OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 3	**0603662D8Z - Networked Communications Capabilities**

Cost ($ in Millions)		FY 2006 Actual	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Total Program Element (PE) Cost		0.000	0.000	40.000	40.000	29.000	26.562	26.956	27.530
P662	Airborne Network Gateway	0.000	0.000	20.000	20.000	9.000	0.000	0.000	0.000
P663	Network Communications Analysis	0.000	0.000	20.000	20.000	20.000	26.562	26.956	27.530

A. Mission Description and Budget Item Justification: (U) War-fighters today rely more and more on communications networks to support and enable actions from targeting and shooting weapons to video-conferencing back home. Though military basic infrastructure capabilities follow the mainstream commercial internet, for many reasons (security, mobility, robustness), commercial telecommunications -especially commercial wireless ("tactical edge") communications - are not well-matched with the requirements of today's war-fighter. These trends will continue as the military data load becomes more diverse and heavy. The National Research Council's Network Science Report (2005) and Army Mobile Ad-hoc Network (MANET) Jason Report (January 2006) state that the type of networking projected to meet military tactical requirements are not supported by network theory, network design nor analysis tools. These "tactical edge" technology challenges cut across all warfare domains (space, air, ground, sea). In response to recognized technical problems today, as well as anticipated problems in the future, this research will focus on two key problems in networked technologies: the need for expanded wireless reach where no communications infrastructure exists, and the need to create ways to manage diverse wireless communications load and heterogeneous network types. Airborne Network Gateway will expand the wireless communications and networking reach for the tactical force in the form of an airborne network gateway capability. Network Communications Analysis will establish the scientific foundations for military tactical mobile networking with a specific emphasis on the integrated network management of tactical networks. This research will provide the technical basis to standardize the implementation of military network communications capabilities in the areas of airborne network gateways and network communications analysis across the military services, joint staff, OSD, and defense agencies.

B. Program Change Summary	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)				
Current BES/President's Budget (FY 2008/2009)	0.000	0.000	40.000	40.000
Total Adjustments	0.000	0.000	40.000	40.000
Congressional Program Reductions				
Congressional Rescissions				
Congressional Increases				
Reprogrammings				
SBIR/STTR Transfer				
Other			40.000	40.000

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APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 3	**0603662D8Z - Networked Communications Capabilities**

C. Other Program Funding Summary: Not Applicable.

D. Acquisition Strategy: Not Applicable.

E. Performance Metrics:

FY	Strategic Goals Supported	Existing Baseline	Planned Performance Improvement / Requirement Goal	Actual Performance Improvement	Planned Performance Metric / Methods of Measurement	Actual Performance Metric / Methods of Measurement
08						

Comment: Network Communications Analysis comprises multiple research efforts. Metrics for success for the overall effort will be in the modes of infrastructure development and knowledge generation, and be measured according to the quality and relevance to the topic. Metrics for individual research initiatives will vary according to the mode, but will include performance, quality, relevance and the generation of human capital at a minimum. Lastly, technology selection and transition will be assessed according to success or failure for each of the sub-project areas.

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603662D8Z - Networked Communications Capabilities**	**P662**

Cost ($ in Millions)		FY 2006 Actual	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
P662	Airborne Network Gateway	0.000	0.000	20.000	20.000	9.000	0.000	0.000	0.000

A. Mission Description and Project Justification: Airborne Tactical Relay - (U) An airborne tactical relay capability enables Beyond Line of Sight (BLOS) range extension for tactical mobile communications. Within the current deployed forces there is no airborne network tier to support locally distributed ground and naval forces at lower tactical levels. The need to increase the capability to support tactical forces at lower levels is highlighted in the 2006 Naval Research Advisory Committee (NRAC) Distributed Operations Study. The current lack of an airborne tactical relay limits BLOS tactical communications to available satellite communications. This research will develop, integrate and demonstrate airborne tactical relay technology to support locally distributed tactical forces and achieve improved near-term networked communications capability. Focus will be placed on the transition from research to acquisition for accelerated fielding. Several candidate payloads and platforms will be investigated to meet the needs of the tactical military user at the lower tactical network tiers, for example, small unit relay. Upon the selection of candidates, the technologies will be integrated, matured and demonstrated to support transition. Research and development will include the development and integration of the payload to include Single Channel Ground and Airborne Radio System (SINCGARS), Enhanced Position Location and Reporting (EPLRS), and Soldier Radio Waveform (SRW) for example; the payload to platform integration to support demonstration; and the development of a small unit Concept of Operations (CONOPS) to demonstrate operations supported by the range extension for tactical units. Demonstrations will be used to support technology maturation and verify technology transition criteria.

Airborne Network Gateway - (U) An airborne network gateway interconnects dissimilar networks among tactical forces and also interconnects tactical forces with higher headquarters and command centers. In general, gateways interconnect networks with different, incompatible communications protocols. Gateways are commonly used commercially in the wired internet world to bridge between different networks. The Department of Defense (US Air Force) has initiated a program, Objective Gateway, to develop a family of modular, scalable airborne and ground-based gateways based on the reduction/demonstration efforts, Battlefield Airborne Communications Node (BACN) and Rapid Attack Information Dissemination Execution Relay (RAIDER). As an airborne network gateway, the Objective Gateway program will bridge between disparate data links and voice networks, integrate sensors into the network and provide Internet Protocol (IP) connectivity to the tactical edge. The Airborne Network Gateway research will develop, integrate and demonstrate airborne network gateway technology to facilitate near term networked communications capability that will be transitioned to the Objective Gateway program. Specifically, this research will investigate the data links (eg. Link-16), networks (eg. Tactical Targeting Network Technology (TTNT)), and voice (eg. cellular) candidates for an airborne network gateway, assess technology issues and maturity, and develop enhancements that will overcome shortfalls that preclude the ability to more broadly network the force through an airborne network gateway. One specific area of emphasis will be the analysis of the airborne network gateway effectiveness across sensor to weapon scenarios. Demonstrations will be used to support technology maturation and verify technology transition criteria.

Gateway Interoperability - (U) As discussed above, the Objective Gateway program will develop a family of modular, scalable airborne and ground-based gateways. Additionally, there will be gateway functions performed by other components within the network. Gateways as a general term include relays (range extension), bridges (connect across networks), message translation (connect across data links), and guards/cross domain security (connect across security domains). This research will define, develop, integrate, demonstrate, and assess technology that provide standards to perform gateway functions from the tactical edge to the core Global Information Grid network. Many technologies and components exists to perform the variety of gateway functions discussed. These would be assessed to identify desirable aspects to be leveraged as the foundation for providing improved interoperability. Emphasis will be placed on demonstrating capabilities to support airborne tactical relays and airborne network gateways. The research will be expanded to provide the technical basis for standards and

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603662D8Z - Networked Communications Capabilities**	**P662**

policies that can be applied across DoD, specifically in support of the Global Information Grid.

B. Accomplishments/Planned Program:

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Airborne Tactical Relay	0.000	0.000	5.000	5.000

Increase the understanding of airborne tactical relays. Demonstrate the network communication technology required to support small unit distributed operations. Establish the concept of operations for how these technologies will be operationally used and supported.

FY 2008 Plan - (U) Select the payloads and platforms to be demonstrated for the airborne Tactical Airborne Relay. Develop, integrate and test the payloads; procure platforms (UAV, ground terminals and portable equipment); and initiate payload to platform integration for operational demonstration. Establish the concept of operations and operational scenario to be evaluated at the military utility assessment. Initiate technology transition criteria.

FY 2009 Plan - (U) Complete integration for operational demonstrations. Conduct military utility assessment. Assess technology maturity and validate technology transition criteria. Continue the development for follow on assessment and technology maturation.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Airborne Network Gateway	0.000	0.000	10.000	10.000

Evaluation of the technology maturity of the data link, networks, and voice capabilities to be integrated into a form factor with size, weight, and power design constraints. Development of enhancements to improve networking across the battlespace. Incorporation of standards that will lead to improved interoperability. Increased understanding of the operational concepts that will use this integrated capability.

FY 2008 Plan - (U) Assess technology maturity of data link, network and voice communications capability to be used for airborne network gateway candidates. Initiate the development of enhancements to support shortfalls discovered. Initiate the development of technology transition criteria.

FY 2009 Plan - (U) Conduct operational field demonstration of enhancements developed for the airborne network gateway capability. Continue to assess technology maturity of candidates. Conduct military utility assessment. Continue development for follow on assessment and technology maturation.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Gateway Interoperability	0.000	0.000	5.000	5.000

Increase understanding of gateways, a complex area of networking within DoD. Establish the technical basis for DoD policy and standards for the Global Information Grid, specifically in the area of the tactical edge attachment to the Global Information Grid core networks.

FY 2008 Plan - (U) Evaluate gateway technologies and program candidates. Define the criteria for acceptable gateway technical and operational performance criteria. Initiate the integration of gateway

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)		Date: February 2007
APPROPRIATION/ BUDGET ACTIVITY RDT&E/ Defense Wide BA# 3	PE NUMBER AND TITLE **0603662D8Z - Networked Communications Capabilities**	PROJECT **P662**

candidates for testing and assessment. Produce initial technical report for gateway standardization and interoperability. Initiate the development of technology to fill shortfalls for airborne tactical relay and airborne network gateway.

FY 2009 Plan - (U) Complete gateway testing and assessment. Finalize gateway technical report recommendations. Establish gateway technology transition plan.

C. Other Program Funding Summary: Not Applicable.

D. Acquisition Strategy: Not Applicable.

E. Major Performers Not Applicable.

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603662D8Z - Networked Communications Capabilities**	**P663**

Cost ($ in Millions)		FY 2006 Actual	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
P663	Network Communications Analysis	0.000	0.000	20.000	20.000	20.000	26.562	26.956	27.530

A. Mission Description and Project Justification: Tactical Mobile Networking - (U) As studies have suggested, for instance, the National Research Council's Network Science Report (2005) and Army Mobile Ad-hoc Network (MANET) Jason Report (January 2006), the type of networking projected to meet military tactical requirements are not supported by network theory, network design and analysis tools. This research will define those technical parameters important to military tactical mobile networking environments, investigate the status of network design and analysis tools, and evaluate how modeling and simulation is conducted to support tactical mobile networking environments. The role of network experimentation with respect to network modeling will be explored. Further development and analysis will be conducted to improve the awareness of the condition of tactical mobile networking technologies. Design tools, architectures and technical approaches will be recommended to acquisition programs as a result of this research.

Network Management Tools and Analysis - (U) Network management in the commercial world is a highly organized, synchronized activity that has excellent tools to monitor activity and repair disrupted networks as needed. These same tools are ill-matched for management in the wireless world, and specifically for military tactical mobile networking. In addition, the military tactical mobile networking environment lack the infrastructure (connectivity) and support (helpdesk) because resources (spectrum, people, equipment) are scarce (not in harms way). As the complexity of networking grows and as network capabilities are introduced, improved network management is required. For military operations, assured delivery may be needed for specific information and operations. This requires management tools to be in place to ensure continued secure and robust operations, which is not achieved with commercial wireless technologies. This research will assess network management tools in place for the military tactical mobile networking environment, develop technology and tools to address shortfalls with the goal to transition technology to operational systems.

Spectrum Management Tools and Analysis - (U) For wireless, tactical mobile networking, the management of the use of spectrum effects network operations. The demand for spectrum is increasing due to the expanded use of sensors, imagery and voice. This demand increases the pressure on the limited shared radio frequency (RF) spectrum for military tactical networking. The current DoD frequency planning and management infrastructure will have a limited ability to cope with this demand through operational planning, Coalition Joint Spectrum Management Planning Tool (CJSMPT) Joint Capability Technology Demonstration (JCTD) and the Global Electromagnetic Spectrum Information System (GEMSIS). Advanced spectrum management concepts such as sense and adapt, spectrum sharing, and dynamic reallocation are under investigation but not yet mature support operations. This research will evaluate opportunities for more efficient and effective use of the frequency spectrum within DoD. Technology advances are expected to advance the concept of cognitive radio devices to sense and adapt operations based on spectrum policy and usage, the management of multiband and multifunction apertures, and the use of spectrum efficient waveforms for use in military environments. This research will develop the models and tools to demonstrate capabilities for operational planning and monitoring of spectrum as these technologies are introduced.

Integrated Network Management Capability - (U) Network management becomes more complex as more and differt types of networking capability becomes available. Integrated network management across heterogeneous systems, especially wireless systems, requires definition, design and development. Operationally, network management assumes all functions required to share networking resources and ensure proper operation for participants. This research will define integrated network operations tools for all aspects of network resource management and to prioritize across operational spectrum management, security management, network management, and information management. This research will also develop testbeds specially

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603662D8Z - Networked Communications Capabilities**	**P663**

to validate models and simulations used to develop and test network management tools, and conduct experimentation on approaches developed.

B. Accomplishments/Planned Program:

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Tactical Mobile Networking	0.000	0.000	3.500	3.000

Increased understanding of the condition of tactical mobile networking technologies. Improved specification of technical standards and policy for tactical mobile networking. Finer fidelity modeling and simulation to support operations analysis and the articulation of operational requirements and performance parameters.

FY 2008 Plan - (U) Define the technical parameters to be met for tactical mobile networking. Evaluate modeling and simulation along with design and analysis tools to support tactical mobile networking. Initiate the development of an improved set of tools to support tactical mobile networking. Initiate experimentation to evaluate tools

FY 2009 Plan - (U) Continue the development of an improved set of tools. Develop testbeds and demonstrate tools in a laboratory testbed environment.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Network Management Tools and Analysis	0.000	0.000	5.000	5.500

Increased understanding of the complexity of the tactical network management. Determination of the support required for tactical network operations. Evaluation of technology to support transition and fielding to operational capability.

FY 2008 Plan - (U) Assess network management tools for the military tactical mobile networking environment in operational and laboratory testbed environments. Develop technology and tools to address shortfalls.

FY 2009 Plan - (U) Demonstrate management tools developed to evaluate technical maturity and military utility. Initiate technology transition planning.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Spectrum Management Tools and Analysis	0.000	0.000	4.000	4.000

Technical basis to support changes regarding the operational use of spectrum both within the military and among spectrum regulatory bodies.

FY 2008 Plan - (U) Develop the spectrum technology strategy for the introduction of advanced capability beyond operational mission planning. Demonstrate technologies to support monitoring and plan adjustments as spectrum conditions allow. Assess emerging spectrum technologies for inclusion to support military operations.

FY 2009 Plan - (U) Demonstrate concepts and technologies to support a more efficient and effective use of spectrum.

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603662D8Z - Networked Communications Capabilities**	**P663**

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Program Outputs and Efficiencies - (U) Technical basis to support changes regarding the operational use of spectrum both within the military and among	0.000	0.000	7.500	7.500

Common integrating framework to support interoperability among various aspect of developmental network operations and management to include: spectrum management, network management, security management and information management. Reduce the cost to develop, procure and support networks through the integration across networks and functions within networks.

FY 2008 Plan - (U) Establish testbed to explore how individual network management tools work together in heterogeneous networks. Establish the integrating framework for network management. Demonstrate network managers to assess technical shortfalls. Initiate development of integrated management tools.

FY 2009 Plan - (U) Continue the definition of an integrated network management framework. Demonstrate tools that provide integrated network management.

C. Other Program Funding Summary: Not Applicable.

D. Acquisition Strategy: Not Applicable.

E. Major Performers Not Applicable.