One Controlling Many

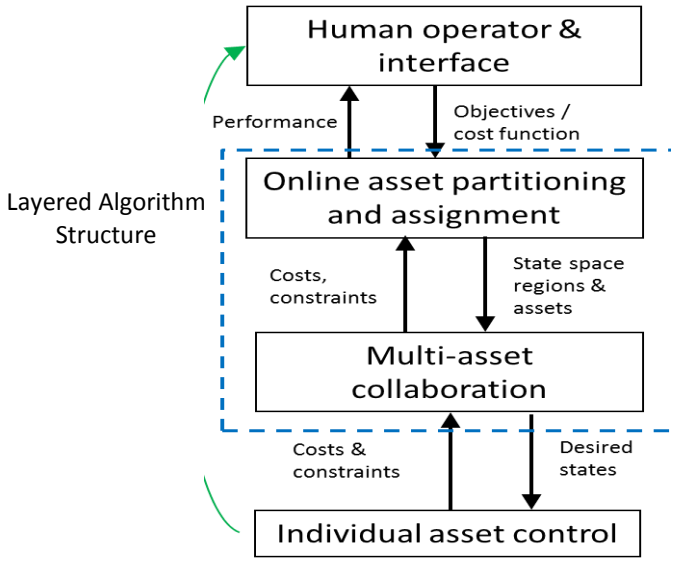
As Unmanned Systems proliferate the battle space, the decisive advantages historically provided by strategy, tactics, and training must be translated into Unmanned Systems (UMS) Control Systems. It is a challenge to effectively control large numbers of UMS. The human operator must be freed to focus on high level perception, tactics, and strategy while the system automates lower level functions. The Intelligent Systems, Robotics, and Cybernetics (ISRC) Group at Sandia National Laboratories is working to develop a controls system for single-operator multiple unmanned systems control.

Critical Characteristics

- A single operator controls a heterogeneous team of several (three to six) unmanned ground (UGVs) and aerial vehicles (UAVs) performing multiple solo and collaborative behaviors
- Operate effectively in tactical scenarios with dynamic, unpredictable adversaries
- The operator is in control at all times, and directs on the basis of desired mission outcomes (e.g. continuously image a suspicious actor) rather than assigning individual unmanned system behaviors
- Control algorithms are layered to enable variable autonomy and use of contractor-provided, platform-specific lower-level autonomous behaviors

Technical Elements

- Sandia Architecture for Heterogeneous UMS Control (SAHUC) enables key data structures (e.g. system states, environment model, mission information) to be shared among and modified by all system agents, in centralized or more fully distributed implementations
- Layered control elements including a supervisory optimization layer for assigning UMS to tasks, an intermediate control layer for execution of individual and cooperative behaviors, and low-level execution
- Integrated with 3D modeling/simulation engine in real time to enable advanced optimization and continuous situational awareness

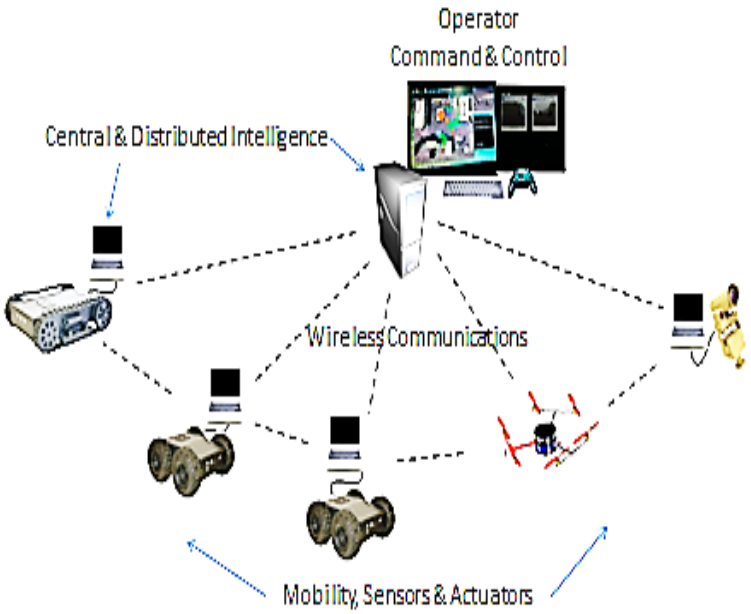


Key Development Milestones

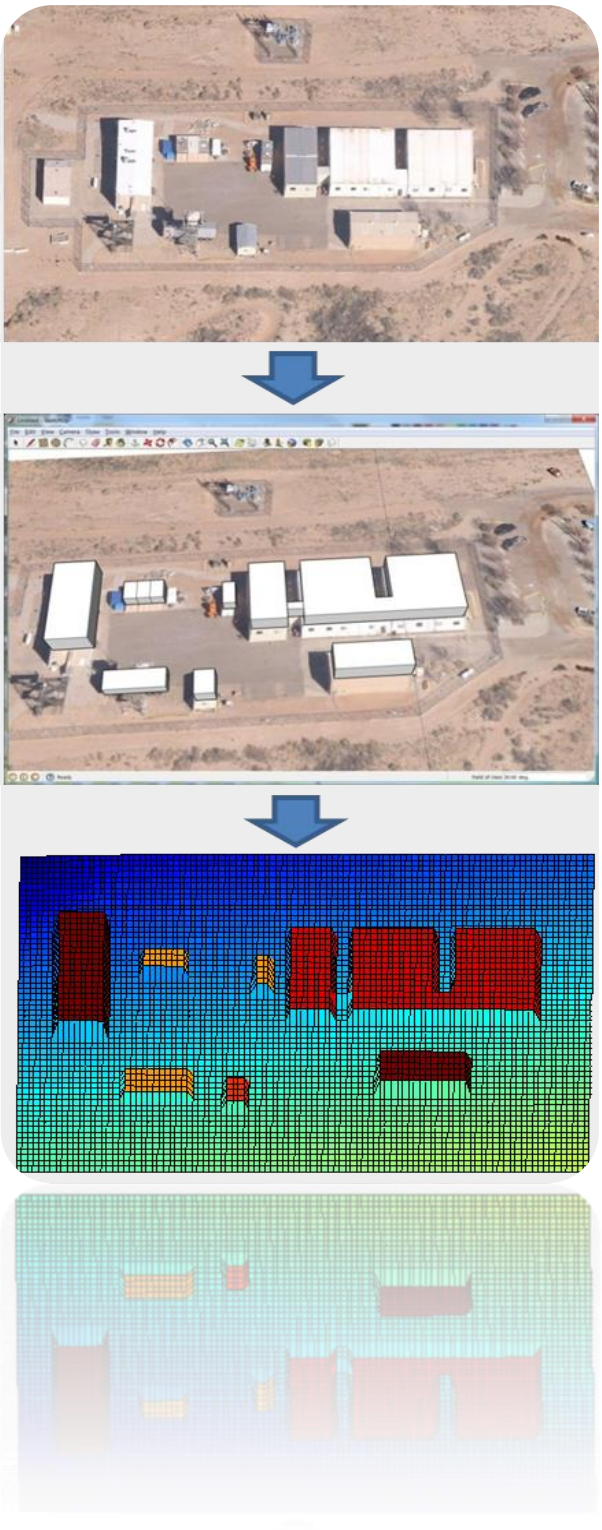
- Demonstrate multi-behavior missions executed by a team of three UGVs and a pan /tilt tower camera working against unpredictable moving adversaries
- Integrate full UAV / UGV teaming and demonstrate that shared aerial sensing perspective can improve ability of UGVs to operate in challenging environments

User Interface and Tools

- Before an operation, an operator can create simple 3D models of the environment from 2D satellite photos by sketching in representations of objects in correct GPS-referenced locations
- Main model-based map display provides comprehensive situational awareness
- Interactions with display intuitively associate sensor feeds, current mission objectives, priorities and assignments, and tabular data



3D Map Generation



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