Command, Control, Communications, Computers and Intelligence (C4I) Community of Interest (COI)
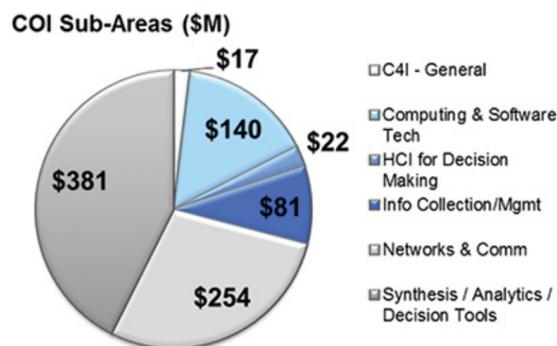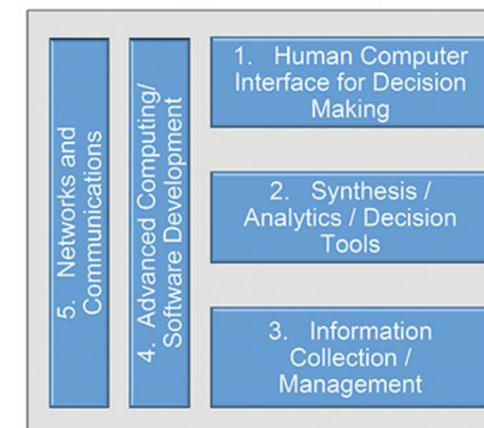
DoD Investment Profile

COI Sub-Areas ($M)

Pie chart values:
- $17
- $140
- $22
- $81
- $254
- $381

Legend:
- C4I - General
- Computing & Software Tech
- HCI for Decision Making
- Info Collection/Mgmt
- Networks & Comm
- Synthesis / Analytics / Decision Tools

COI Description

The Command, Control, Communications, Computers & Intelligence (C4I) COI will coordinate the DoD C4I Science & Technology (S&T) portfolio investment and review DoD organizations' strategic plans to support C4I related S&T investments in the context of overall DoD strategic priorities and goals. The C4I COI will establish priorities and guidance, monitor current and planned investments in S&T including but not limited to Networks, Command & Control, and Data to Decision efforts. The COI will identify gaps, establish and maintain a set of S&T roadmaps to guide DoD research program investments, perform portfolio assessments, and provide future resource recommendations to leadership. The C4I COI will also establish mechanisms to encourage coordination between researchers to facilitate information exchange, and promote collaboration.

Technology Working Groups

- 5. Networks and Communications
- 4. Advanced Computing/ Software Development
- 1. Human Computer Interface for Decision Making
- 2. Synthesis / Analytics / Decision Tools
- 3. Information Collection / Management

Capability Roadmaps/Gaps/Opportunities

Key C2 Capability Challenges

Collaboration — Enable human interaction and collaborative decision making to achieve unity of effort

Automation / Autonomy — Unburden warfighters through Automation/Autonomy

Uninterrupted Command — Enable mission execution at all echelons anywhere, at anytime, regardless of network/system status

Interoperability / Coordination — Seamless and secure movement and integration of mixed format data/ information between service, joint and coalition networks/systems

Priority Challenges / Enabling S&T Investments

Uninterrupted C2
- Operate in A2/AD Environment
  - Maintain Connectivity
  - Operate Disconnected
- C2 in Austere Environs
- C2 On The Move

Near: Mobile computing platforms, Discovery algorithms, Study alternative transmission platforms
Mid: Mission aware prioritization, cognitive radio
Far: Non-contiguous spectrum, Hardened/advanced transmission media (quantum, optical)

Autonomy/Automation
- Machine "Comprehension" of CDR's Intent
- Lighten the staff's load
- Improve Decision Making

Near: Planning/COA Analysis, autonomous interpretation of intent, better understanding of trust
Mid: Real-time planning updates, Certainty metrics in support of recommendations/actions, V&V in support of trust
Far: Staff support in absence of staff, near real-time planning updates, comprehend orders documents

Priority Challenges / Enabling S&T Investments

Collaboration
- Capture CDR's Intent
- Intuitive
  - Product Sharing
  - Interaction

Near: Touch, gesture, voice interaction, improve understanding of distributed decision making, tailorable visualization
Mid: Automated/user-sensing display management, Human Machine Experimentation Environment,
Far: Decomposed representation of commander's intent, transparent facilitated collaboration, context/user aware information display
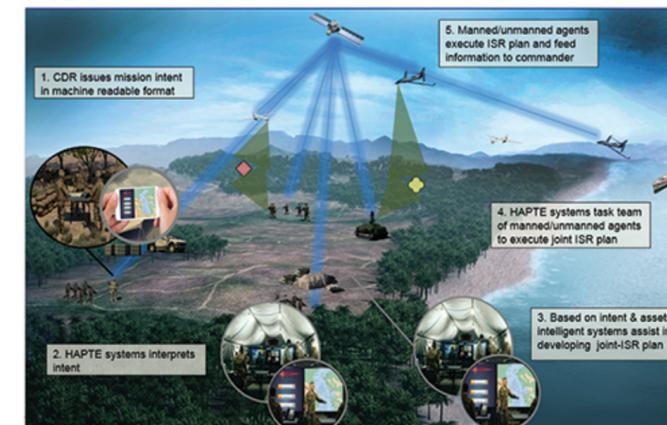
Interoperability/ Coordination
- Cross Domain Solutions
- Cognitive Systems

Near: Push/pull info mechanisms, scalable waveforms, language translation, exploration of data/info sources
Mid: Unified, cross domain platform solutions, reduce unstructured data exchange, unstructured data transformation
Far: Real-time spectrum management, information sharing across waveforms and message standards, automatic info guard functions

Engagement Opportunities

Research area	Challenge	Sampling of Research Opportunities	
1. Human Computer Interaction for Decision Making	Speed of Command requires timely delivery of useful information, to the right people at the right time, presented so as to support mission critical decisions. Too much data - not enough information	• Valuing & sharing information based on task needs • Proactive Planning Decision Support • Machine Facilitated Collaboration for managing Autonomous & Complex Systems	• Information Management for limited connectivity • Information Provenance Pedigree • Uncertainty Management
2. Synthesis/ Analytics/ Decision Tools	Current C2 processes exhibit information gaps and human planners lack cognitive bandwidth to effectively coordinate and synchronize operations across the unique complexities of multiple domains.	• Tools for tracking, positive ID, observing behaviors and activities of objects to determine adversary threats • Determine impact of conditions and events on force capabilities and commander's intent	• Tools for developing, evaluating, and selecting courses of action • Technologies for synchronization of forces, and real-time planning updates
3. Information Collection/ Management	We must consistently prepare for operations in contested environments that are communications constrained and demand increased op tempo and exploitation of heterogeneous sources	• Tactically distributed collection and processing • Task-centric, federated, extensible data models • Dynamic context (mission/user) aware information retrieval	• Context enhanced information fusion and integration • Scalable semantic interoperability
4. Advanced Computing/ Software Development	Rapid obsolescence hinders maintenance of overmatch, consumer systems enable opportunities to challenge our overmatch. Disruptive technologies such as quantum, bio-mimicking, and other new architectures present opportunities and threats.	• Robust real-time situational awareness for C2 • Future computing architectures and associated algorithms and software • Distributed Computing	• Reduce Size, Weight, power, Cost • Cost of Tech Refresh: Improve Reconfigurability, Modularity, Interoperability, Extensibility
5. Networks and Communications	An increasingly crowded spectrum and contested environments threaten our ability to assure connectivity for C2	• Autonomous Network Management & Control • Increased Loss Tolerance & Recovery • Spectral Efficiency and Diversity	• Mobile Ad Hoc Networking • Electronic Protection • Increased Range

Human- Agent Planning Teaming and Execution

Developing machine capability to capture and intelligently interpret Commander's Intent, demonstrating improved Commander's mission analysis, COA development / assessment and multi-agent development and execution of Joint ISR plans

1. CDR issues mission intent in machine readable format
2. HAPTE systems interprets intent
3. Based on intent & assets, intelligent systems assist in developing joint-ISR plan
4. HAPTE systems task team of manned/unmanned agents to execute joint ISR plan
5. Manned/unmanned agents execute ISR plan and feed information to commander

For more information, visit us on the Innovation Marketplace at: http://www.defenseinnovationmarketplace.mil/