HUNT: Heterogeneous Unmanned Networked Teams

- Future Naval Combat Operations and Systems will entail small expeditionary forces which must monitor and protect large and complex areas continuously.
- The purpose of HUNT is to push the state-of-the-art in complex, time-critical mission planning and execution for large numbers of heterogeneous vehicles collaborating with warfighters.
- Sophisticated cooperation among intelligent biological organisms will offer critical insight and solution templates for many hard engineering problems.

Prototypical Progression of a Hunt

- Prototypical progression through foraging states shown to the right.
- Hunt begins with wolves searching for prey.
- Once prey is discovered, the wolves transition to approach.
- Transition to attack group when prey begins running.
- Transition to attack individual when a weak individual is discovered.
- Transition to capture when the prey is close enough to make contact.
- Capture ends in a kill for successful hunts.

Implementing Wolf Behavior

- Software implementation was accomplished through a set of releasers (stimuli) and a weighted roulette wheel of probabilities.
- The presence or absence of stimuli make a transition possible (we say they release that transition).
- The set of releasers and the transitions they facilitate are shown in the table to the right.

Finite State Automata

- The foraging states and transitions are represented by states and triggers in the Finite State Automata (FSA) shown below.
- The FSA is a fully connected graph, however the only transitions possible are those with the necessary releasers present.

Results

- Experiments were run for 4 scenarios:
  - 1 wolf, 1 elk (stop)
  - 1 wolf, 1 elk (run away)
  - 1 wolf, 3 elk (run away)
  - 2 wolf, 3 elk (run away)
- Each scenario was run 20 times and the progression of the wolf through the foraging states was recorded for each run.
- The tabulated values show a high fidelity to the original observed probabilities.
- Differences between probabilities in each scenario show that the wolves behavior reacted to prey behavior.