TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Advanced Decision Architectures Collaborative Technology Alliance (ADA CTA)

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Vision

Better & Faster Decisions Based on Displayed Information

Research Areas

- Cognitive Modeling and Metrics
- Team Communication and Collaboration
- Context-Sensitive Information Presentation
- Fusion and Intelligent Architectures

Success Requires Partnerships

- 482 publications
- 5 published books and 43 book chapters
- 28 workshops, seminars and short courses
- Millions in technology transition funding

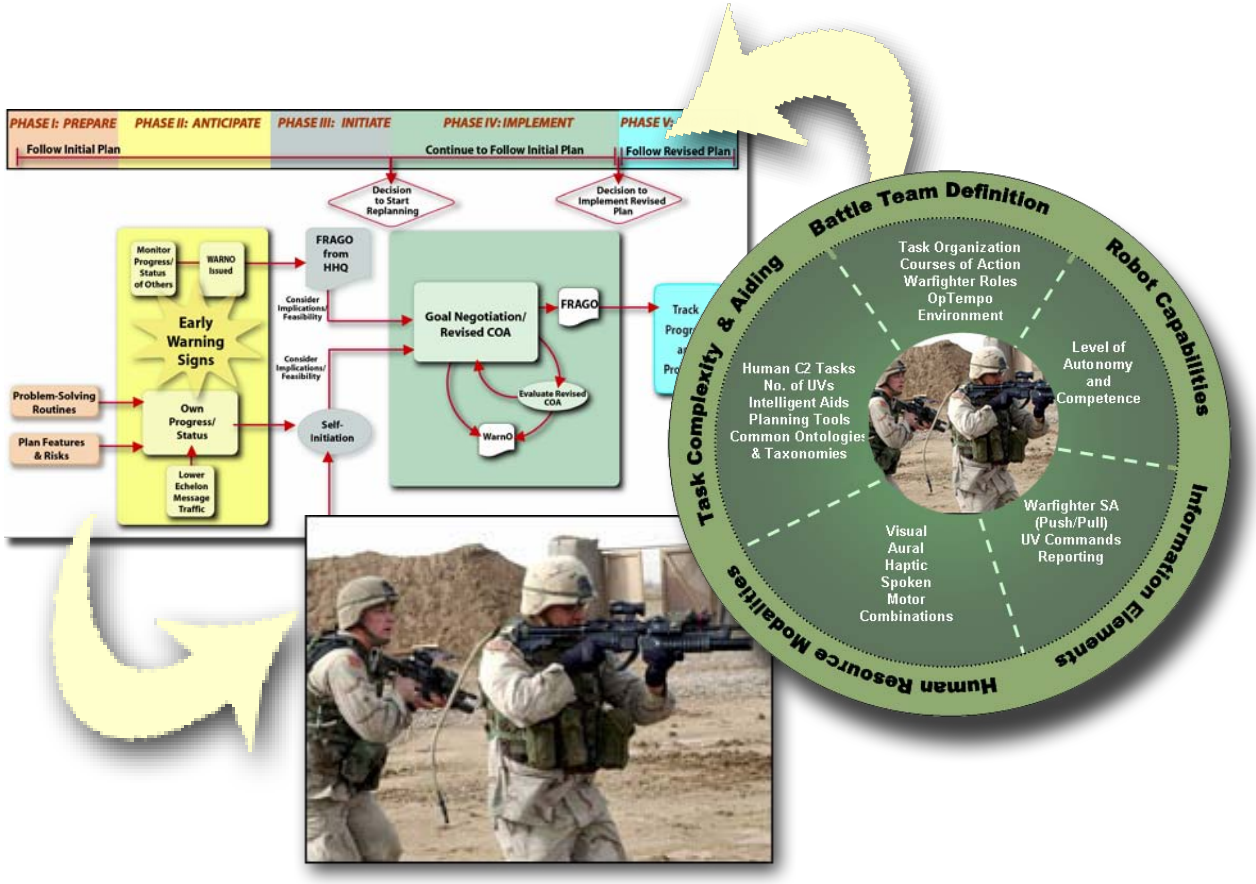
External Collaborations:

- JFCOM J9
- Fort Leavenworth BCBL
- Robotics CTA
- Sensors CTA
- Communications and Networks CTA
- AFRL
- CERDEC
- USMA
- DARPA
- National Science Foundation
- Institute for Creative Technologies
- Flexible Display Center

Cognitive Modeling and Metrics

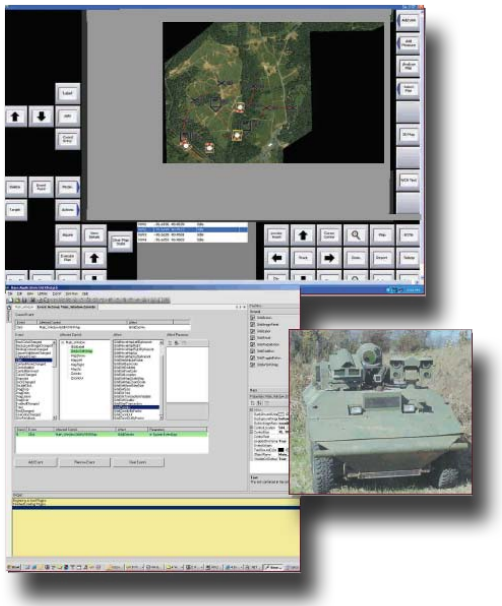
Approach:

- Model cognitive processes as a foundation for work on collaborative technologies and decision support systems
- Define unobtrusive methods to quantitatively assess users' states and better support decision making
- Define and showcase user-centered design



The goal is to understand the cognition underlying Soldier activities and lay the foundation to develop decision-centered technology

Cognitive Modeling and Metrics



▲*Graph-based Interface Language GUI Evaluation System that combines cognitive and task models*

- **Developed an efficient computational model of decision making.**
- **Created models to describe interactions between fusion processes and decision making.**
- **Conducted an experiment to determine how decision making intelligent agents can best assist S2 and S3 in the 3-Block Challenge scenario.**

FY06-07

- **Integrate spatial reasoning capabilities into the Graph-Based Interface Language GUI evaluation system.**
- **Computational models to predict situation awareness during complex scenarios.**

FY08-09

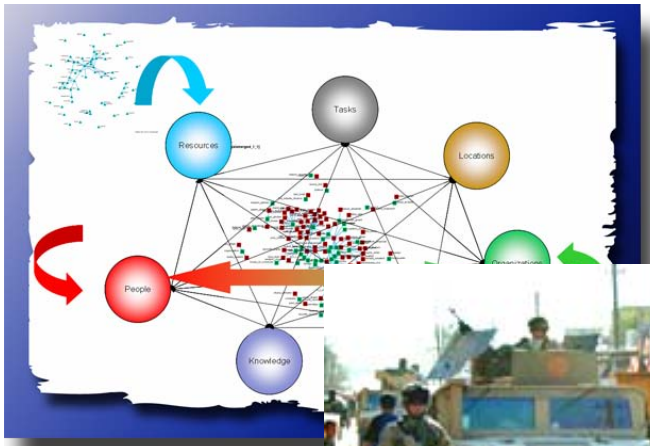
Planned Transitions

- **Autonomous Vehicle Operator Span of Control Evaluation Tool linked to cognitive models to assist Robotics CTA.**
- **Human Performance Measurement Framework for use in DARE.**
- **Models to predict how humans learn Recognition-Primed Decision Making for Network Enabled Command and Control.**

Team Communication and Collaboration

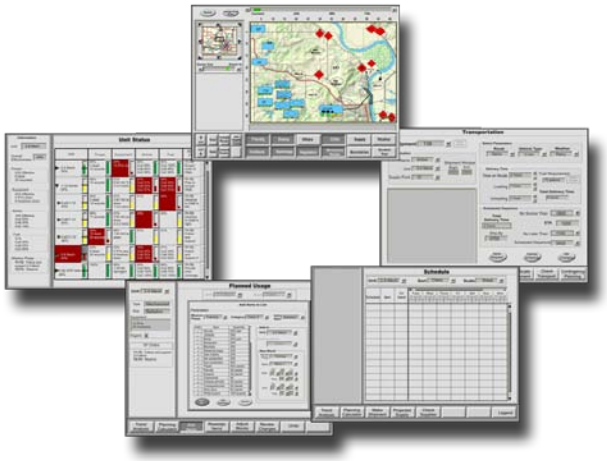
Approach:

- Perform work to understand how individuals and teams make decisions, assess situations, and interact with technology
- Prototype and validate collaborative software-based tools with actual Army decision makers
- Provide tools and techniques to enable Soldiers to operate in multi-cultural environments



The goal is to improve commander and team decision making and operations across the full spectrum of military operations

Team Communication and Collaboration



▲ *Interface concepts driven from Goal-Directed Task Analysis approach*

- **Improved distributed planning activities via Collaborative Slide Annotation Tool during CERDEC JF Experiment.**
- **Developed C2 network analysis toolkit to help commanders visualize C2 structures, analyze effectiveness and redesign the structure, if necessary.**

FY06-07

- **Methods to facilitate decision making across distributed teams.**
- **Mission planning and replanning tools.**
- **Capabilities to enable Soldiers to communicate effectively in multi-cultural environments.**
- **Measures to describe and predict team performance and subsequent impact on overall system performance.**

FY08-09

Planned Transitions

- **Display concepts to improve situation understanding.**
- **Goal-directed task analyses to LW-SI and FCS.**
- **Organizational Risk Analyzer that enables commanders to visualize relationships between humans, resources, knowledge, tasks & missions.**

Context-Sensitive Information Presentation

Approach:

- Design, prototype, test and validate state-of-the-art displays to include different modalities of information presentation and interaction
  - Visual
  - Tactile
  - Thermal
  - Natural Language (speech and text)
- Develop algorithms to support Army planning systems

The goal is to put the Soldier in control of the decision support environment

Context-Sensitive Information Presentation

▲*Prototyped interfaces to promote efficient and effective human-agent interaction*

- **Created haptic devices and guidelines for their use that can be used to silently communicate with Soldiers in the field.**
- **Developed and demonstrated integrated research environment that supports experimentation of integrated ADA components.**
- **Prototyped adaptive delegation interface to accomplish human supervision of multiple autonomous agents.**

FY06-07

- **Multimodal technologies (tactile, visual, speech) and physiological sensors systems to maintain contact with Soldiers in the field.**
- **Report on how flexible displays can optimally provide dismounted Soldier information requirements.**

FY08-09

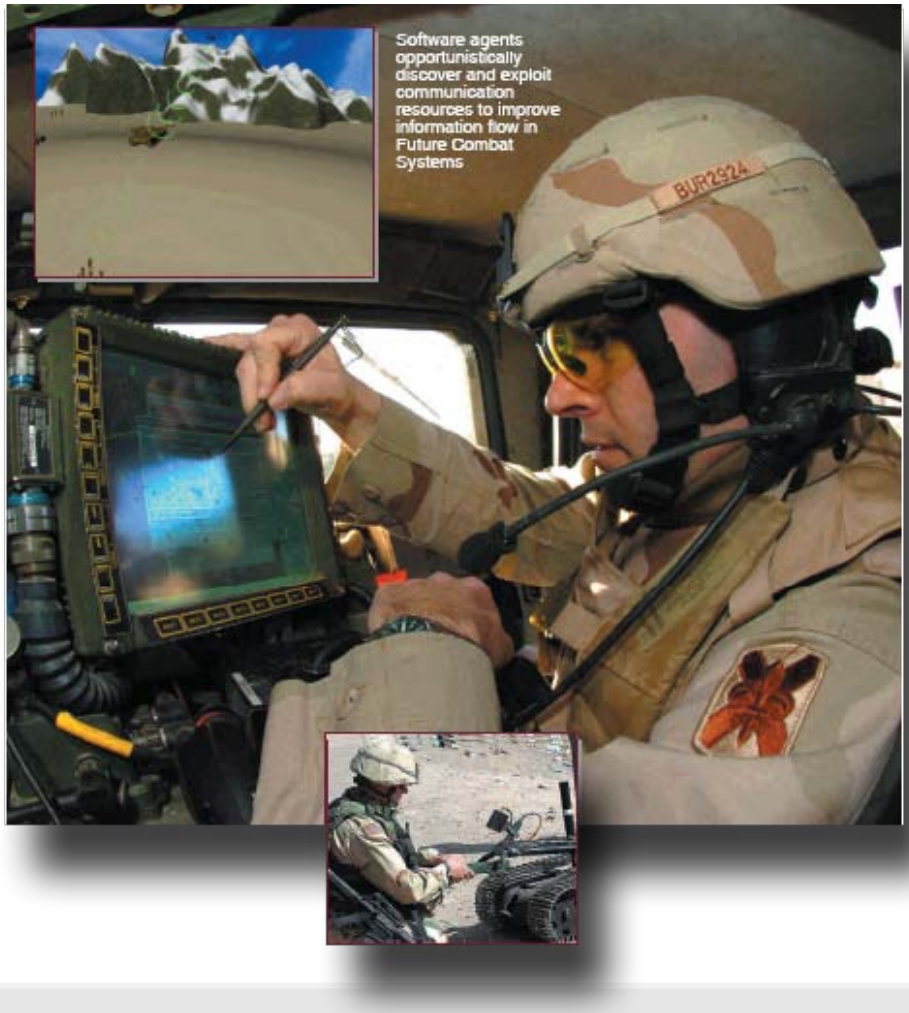
Planned Transitions

- **DARE for concept exploration and experimentation.**
- **Tactile devices with tactor arrays to provide context-rich messages to dismounted Soldiers.**
- **User interfaces for human-robot interaction to provide situation awareness in complex environments.**

Fusion and Intelligent Architectures

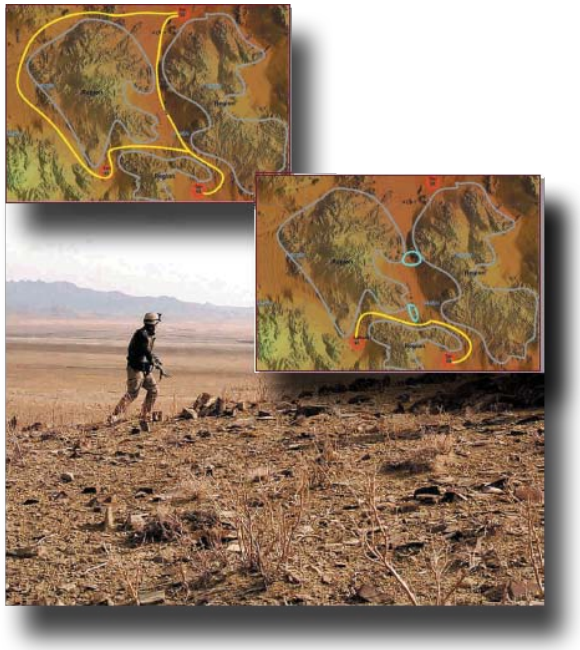
Approach:

- Develop methods to efficiently fuse large amounts of information using automated algorithms
- Develop automated tools to support planning and real-time situation understanding
- Develop key principles and control algorithms for applying auto-adaptation



The goal is to create decision tools that support fluent coordination and synchronization across human-automation teams

Fusion and Intelligent Architectures



▲*Algorithms to assist Soldiers in spatial reasoning in complex terrain*

- **Demonstrated agile software agents on FCS platforms.**
- **Demonstrated computer reasoning algorithms that address entity re-identification relevant to intelligence analysis systems.**
- **Conducted experiments to improve appropriate perception of risk in decisions that involve uncertain information (including asset health, status and location).**

FY06-07

- **Demonstration of fusion engine in a tactical overwatch scenario.**
- **Prototype interface to develop and assess sensor allocation plans.**

FY08-09

Planned Transitions

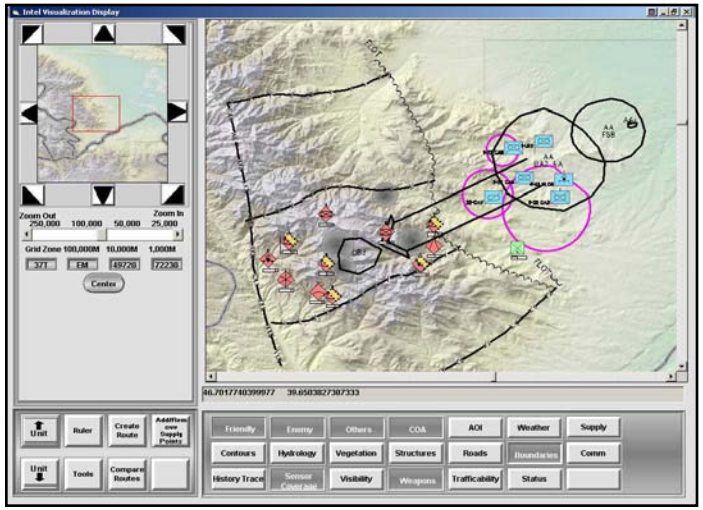
- **Agile agent infrastructure integrated with policy management and domain services to enable efficient use of network resources.**
- **Spatial reasoning components for integration into ACT-R open source cognitive modeling architecture.**

Advanced Decision Architectures FY08 Program Direction

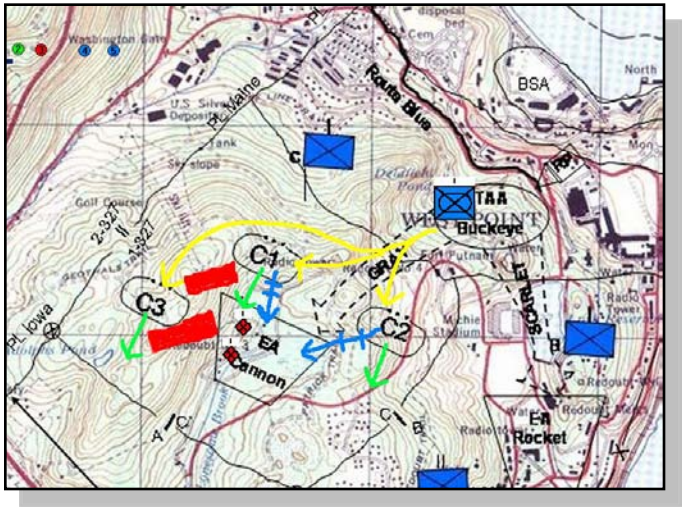
Research Area	Focus	Transitions
Cognitive Modeling and Metrics	• Measures • Cognitive Processes • Computational Models	• Compendium of human performance metrics to CERDEC • Methods to integrate decision making simulations to CERDEC I2WD • Cognitive agents & models to Robotics Collaboration ATO
Team Communication and Collaboration	• Culture in Teamwork • Tools for Team Decision Making	• Social Network Analysis to Army G-2 • Dynamic Planning Tools to FCS • Multi-cultural Collaboration Tools to JFCOM
Context-Sensitive Information Presentation	• Multi-Modal Displays • Coordination of Multiple Perspectives	• Visualization Technologies to Robotics Collaboration ATO • Enhanced Tactile Displays to FCS • Improved distributed planning activities via CSLANT to CERDEC
Fusion and Intelligent Architectures	• Intelligent Architectures for Fusion and Planning • Agile Computing Infrastructure	• Spatial Reasoning Systems to FCS • SOS Modeling Architecture to Robotics Collaboration ATO and FCS • Intelligent Agents to FCS

Significant Transitions

The Fusion Engine has an impressive technical transition record with the agencies of DARPA, AFOSR, and CERDEC- I2WD



Displays to enable decision making on the move to FCS



Displays to improve SA and understanding of intent when communicating operations to CERDEC

In process:

RPD-Enabled Agents to enhance human-agent team performance to CERDEC