# NRI: INT: Balancing Collaboration and Autonomy for Multi-Robot Multi-Human Search and Rescue

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#### Challenge

 Enabling teams of human searchers and unmanned aerial vehicles to collaborate towards improving search outcomes and reducing human effort.

# Solution

- Risk-aware human-UAV search planner.
- Agent-based lost person model.
- In-field computational backpack.

Multi-agent models for lost person and search  $|-b)\dot{x}_i = \sum_{i=1}^{n} F_{ij}$ for agents  $i = 1, 2, \ldots, N$ archer feedback and dynamic robot Human-Robot Task Generatio asking (for search tasks and computatio Voronoi partitioning constrained by search leader input, communication and human-robot collaboration Human-Robot Task Assignment Constrained MDP for efficient search ssignments and team compositions ons and collaboration poir Regression: Estimated probability nap generated from robot peasurements, lost person model man feedback, and prior map Risk-aware human-robot planning fi hance-constrained ontimization

Project overview.

## Scientific Impact

 Planning and control systems that autonomously gather information while adapting to uncertain human plans.

#### **Broader Impact**

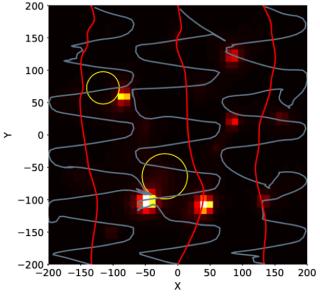
Volunteerism is in dramatic decline nationally and across Virginia, and thus UAVs could eventually supplement the lack of trained volunteers.

• Web-based SAR interface.

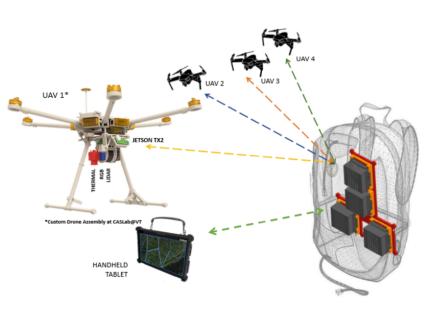
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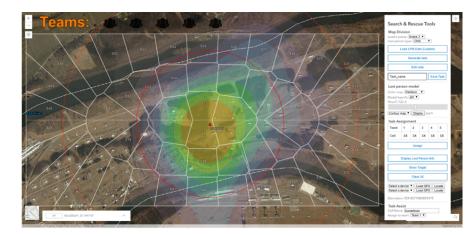
#### Summary of Current Results:



Lost person modeling and human-UAV search planner.



In-field computational backpack.



Search and rescue interface.