Current Applied Soar Agent Development

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SOARTECH

Applied Soar Agents

- Agents developed for DoD projects, for which:
  - Application of Soar is the emphasis of research/development of Soar
  - Primary design and implementation goal of Soar programs is to meet application-specific reasoning and behavior generation requirements
  - General emphasis of this talk is on reasoning agents that interact as role players in some DoD simulation environment

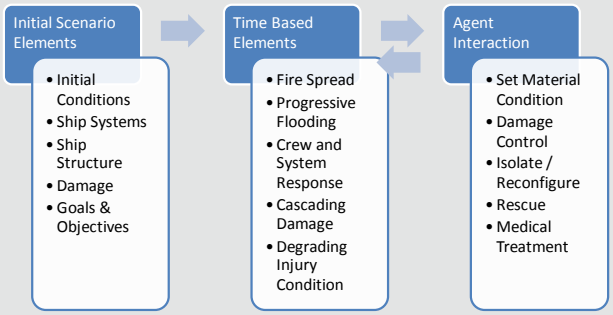
General Highlights

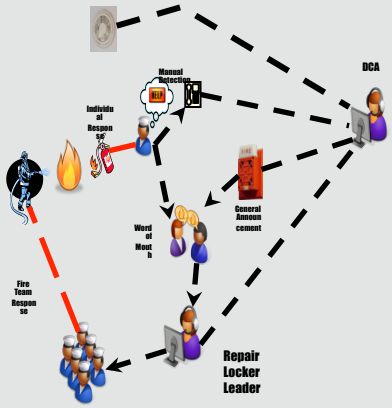
- There continues to be interest in applied (in contrast to research) systems that use Soar agents
- Soar continues to demonstrate advantages for certain types of applied, interactive systems
- Potential transition of some applied Soar agents to actual DoD programs
- Significant amounts of reuse across agents and development of new, reusable rule sets and/or patterns
- Soar 9 mechanisms beginning to move into the mainstream
- Improving focus on when and where to use Soar

Points of emphasis for Soar applications

- The integrated cognitive/reasoning capabilities in Soar provide an engineering advantage in situations where:
  - Integrated knowledge, reasoning, and expertise are necessary to the capability to manage the large number of special cases and exceptions
  - Knowledge-based reasoning can generate decisions, actions, and expectations, and evaluate alternative hypotheses
    - that are highly situation dependent
    - that change fluidly as the dynamics of a situation unfold

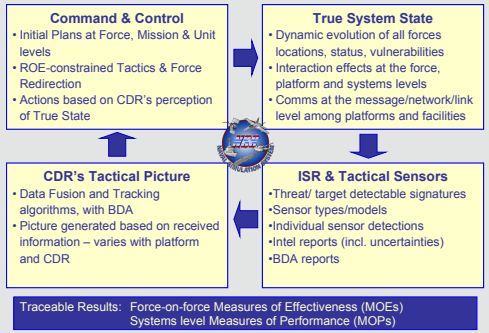
IRM-CGF





- Naval ship recovery management simulator
- Simulation of weapons, damage, fire, smoke, flooding effects on ships
- Crew members modeled with "omniscient" hierarchical task decompositions, implemented in TCL
- Use of Soar
  - No reimplementation of existing task hierarchies in TCL
  - Soar code provides higher-level situation understanding and decision making, using TCL tasks as primitives
  - Soar code also monitors progress of TCL tasks and interrupts where appropriate
  - Soar agents are not "omniscient" and so must reason about attention, situation understanding, and communication using ship comm channels and chains of command
  - Simple set of initial prototype agents under development
  - Significant reuse of code "libraries" from other projects
    - "NGS-extra-lite" goal handling
    - Reception and processing of incoming messages
    - Delayed/synchronous response generation

NSS-CGF



- Naval Ship Simulation – simulation of fleet operations and command decision making
- Simulation of individual ships and aircraft
- Each vehicle has a set of reactive tasks associated with it
  - No interruptibility, no learning, only very simple reactivity and situation understanding, no teamwork
- Use of Soar
  - Model various command roles for ships in the fleet
  - Management of investigation and engagement of threats, with variations including:
    - Reinforcement learning about decoy tracks
    - Teamwork modeling to allocate engagement resources
    - Cognitive load modeling, to demonstrate errors under high load
    - Situation understanding and interruptible adaptive reasoning
  - Simple set of prototype agents for each type of capability
  - Developing reusable "libraries" for message processing and delayed response handling
  - July workshop and tutorial in San Diego, targeting DoD and Defense Contractor users (and potential users) of NSS

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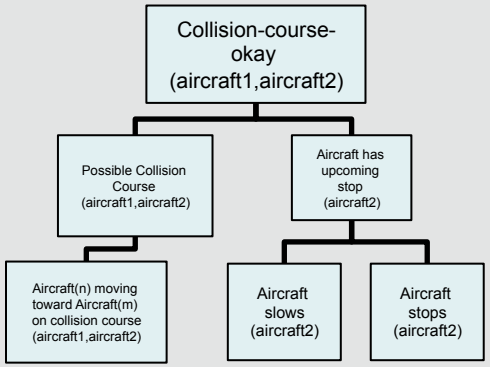

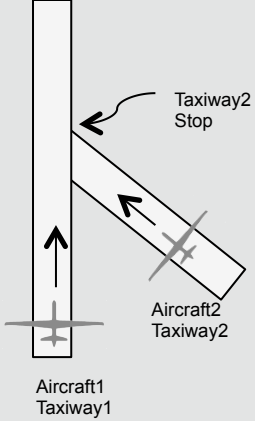

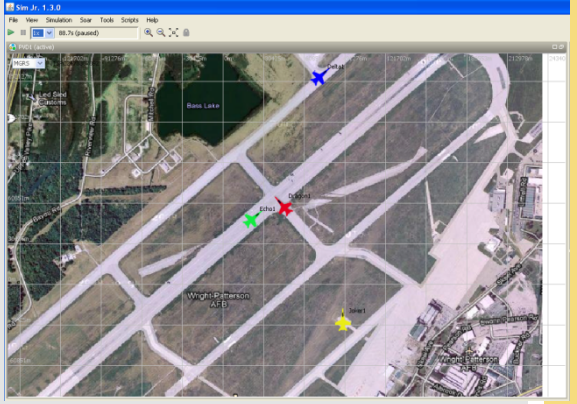

- Generation of expectations, prediction of intent, and appropriate reaction for autonomous air vehicles in the terminal area of operations
- Customer currently wants focus on cognitive capabilities developed in simulation
  - Working relationship with Dr. Ella Atkins to target actual vehicles, if possible
- SimJr as simulation platform for research, development, and evaluation
- Use of Soar
  - Adapting Soar-based Schema Engine (previously seen in projects for cultural reasoning and air traffic control)
  - Extending Schema Engine to handle multiple agents simultaneously and to parameterize to different situations (geography, physical platform)
  - Future plans to incorporate Soar implementation of “Explanation Based Learning of Correctness” (knowledge-patch learning mechanism)
- Project cited in the popular press

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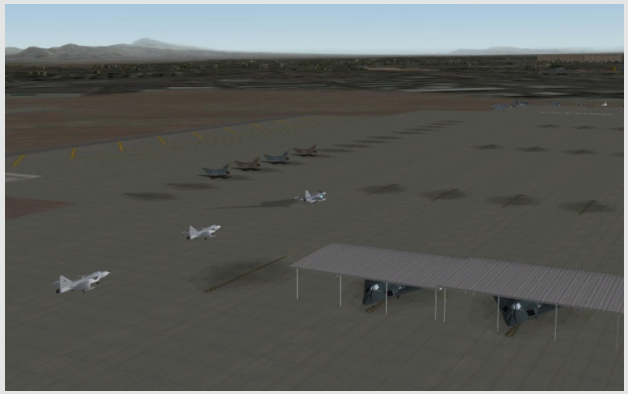
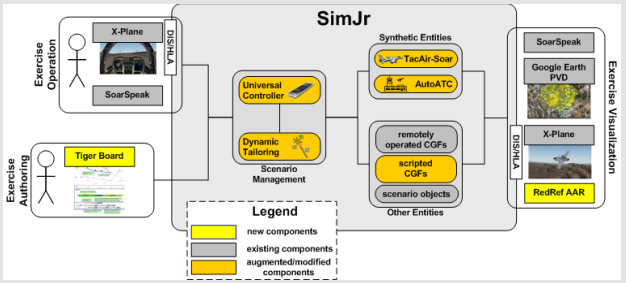
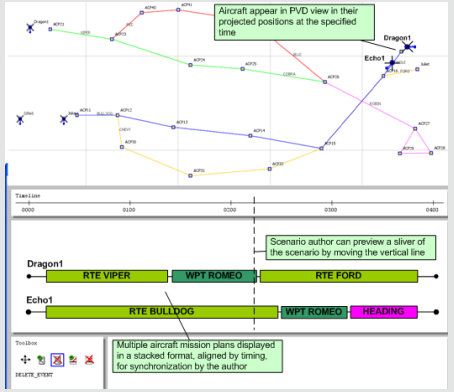




- A portable, authorable practice environment for international participants which will allow them to rehearse Red Flag flight domestics
- Self-contained, deployable product with SimJr and Soar at the core
- Major goals are system portability, content authoring, and sufficient level of realism for useful rehearsal
- Use of Soar
  - Fully autonomous friendly and enemy synthetic aircraft using TacAir-Soar and new enhancements
  - Adaptation of Schema Engine to detect and anticipate violations and provide instant feedback to the pilot
  - Integrated speech recognition and generation via SoarSpeak

Tiger Board



- Scenario composition tool for airspace management training
- Easy authoring of robust new training content
- Realistic and correct interaction of synthetic aircraft with air-traffic control trainees
- Use of Soar
  - Smart Interface Device (using Schema Engine) to task synthetic aircraft (Soar and non-Soar) with varying autonomous capabilities
  - Helo-Soar agent provides some aircraft behaviors
  - Investigating transition to the Army's Tactical Airspace Integration System, to support training (tentative program start in 2012)

Summary

- Gold
  - Continued demand for applied Soar-based agents
  - Making gradual in-roads to "prime time"
  - Fair degree of reuse across systems, making systems more cost effective to build
  - Starting to use Soar 9 features
- Coal
  - Haven't yet used semantic or episodic memories in an applied agent
  - Some applications remain simple prototypes
  - Some reusable code units have not yet been "packaged up"
  - Some "unapproved" uses of Soar, for the sake of engineering
  - Heavy use of NGS, no use of UM-style goals
    - But see other talk on this topic