Soar Technology
Thinking *inside* the box.

Participatory scenario design and simulation on the ICF testbed

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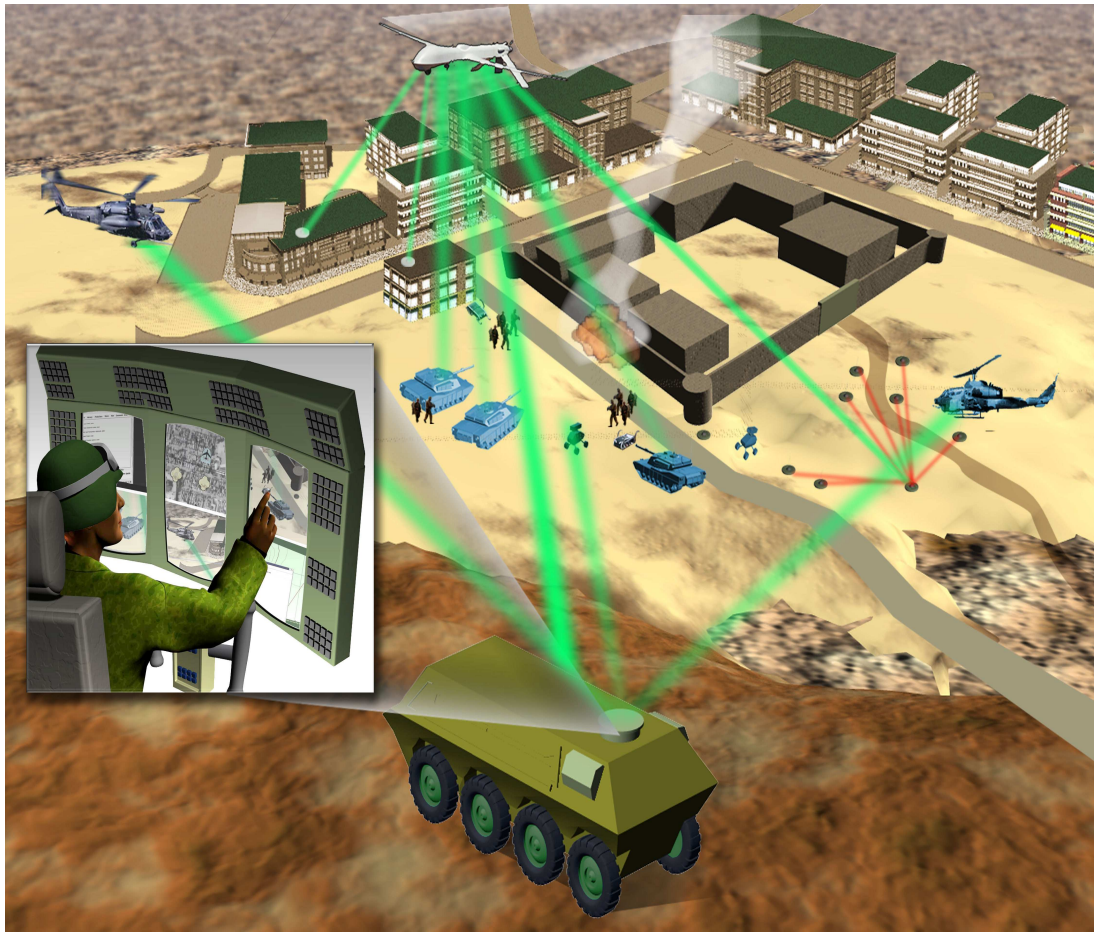
Soar Technology, Inc.

Future Battlefield Teamwork

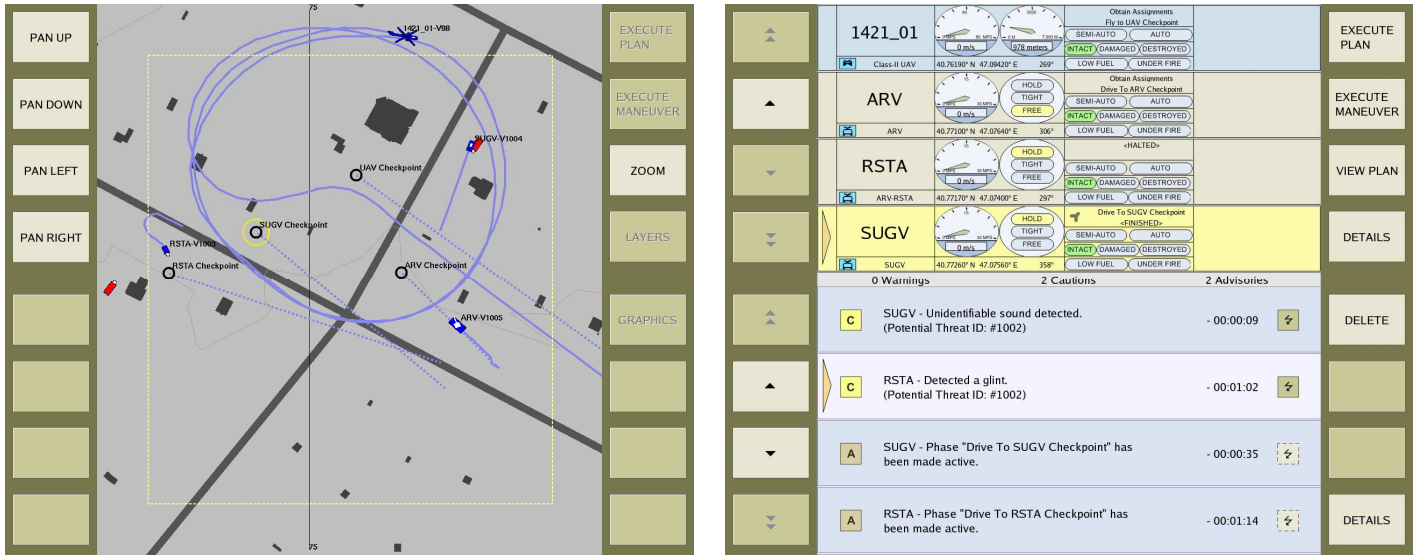


- U.S. Army is undecided on future UV capabilities and UV-human team structure
  - C2 of UVs requires new tactics, techniques and procedures
- There is little known about how to support effective C2 of multiple autonomous systems
  - Current robot control primarily teleoperation
  - Autonomous is not the same as effective

Intelligent Control Framework (ICF)

- Research operator-oriented issues in C2 of mixed human-robot teams
- Develop multi-agent control framework and components for operator C2 of robot teams
- Build a test bed, method and techniques for scenario-based simulation and evaluation

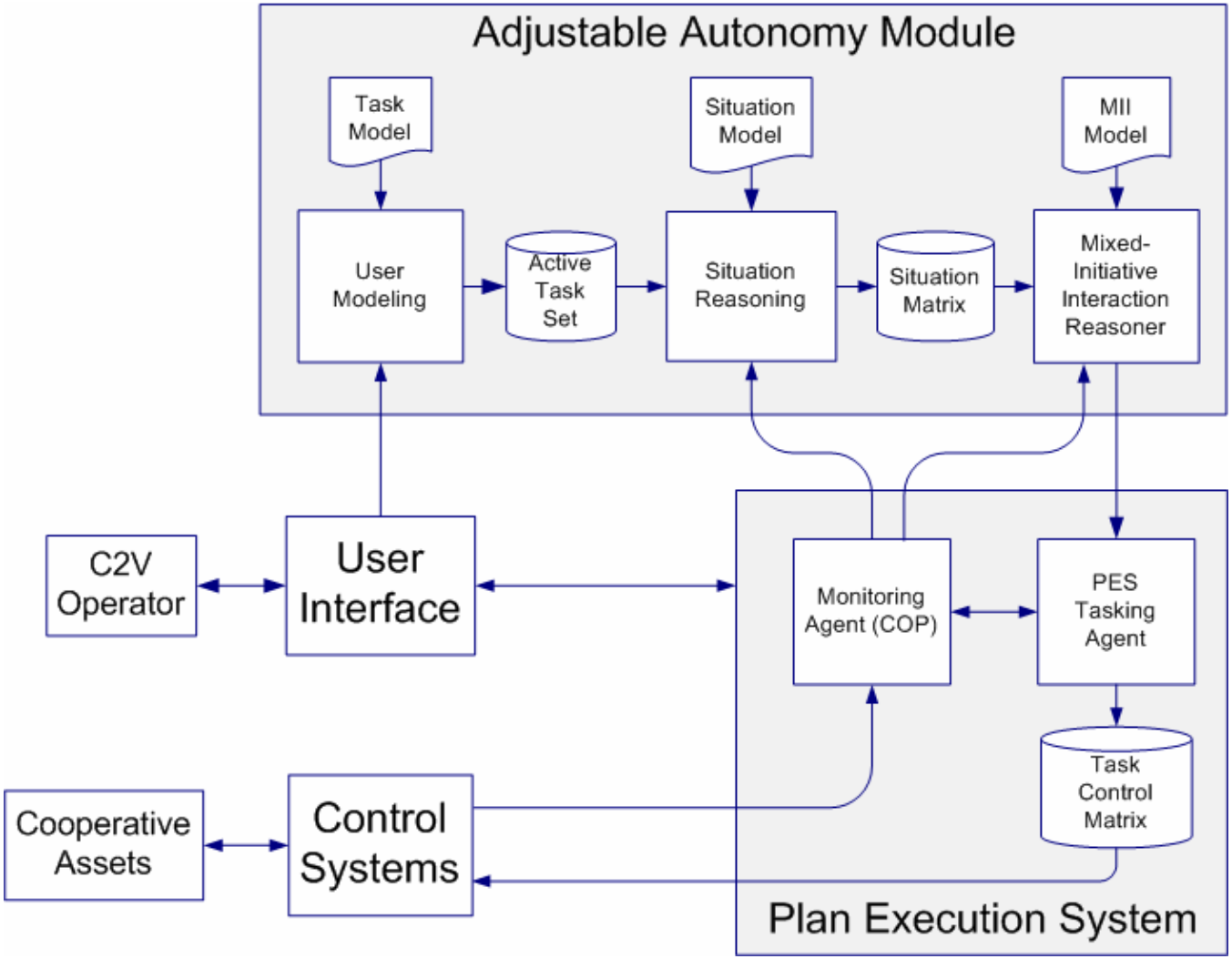
Issues in human-UV teamwork



- Collaborative replanning
  - Option generation and selection
  - Autonomy allocation and real-time adaptations
- Maintaining team SA
  - Fog of war, imperfect sensors and soda straws
  - Multiple simultaneous tasks
- Operator attitude
  - Confidence, over-reliance, etc.

There is no perfect solution for every situation, user or robotic team

ICF Architecture (Year 1)



System knowledge and behaviors are driven by data files and heuristics

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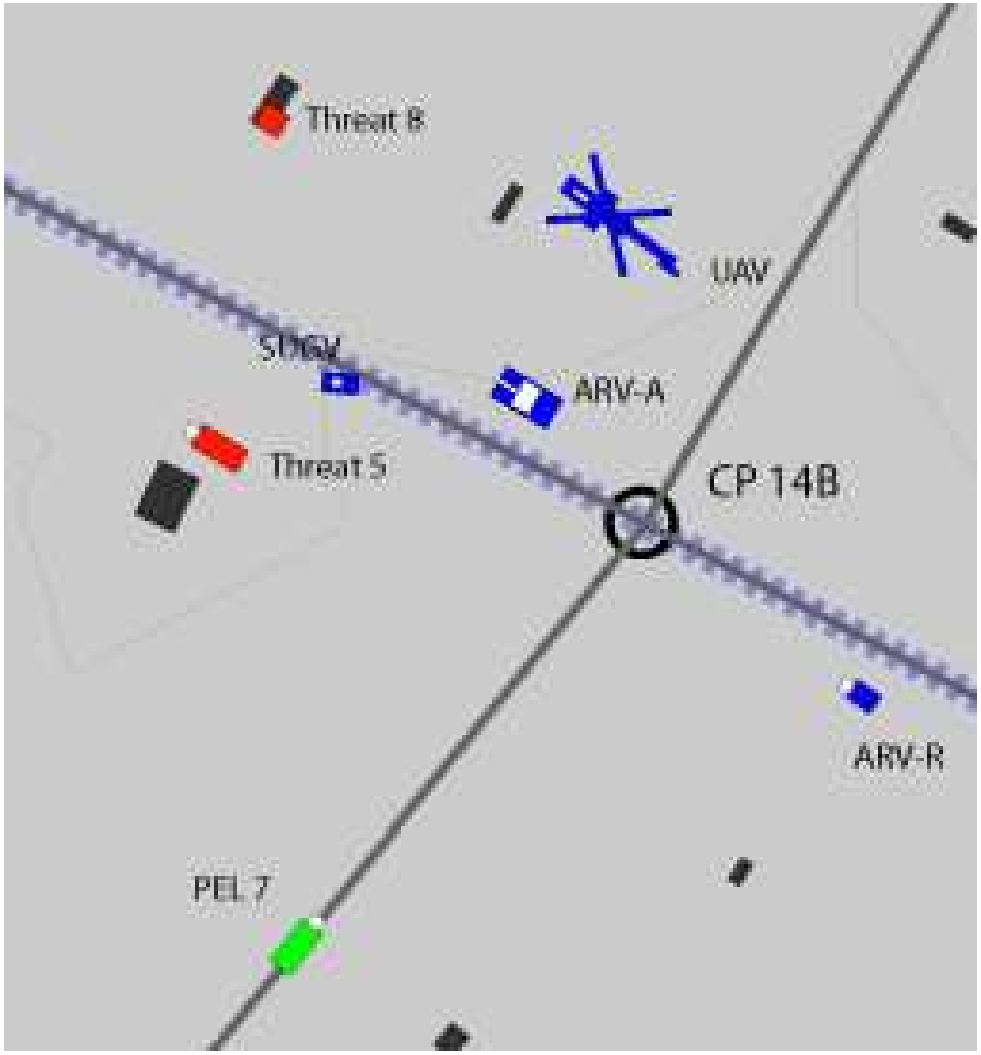
ICF testbed development efforts

- *Tools* for simulation of C2 of multi-UV teams and mixed human-robot teams
- *Techniques* for SME knowledge elicitation based on wargaming and participatory design
- *Methods* for scenario based design and assessment of TTPs, policies, and UVs

Example Scenario: IED Ambush



- IED discovered, small arms fire, multiple moving contacts (hostile & unknown)
- What happens in the first few seconds will likely determine the survivability of the assets
- RNCO has 4 UVs to think of and 3 possible threats.
- Automation has possible advantages here, but automation not always appropriate or effective

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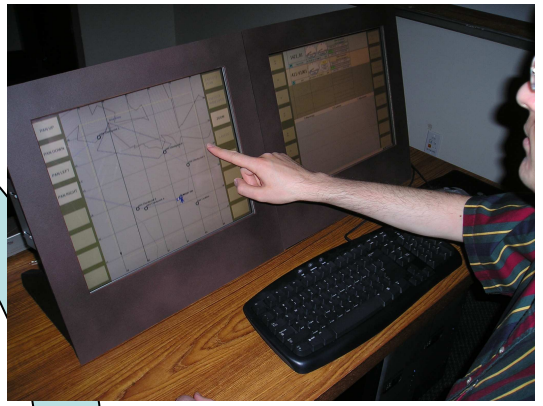
Next steps

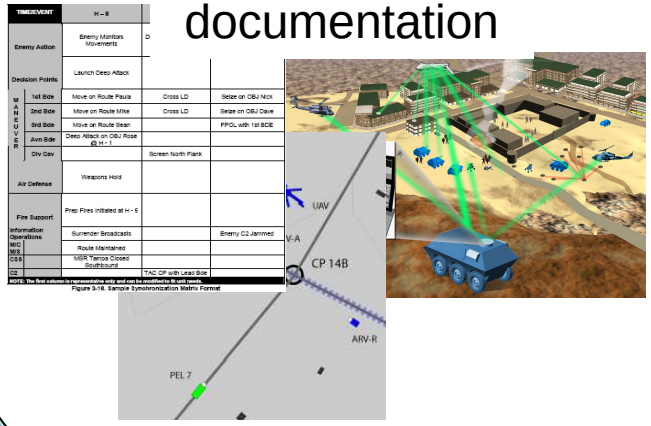
- Explore possible variations and endings
  - Work with SMEs to identify tactics, useful automations, and policies (ROEs)
- Translate findings into ICF prototype
  - Encode SME knowledge into domain ontologies and behavior models
- Evaluate and redesign the ICF UI
  - Identify key operator issues in management of robot teams and develop solutions

Approach: Iterative scenario development and simulation

Build

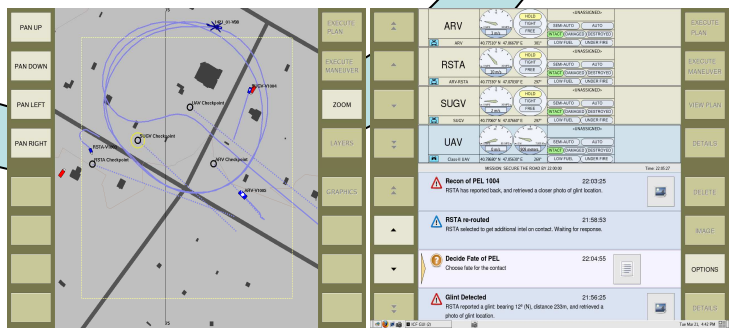


Scenario documentation



Evaluate

Rapid knowledge acquisition and design iteration before and after test bed implementation



Design

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What's inside this box?

Nuggets

- Military compatibility
  - U.S. military already uses similar wargaming and simulation techniques
- Reduce engineering time
  - Iterative wargaming can reduce development time in the face of unknowns
- Iterative refinement
  - This process will help refine the ICF test bed, and the ICF test bed will be a valuable piece in this process

Coals

- Good men = hard to find
  - There are few soldiers with significant amount of robot experience
- Good men = expensive
  - SMEs are expensive and it can be difficult to get them to think outside their box
- Need more tools
  - There is currently little tool support to ease translation from envisioned capabilities to encoded behaviors

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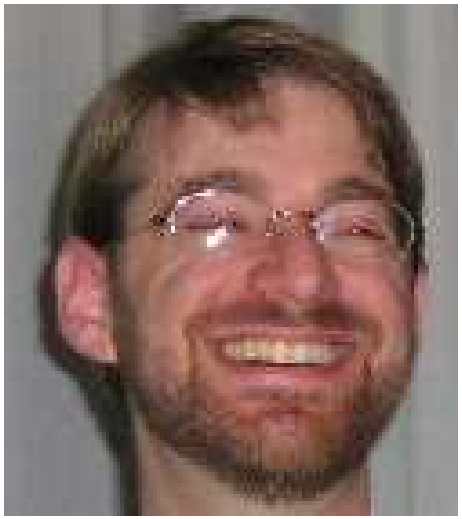
Discussion



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