mission?



### Key Findings

#### Search Phase

- LVC guidance works well for the open-space and urban (both outdoor and indoor) environments
- Mission success rate is improved by
  - increasing the swarm size
  - utilizing multiple entry points
  - imposing a realistic turn-rate limitation

#### Track and Engage Phase

- Utilizing PSO-based guidance has a very positive effect (about fivefold time reduction) urban outdoor environment.
- Mission success rate is improved by
  - Increasing detection range (employing better sensors)
  - Increasing engagement range and offensive capability (weaponry)

### Future work

- Refinement of algorithm
- Implement on a swarm of Pioneer3 UGVs and evaluate them at an urban terrain test site

