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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							DATE February 2003	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development				R-1 ITEM NOMENCLATURE Network-Centric Warfare Technology PE 0603766E, R-1 #50				
COST (In Millions)	FY 2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009
Total Program Element (PE) Cost	0.000	0.000	95.654	151.966	205.382	183.796	200.335	203.073
Joint Warfare Systems NET-01	0.000	0.000	24.144	44.768	48.925	49.833	58.570	61.438
Maritime Systems NET-02	0.000	0.000	19.685	34.327	41.586	43.482	45.391	49.248
Classified NET-CLS	0.000	0.000	51.825	72.871	114.871	90.481	96.374	92.387

(U) Mission Description:

(U) The Network-Centric Warfare Technology program element is budgeted in the Advanced Technology Development budget activity because it addresses high payoff opportunities to develop and rapidly mature advanced technologies and system concepts for today's network centric warfare concept. It is imperative for the future of the U.S. forces to operate flawlessly with each other, regardless of which Services and systems are involved in any particular mission. The overarching goal of this program element is to enable technologies at all levels, regardless of Service component, to operate as one system.

(U) The Joint Warfare Systems project will create enabling technology for seamless joint operations from high-level, strategic planning to low-level, tactical operations. The operational benefits of this project will be an enhanced ability to counter opponents' capabilities, not just facilities and equipment. This project includes efforts at the strategic/operational level that generates targeting options against opponents' centers of gravity having complex networked relationships, the operational/tactical level that manages highly automated forces with tight coupling between air and ground platforms, and the focused tactical level that develops targeting platforms that can acquire targets of opportunity cued by network-based analysis of likely enemy operations. Programs in the project are closely coordinated with those in project NET-02 of this program element and those in PE 0603764E.

(U) The Maritime Systems project will identify, develop and rapidly mature critical advanced technologies and system concepts for the naval forces' role in today's network centric warfare concept. Naval forces play an ever-increasing role in network centric warfare because of their

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forward deployed nature, their unique capability to operate simultaneously in the air, on the sea and under the sea and their versatile ability to provide both rapid strike and project sustained force. The technologies developed under this project will capitalize on these attributes, improve them and enable them to operate with other network centric forces. Programs in this project are closely coordinated with those in project NET-01 of this program element and those in PE 0603763E.

(U) <u>Program Change Summary:</u> <i>(In Millions)</i>	<table border="0"> <tr> <td></td> <td align="right"><u>FY 2002</u></td> <td align="right"><u>FY 2003</u></td> <td align="right"><u>FY 2004</u></td> <td align="right"><u>FY2005</u></td> </tr> <tr> <td>Previous President's Budget</td> <td align="right">0.000</td> <td align="right">0.000</td> <td align="right">0.000</td> <td align="right">0.000</td> </tr> <tr> <td>Current President's Budget</td> <td align="right">0.000</td> <td align="right">0.000</td> <td align="right">95.654</td> <td align="right">151.966</td> </tr> <tr> <td>Total Adjustments</td> <td align="right">0.000</td> <td align="right">0.000</td> <td align="right">95.654</td> <td align="right">151.966</td> </tr> <tr> <td> </td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Congressional program reductions</td> <td align="right">0.000</td> <td align="right">0.000</td> <td></td> <td></td> </tr> <tr> <td>Congressional increases</td> <td align="right">0.000</td> <td align="right">0.000</td> <td></td> <td></td> </tr> <tr> <td>Reprogrammings</td> <td align="right">0.000</td> <td align="right">0.000</td> <td></td> <td></td> </tr> <tr> <td>SBIR/STTR transfer</td> <td align="right">0.000</td> <td align="right">0.000</td> <td></td> <td></td> </tr> </table>		<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY2005</u>	Previous President's Budget	0.000	0.000	0.000	0.000	Current President's Budget	0.000	0.000	95.654	151.966	Total Adjustments	0.000	0.000	95.654	151.966	 					Congressional program reductions	0.000	0.000			Congressional increases	0.000	0.000			Reprogrammings	0.000	0.000			SBIR/STTR transfer	0.000	0.000		
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(U) **Change Summary Explanation:**

FY 2004 – 2005	New program element and projects. Programs transferred from PE 0603763E and PE 0603764E in addition to new efforts in these years.
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COST (In Millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Joint Warfare Systems NET-01	0.000	0.000	24.144	44.768	48.925	49.833	58.570	61.438

(U) Mission Description:

(U) The objective of the Joint Warfare Systems project is to create enabling technologies for seamless joint operations, from strategic planning to tactical operations. By leveraging current and emerging network, robotic and information technology, next generation U.S. forces will realize greatly expanded capability, lethality, and rapid responsiveness, particularly through the use of light, highly mobile weapon systems. The critical constraints facing this project are: 1) U.S. opponents are using and adapting network technology to make their systems more flexible and robust and more difficult to neutralize; and 2) we will be expected to limit the use of firepower and lessen the impact of operations on noncombatants. These two challenges require an understanding of opponent networks, the creation of options to target them, and synchronized air and ground operations (from all services) to apply force only where needed and with specific effects, while still being able to operate against fleeting targets of opportunity. The operational benefits of this project will be an enhanced ability to counter opponents' capabilities, not just the facilities and equipment. This project will support all levels of the force structure including: 1) the strategic/operational level, by generating targeting options against opponents' centers of gravity that have complex networked relationships; 2) the operational/tactical level, by managing highly automated forces with tight coupling between air and ground platforms; and 3) the focused tactical level, by developing targeting platforms that can acquire targets of opportunity cued by network-based analysis of likely enemy operations.

(U) Program Accomplishments/Planned Programs:

	FY 2002	FY 2003	FY 2004	FY 2005
Effect Based Network Targeting	0.000	0.000	6.939	13.877

(U) The Effects-Based Network Targeting program will develop technology to identify, determine vulnerabilities, target and anticipate workarounds in enemy networks. These techniques will use all-source information to continuously update models of urban networks (e.g., transportation, energy, social). Techniques will be developed to elicit operational objectives for urban interventions, expressed in terms of desired and undesired effects. It will use these objectives to find vulnerabilities in the networks, and nominate targets simultaneously to maximize desired

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effects while minimizing undesired effects. Finally, this program will develop techniques to predict observables that rapidly identify an opponent's response when several courses of action are available. The program will provide a capability to develop effects-based target sets at forward command nodes, permitting disruption of opponents networked systems such as communications, logistics and support. It will also provide a mechanism to anticipate and counter an opponent's workarounds while minimizing undesired effects through the anticipation of downstream consequences and through the selection of targets with low risk of collateral damage; thus permitting targeting operations to proceed within restrictive rules of engagement.

(U) Program Plans:

- Develop tools to extract relevant information from source data (especially signals, text and imagery), correlate that information to existing models, update the models while resolving conflicts among sources and analyze the overall effect of newly discovered changes.
- Develop tools to analyze networks, both in isolation and in combination, to identify vulnerabilities and to predict effects of candidate interdictions.
- Demonstrate selected tools on real-world cases, validating them against historical and natural situations.

	FY 2002	FY 2003	FY 2004	FY 2005
Future Combat Systems MultiCell and Dismounted Command and Control	0.000	0.000	6.938	11.894

(U) The Future Combat Systems MultiCell and Dismounted Command and Control program will develop and support experimentation with advanced command and control information technology for highly networked joint operations. It will emulate the functionality of a tactical cell, incorporating both unmanned air and ground robotic platforms, expanded to include multiple cells, higher headquarters working at the operational level, and human dismounts. Computational needs and automated battle command processes will be assessed. The program will develop planning factors for multiple entities from simulated ground operations including dismounted commanders and soldiers, both constructive and virtual. It will evaluate command effectiveness improvement from the use of automation technology by functionally analyzing command group behaviors and critical compound group functions and also recommend interface functions and workload. The program will provide an experimentally validated understanding of the dynamics of command in complex organizations containing highly automated forces. Commander interface

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layouts, functions and displays for maximum flexibility and effectiveness will be defined. It will generate recommendations for capability enhancements in supporting technology for the nomination of sources of information and support visualization of current and future operational states. Finally, this program will permit future command and control operations to be supported with a significantly reduced staff.

- (U) Program Plans:
- Develop prototype command and control interfaces for higher commanders, cell commanders and dismount commanders.
 - Conduct human-in-the-loop experiments with dismounts and higher headquarters to understand interactions between these entities.

	FY 2002	FY 2003	FY 2004	FY 2005
Confirmatory Hunter Killer System	0.000	0.000	6.822	16.545

(U) The Confirmatory Hunter-Killer System program will develop a low-cost, expendable loitering weapon/unmanned air vehicle for deployment along lines-of-communication or near critical facilities (e.g., suspect underground facilities) to provide continuous surveillance against limited (one or two) specific target classes with on-board electro-optics/infrared or low cost radar (motion cue or imagery based detection) sensors. It will develop and demonstrate an on-weapon automatic target recognition capability to detect the presence of valid target vehicle and confirm engagement with operator, as well as demonstrate the capability to provide image based, long duration suppression of non-emitting surface-to-air missiles and surface-to-surface missiles. The program will provide persistent, on-station munitions that enable rapid weapon response to emerging targets. Unmanned mechanisms will be developed that will patrol lines of communication and other delimited regions to prevent breakout, escape and reinforcement. The program will provide a capability to suppress emergent targets from suspect underground facilities. Finally, it will provide a capability to suppress pop up electronic warfare threats, before they emit.

- (U) Program Plans:
- Characterize component capabilities (platform, sensor, on-board automatic target recognition and data links).
 - Develop and analyze alternative designs, using high fidelity simulation and analysis tools, in a variety of joint mission contexts.
 - Select combinations of components that achieve the most effective system capabilities.

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- Develop a brass board platform, mountable on a standard test aircraft, to verify sensor, automatic target recognition and data link performance.
- Tailor and improve component capabilities to reduce manufacturing cost while preserving effectiveness.
- Construct prototype vehicles and conduct field tests.

	FY 2002	FY 2003	FY 2004	FY 2005
Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration (ACTD)	0.000	0.000	3.445	2.452

(U) The primary goal of the MAV ACTD program is to further develop and integrate MAV technologies into militarily useful and affordable backpackable systems suitable for dismounted soldier, marine, and special forces missions. It will focus on the development of MAVs to accomplish unique military missions, particularly with regard to flight operations in restricted environments. The objective of the MAV ACTD is to demonstrate a backpackable, affordable, easy-to-operate, and responsive reconnaissance and surveillance system. The system will provide the small unit with militarily useful, real-time combat information of difficult to observe and/or distant areas or objects. The system will also be employable in a variety of warfighting environments. For example, it will be beneficial in complex topologies (i.e. mountainous terrain with caves), heavily forested areas/dense foliage/triple canopy jungle, confined spaces (often internal to buildings) and high concentrations of civilians (where it may be critical to determine the neutral or hostile intent of a crowd). The initial MAV technology development program focused on the technologies and components required to enable flight at small scales, including flight control, power and propulsion, navigation and communications. It successfully demonstrated a new class of air vehicles, MAVs, which are at least an order of magnitude smaller (between 15 and 23 cm in diameter) than previously available flying systems. The MAV ACTD program will also leverage other DARPA technology development efforts, including advanced communications and information systems, high performance computer technology, Microelectromechanical Systems (MEMS), advanced sensors, advanced electronic packaging technologies, and lightweight, efficient high-density power sources. In FY 2003, this program is funded from PE 0603764E, Project LNW-01.

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- (U) Program Plans:
- Demonstrate electric MAV in military operations in urban terrain exercises and conduct experiments with troops in field trials.
 - Evaluate lessons learned and design of a diesel MAV.
 - Conduct further experiments with troops in the field to complete detailed design of hybrid MAV.
 - Conduct experimentation of hybrid MAV; evaluate lessons learned; provide optimum MAV for evaluation.
 - Conduct experimentation of optimum MAV and complete final military evaluation.

(U) **Other Program Funding Summary Cost:**

Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration (ACTD)	FY 2002	FY 2003	FY 2004	FY 2005
PE 0603001A, Army	10.000	0.000	0.000	0.000
PE 0603750D, OSD	1.000	4.400	3.400	3.100

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COST (In Millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Maritime Systems NET-02	0.000	0.000	19.685	34.327	41.586	43.482	45.391	49.248

(U) Mission Description:

(U) The objective of the Maritime Systems project is to identify, develop and rapidly mature critical advanced technologies and system concepts for the naval forces' role in today's network centric warfare concept. Improvements in communications between and among submarines, surface ships and naval aircraft have allowed these forces to operate seamlessly with each other and with other Service's network centric systems. Naval forces will play an ever increasing role in network centric warfare because of their forward deployed nature, their unique capability to operate simultaneously in the air, on the sea and under the sea and their versatile ability to provide both rapid strike and project sustained force. The technologies developed under this project will capitalize on these attributes, improve them and enable them to operate with other network centric forces. This project funds the Loki program and Piranha program, which are closely coordinated with Project NET-01 of this PE and those in PE 0603763E.

(U) Program Accomplishments/Planned Programs:

	FY 2002	FY 2003	FY 2004	FY 2005
Loki Program	0.000	0.000	14.764	17.654

(U) The Loki program has two major elements: the Vortex Combustor Development program and the Loki Systems Development program. The goal of these programs is to investigate revolutionary technologies that have high military payoff and turn them into coherent functional technology prototypes. Objectives include: (1) the development of an energy-dense, air independent underwater power source as a potential propulsion system for an underwater fighter, and 2) the investigation and development of detailed concepts of supporting systems and potential hull forms necessary for the operational viability of a future underwater fighter. Such an underwater vehicle would have the potential to revolutionize military and commercial undersea operations and the operational agility of maritime operations in the littoral. This program originated in PE 0603763E, Project MRN-02.

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- (U) Program Plans:
- Vortex Combustor (VC).
 - Develop advanced control system, fabricate high power VC units, and conduct advanced tests.
 - Propulsion system design and fabrication.
 - Loki Systems Development.
 - Continue structural, material and architectural trade studies, including: hydrodynamic performance modeling and system structural materials explorations.
 - Continue concept of operations and military utility studies.
 - Component technology development, including:
 - Investigate novel communications and sensing modalities.
 - Explore autonomous control systems.
 - Investigate advanced propulsion systems concepts.
 - Initiate off-board cueing, communications and signature trade studies.

	FY 2002	FY 2003	FY 2004	FY 2005
Piranha	0.000	0.000	4.921	16.673

(U) The Piranha effort will enable submarines to engage elusive maneuvering land and sea targets by exploiting emerging battlefield Intelligence, Surveillance and Reconnaissance (ISR) sensors, wideband networked communications, real-time exploitation targeting algorithms, and existing/planned submarine strike weapon systems. Submarines are a key and enduring element of the current and future naval force with unique stealth, mobility, and endurance characteristics and are often the first strike unit on scene. Submarines have proven to be relatively immune to advances in weapons and information technology that increasingly put U.S. surface/air forces at risk, and their importance as an effective forward deployed strike asset is likely to continue to increase. This effort will develop key technologies that enable attack and cruise missile submarines to play a wider role in responding to time-urgent maneuvering targets from a forward-deployed position. The Piranha effort

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will focus on the following key technology areas that enable submarine strike missions in the littorals: continuous asymmetric connectivity to intelligence, sensors, weapons and other vessels while at depth; ISR sensor data exploitation for targeting (sensor-to-weapon handoff); advanced offboard sensor concepts to include swarms of mini unmanned underwater vehicles (UUVs) for sensing sea targets; mobile underwater Global Positioning System (GPS) concepts; undersea networked sensor communications; and low latency target detection, identification, and geo-referencing. The effort will pursue a progression of more realistic demonstrations, culminating in closed-loop submarine engagement of moving ground surface vehicles and sea targets. This program transitioned from PE 0603763E, project MRN-02 in FY 2004 to better reflect its inherent network centric emphasis.

(U) Program Plans:

- Assess concepts employing swarms of mini-UUVs as advanced sensor systems for littoral operations.
- Assess concepts for small area underwater mobile GPS systems.
- Develop prototype low cost mini-UUV sensor systems, undersea sensor communications, and a mobile underwater GPS capability.
- Design and prototype off-board Global Broadcast Satellite (GBS) antenna.
- Demonstrate endurance of underwater fiber optic link between global broadcast satellite antenna and moving platform.
- Receive operational ISR data over GBS at depth.
- Demonstrate Common Data Link (CDL) forward link to airborne receiver and receive tactical ISR data using CDL.
- Demonstrate closed-loop submarine engagement of a moving ground surface vehicle by a submarine using off-board and traditionally non-available sensors.

(U) **Other Program Funding Summary Cost:**

- Not Applicable.

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