

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY		PE NUMBER AND TITLE					
<b>2 - Applied Research</b>		<b>0602783A - COMPUTER AND SOFTWARE TECHNOLOGY</b>					
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total Program Element (PE) Cost	6602	9803	5495	5591	5686	5838	6018
Y10	COMPUTER/INFO SCI TECH	3745	5332	5495	5591	5686	5838
Y11	COMPUTER & INFORMATION SCIENCE APPLIED RES CA	2857	4471				

**A. Mission Description and Budget Item Justification:** This program element (PE) funds research and application of information and communications technology to enhance the understanding and speed the decision cycle for mounted and dismounted commanders and leaders operating in the mobile dispersed environment envisioned for the Future Force. Focus is on a spectrum of command and control (C2) solutions for lower echelon teams. This program investigates and matures command, control, communications and computer (C4) technologies to increase Future Force lethality and survivability through improved commanders' decision making and situational awareness and, where feasible, exploits opportunities to enhance Current Force capabilities. The goals of this program element are to develop information processing technologies to automate the delivery of local/global information for decision making (planning, rehearsal, and execution) so that it is synchronized, parallel, real-time, and to devise communication/network technologies that will enable the synchronization of secure data/information from humans to humans, humans to computers, computers to humans, as well as reducing dependence on mouse and keyboard versus other modes of computer interaction. Challenges for this program include developing automated tools to support the discovery of services within an unreliable ever-changing network topology as well as providing methods for end-users to understand the tactical significance of events generated from both local and global tactical sensors. Technologies addressed in this work will enable a spatial and temporal explanation of the situation through graphical and narrative based multi-media reporting for the commander. Work in this PE is related to and fully coordinated with efforts in PE 0602782A(Command, Control, Communications Technology), PE 0603772A(Advanced Tactical Computer Science and Sensor Technology), and PE 0603008A(Command, Control, Communications Advanced Technology). Project Y11 contains congressional adds only.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement.

Work in this project is performed by the Army Research Laboratory (ARL).

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<b><u>B. Program Change Summary</u></b>	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	6719	5368	5510
Current BES/President's Budget (FY 2009)	6602	9803	5495
Total Adjustments	-117	4435	-15
Congressional Program Reductions		-65	
Congressional Rescissions			
Congressional Increases		4500	
Reprogrammings	10		
SBIR/STTR Transfer	-127		
Adjustments to Budget Years			-15
One FY08 congressional add totaling \$4500 were added to this PE.			
(\$4500) Ruggedized Cylinders for Expandable Mobile Shelters			

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>		<b>PE NUMBER AND TITLE</b> <b>0602783A - COMPUTER AND SOFTWARE TECHNOLOGY</b>					<b>PROJECT</b> <b>Y10</b>	
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
Y10 COMPUTER/INFO SCI TECH	3745	5332	5495	5591	5686	5838	6018	

**A. Mission Description and Budget Item Justification:** This project funds research and application of information and communications technology to enhance the understanding and accelerate the decision cycle time for mounted and dismounted commanders and leaders operating in the mobile dispersed environment envisioned for the Future Force. Focus is on a spectrum of command and control (C2) solutions for lower echelon teams. Research within this project investigates and matures command, control, communications, and computer (C4) technologies to increase Future Force lethality and survivability through improved commanders' decision-making and situational awareness and, where feasible, exploits opportunities to enhance Current Force capabilities. The goals of this project are to develop information processing technologies to automate the delivery of local/global information for decision making (planning, rehearsal, and execution) so that it is synchronized, parallel and real-time; and to devise communication/network technologies that will enable the synchronization of secure data/information from humans to humans, humans to computers, computers to humans, as well as reducing dependence on mouse and keyboard versus other modes of computer interaction. Challenges for this program include developing automated tools to support the discovery of services within an unreliable ever-changing network topology as well as providing methods for end-users to understand the tactical significance of events generated from both local and global tactical sensors. Technologies addressed in this work will enable a spatial and temporal explanation of the situation through graphical and narrative based multi-media reporting for the commander. Work in this project is related to and fully coordinated with efforts in PE 0602782A (Command, Control, Communications Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and PE 0603008A (Command, Control, Communications Advanced Technology).

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<b><u>Accomplishments/Planned Program:</u></b>	<b><u>FY 2007</u></b>	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>
Enhance information processing techniques through the interactive and automated fusion of distributed local and global information sources in order to inform and protect the force from imminent threats. User directed fusion techniques that combined with techniques developed at the Communications-Electronics Research, Development, and Engineering Center (CERDEC) will enable semi-automated fusion to improve the completeness and timeliness of decision-making in C2 operations. The integrated technology will be matured for Distributed Common Ground Station-Army (DCGS-A) and Future Force assessment. In FY07, mined marked-up Resource Description Framework (RDF) and Ontology Web Language (OWL) based data-stores for events/associations across disparate data sources. In FY08, implement ontology to formalize the representation, attributes, and transforms necessary to track a soft target using various data sources. Integrate soft target tracking algorithms as small, self-contained fusion services that support the Intelligence Analyst in interpreting battlefield events. In FY09, will develop and transition fusion services to CERDEC for integration into DCGS-A.	1100	1075	1090
Conduct applied research on tactical information protection technologies for agent-based vulnerability assessment over wireless bandwidth constrained links and security infrastructures for sensor networks. The Future Force will operate in a complex wireless environment where survivability must be maintained in spite of inherent vulnerabilities of standardized protocols and commercial	961	1033	1040

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>2 - Applied Research</b>	<b>0602783A - COMPUTER AND SOFTWARE TECHNOLOGY</b>	<b>Y10</b>	
technologies. In FY07, implemented and evaluated cooperative algorithms for detecting sophisticated attacks involving multiple colluding nodes against Mobile Ad Hoc Network (MANET) routing protocols. Evaluated clustering algorithms for creating and maintaining a dynamic hierarchy of cooperative intrusion detection components in MANETs. Implemented a prototype network protocol that increased current efficiency of media-access control. In FY08, investigate and evaluate an integrated distributed wireless intrusion detection system (IDS) capable of detecting multiple classes of intrusions from multiple simultaneous intruders. Enhance network protocol to provide a more efficient healing process. In FY09, will evaluate the scalability of the distributed wireless IDS system in large networks and determine the expected bounds of performance (e.g. overhead, missed detection probability, and false alarm probability).			
Investigate techniques to enable automated integration of global and local information, allowing tactical assets to cooperatively share sensed events within a wireless distributed fusion environment in order to inform the force of relevant events. In FY07, using a Distributed Interactive Semi Automated Forces (DISAF) simulation, evaluated the ability of the distributed agent infrastructure to provide a tactically relevant picture of the local operational environment through a series of time sequenced events. In FY08, use social networking concepts to develop soft target tracking algorithms that can be used to identify relevant changes in the tactical environment. In FY09, will integrate cross-security-level information exchange algorithms to insure tactically relevant information is presented to the user in a minimally intrusive manner.	1135	1100	1135
Conduct research into techniques for developing the underlying computational multilingual software framework to enable commanders and troops to bridge language barriers in order to anticipate adversaries and collaborate with allies. In FY07, enhanced the underlying framework to include the ability to extract the metrics required for evaluation of text based machine translation engines. Developed the underlying software framework to integrate the best microphone and two-way speech technologies. In FY08, implement optical character recognition (OCR), machine translation and name extraction via web services in Deployable Harmony DOCEX System (DHDS) and DCGS-A test beds. In FY09 will evaluate use of prototype document image processing tools operating through web service on noisy and handwritten foreign language documents.	549	541	545
Statistical based methods for studying networks supports theory development in network science. Provide a basis to validate or invalidate theoretical results, point gaps between theory prediction, and field performance, provide experimental verification of mobility, channel, topology models, and of convergence of adaptive protocols, guide development of the theoretical effort by providing a basis for refining models and assumptions. All of this leads to the right levels of robust abstraction to understand network behavior. Resulting in a tight coupling between theoretical developments, simulation, emulation, and over-the-air testing in lab and field environments. The long-term goal is to develop a real-time adaptive statistical analysis system that is coupled to a monitoring system that can infer/learn global network behavior and to a control system that controls local behavior so as to predictively improve performance, while ensuring the stability of the overall system. In FY08, acquire software and hardware, including network monitoring tools, and setup emulation and in-the-lab/field experiments to gather network performance data, based on algorithms developed in this PE/Project. In FY09, will refine and expand the scope of the effort (size of the network, complexity of the deployed algorithms and protocols, heterogeneity of the nodes, harshness of the RF channel conditions and sophistication of the adaptation). Theoretical work will be validated against the acquired data.		1497	1685
Small Business Innovative Research/Small Business Technology Transfer Programs		86	
<b>Total</b>	<b>3745</b>	<b>5332</b>	<b>5495</b>