Advanced Topics in Mixed-Initiative, UxV Networked Control System (Horner, Xie, Yoshida)

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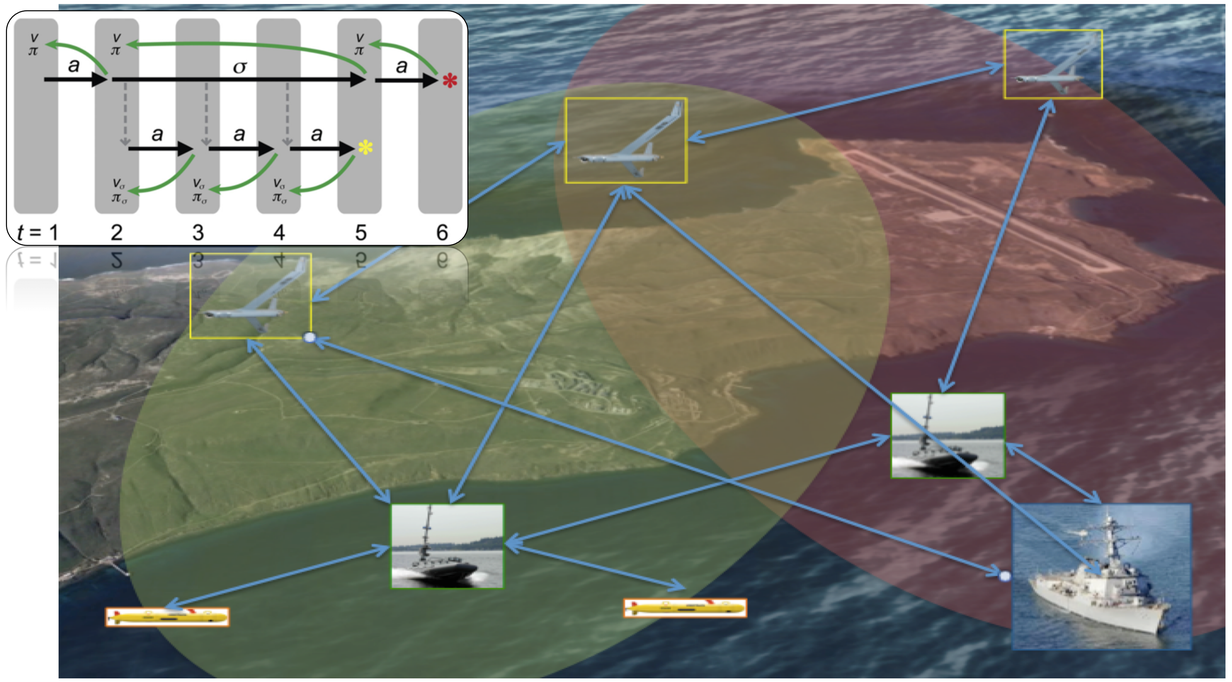

- Leverage prior work in centralized and distributed UxV Network Control System and build new functionality which permits greater flexibility and utility for the overall system. This contains 3 interrelated objectives:
- RL techniques are limited within long horizon, decision-making problems. We propose the development of a new Hierarchical Reinforcement Learning approach for NCS policy optimization.
- Control for mobile networks have overly conservative comms models which limit NCS utility. We propose a Delay Tolerant Network (DTN) communications model for more flexible network topologies to better support of competing mission sub-objectives within the overall NCS.
- Motion of the NCS can reveal critique mission parameters. We propose the use of a Red Cell to anticipate these vulnerabilities and plan for them.

- Development/Analysis/Integration of a Hierarchical Reinforcement Learning techniques for adaptivity for Distributed UxV Adaptive Submodularity (DUAS).
- Development /Analysis/Integration of a Delay Tolerant Network (DTN) framework for DUAS.
- Development and analysis of an initial Red Cell AI approach for masking Commander's intent.
- Delivery of a Hybrid VR/NCS system that is capable of having deployed UxVs together with simulated agents in a VR environment.

- UxV Network Control Systems permit the collaborative use of a heterogeneous mix of unmanned systems to support expeditionary operations. It permits the ability to more effectively and safely conduct missions with less personnel.
- As these systems develop, intelligence will be embedded into the system to automate and quicken the decision cycle.
- Reinforcement Learning techniques permit the selection of optimal policies but new techniques must be development to counter the increasing complexity associated with the optimization function.
- New communications models allow greater system utility by – in part – reducing the requirement of constant conductivity. This permits great flexibility through multiple sub-mission objectives supported by the NCS.

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