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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)						DATE February 2004	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development			R-1 ITEM NOMENCLATURE Network-Centric Warfare Technology PE 0603766E, R-1 #48				
COST (In Millions)	FY 2003	FY2004	FY2005	FY 2006	FY 2007	FY 2008	FY 2009
Total Program Element (PE) Cost	0.000	91.226	125.124	141.257	199.796	221.335	252.073
Joint Warfare Systems NET-01	0.000	25.648	35.090	43.800	85.833	84.570	86.438
Maritime Systems NET-02	0.000	13.253	29.327	34.586	38.482	45.391	49.248
Classified NET-CLS	0.000	52.325	60.707	62.871	75.481	91.374	116.387

(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>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY2005</u>
	Previous President's Budget	0.000	95.654	151.966
	Current President's Budget	0.000	91.226	125.124
	Total Adjustments	0.000	-4.428	-26.842
	 Congressional program reductions	 0.000	 -4.428	
	Congressional increases	0.000	0.000	
	Reprogrammings	0.000	0.000	
	SBIR/STTR transfer	0.000	0.000	

(U) **Change Summary Explanation:**

FY 2004	Decrease reflects congressional program reduction for effects based network targeting and undistributed reductions.
FY 2005	Decrease reflects rephrasing of Loki and Effects Based Network Targeting and transfer of the Micro Air Vehicle ACTD and the Future Combat Systems Multicell programs to PE 0603764E, Project LNW-03.

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COST (In Millions)	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Joint Warfare Systems NET-01	0.000	25.648	35.090	43.800	85.833	84.570	86.438

(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. It leverages current and emerging network, robotic and information technology. This provides next generation U.S. forces with greatly expanded capability, lethality, and rapid responsiveness. 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) U.S. doctrine limits the use of firepower to lessen the impact of operations on noncombatants. Meeting these challenges places a heavy burden on joint war planning. We must acquire an understanding of opponent networks and develop creative options to target them. We must synchronize air and ground operations to apply force only where needed and with specific effects. Finally, we must still be able to operate against fleeting targets of opportunity. The operational benefit of the Joint Warfare Systems project is an enhanced ability to counter opponents' capabilities, not just their 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 platforms that can acquire targets of opportunity cued by network-based analysis of likely enemy operations.

(U) Future Combat Systems Multicell and Dismounted Command and Control, and Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration (ACTD) programs have moved to PE 0603764E, Project LNW-03.

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(U) **Program Accomplishments/Planned Programs:**

	FY 2003	FY 2004	FY 2005
Effects Based Network Targeting	0.000	3.939	6.877

(U) The Effects Based Network Targeting program develops technology to identify, determine vulnerabilities, target, and anticipate workarounds in enemy networks. These techniques use all-source information to continuously update models of urban networks (e.g., transportation, energy, social). One aim is to elicit operational objectives for urban interventions, expressed in terms of desired and undesired effects. The technology will use these objectives to find vulnerabilities in the networks. It then nominates targets for prosecution so as to maximize desired effects while minimizing undesired effects. Further, the program develops techniques for predicting those observables that will rapidly identify an opponent’s response when several courses of action are available. The program enables warfighters to develop effects-based target sets at forward command nodes. It provides commanders a means to anticipate and counter an opponent’s workarounds. Finally, it minimizes undesired effects by anticipating downstream consequences and selecting targets with low risk of collateral damage, permitting targeting operations to proceed, even within restrictive rules of engagement.

(U) **Program Plans:**

- Develop tools to: (1) extract relevant information from source data (especially signals, text and imagery); (2) correlate that information to existing models; (3) update the models while resolving conflicts among sources; and (4) analyze the overall effect of newly discovered changes.
- Develop tools to analyze networks, singly and in combination, to identify vulnerabilities and predict effects of candidate interdictions.
- Demonstrate selected tools on real-world cases, validating them against historical and natural situations.

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	FY 2003	FY 2004	FY 2005
Confirmatory Hunter Killer System	0.000	7.997	9.213

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

(U) Program Plans:

- Characterize component capabilities (platform, sensor, and onboard 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.
- Develop a brass board platform, mountable on a standard test aircraft. 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.

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	FY 2003	FY 2004	FY 2005
Network Command	0.000	13.712	15.000

(U) The Network Command program leverages recent advances in network computing to dramatically improve collaboration among physically separate command posts. It allows commanders, and their staffs, to share situation information; to develop coordinated battle plans; to generate and compare alternate courses of action; and to assess likely outcomes, all without conventional group briefings. It builds on the paradigm established by the Command Post of the Future program which showed how commanders, working with voice-over-IP and robust graphical collaboration software, can build and maintain a coherent understanding of a situation and operational plan without any face-to-face interactions.

- The Command Post of the Future (CPOF) program continues to supply technical improvements to the baseline system deployed with the First Armored Cavalry Division. In particular, it increases network efficiency, analyzes system workload and performance data to tune system control parameters, and modifies display formats to increase the utility of information depicted and shared among the Division and Brigade level command posts. This is a continuation and expansion of CPOF efforts previously budgeted in PE 0603760E, Project CCC-02.
- The Multiuser, Adaptive Command Environment (MACE) program is an outgrowth of the Command Post of the Future (CPOF) program to make collaborative tactical command more adaptive, cross-functional, and scalable. It implants monitors in the collaboration environment to observe data traffic, identify patterns, and proactively move information through the system to meet users' needs more rapidly. It allows users to be distinguished by their military function – intelligence, maneuver, fires, security, logistics – and tailors displays and communication modes to those functions. Finally, it scales the environment from the dozens of workstations to hundreds of workstations operating over a diverse set of tactical communication networks.
- The Network-Centric Situation Assessment program develops and deploys technologies to assess military situations at levels of interest above individual targets. It uses all-source data to reconstruct unit organizations, mission relationships, logistics connections, and communications connectivity. It analyzes data over time to infer movement, communication, and supply patterns. With this context, it analyzes capabilities and hypothesizes future courses of action. The objective is to understand potential capabilities and intentions of opposing forces. This effort provides greater understanding of opponents' force structures, capabilities, and operational practices. For

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commanders, this enables effects-based targeting, rather than simple attrition strategies. It provides a context for discovering vulnerabilities in opposing forces. It also provides cues for intelligence, surveillance and reconnaissance planning, as it suggests areas of future enemy activity that may merit more intense scrutiny.

- The Joint Mission Rehearsal program integrates high-fidelity, mainframe-based combat simulations with situation assessment and planning tools. The objective is to allow rehearsal of joint missions while participants are still at their home stations, or en route to operations. The program uses current situation data to (1) provide initial conditions for the simulations; and (2) to plan data to steer the dynamics of the simulations along the selected courses of action. It streams data from the simulations to display and visualization systems available to the prospective participants. This allows them to interact with the simulation in a manner consistent with their anticipated role in the mission being rehearsed. The program delivers the capability to practice and fine-tune mission plans for joint military operations. It enables commanders and staff to participate from their current location, rather than a training facility. It thereby reduces deployment needs while improving mission planning and effectiveness.

(U) Program Plans:

- Command Post of the Future
 - Instrument deployed CPOF software to record data from field use.
 - Develop analysis tools to reconstruct information paths.
 - Design system management tools to restructure information flows to meet decision needs.
- Multiuser, Adaptive Command Environment.
 - Collect data from field operations describing information flows, timing, and decision patterns.
 - Identify patterns in those data corresponding to decision cycles and special tasks.
 - Develop techniques to proactively move information among workstations to reduce latency while maintaining consistency.
 - Scale the underlying technology to operate over both current and emerging tactical communications systems.
- Network-Centric Situation Assessment.
 - Identify data fields available to a representative theater commander.
 - Apply advanced link-analysis and pattern-matching technology to tactical data.
 - Evaluate technologies using real-world feeds.

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- Joint Mission Rehearsal
 - Enhance existing mission simulations to require fewer red cell and white cell participants.
 - Develop tools to rapidly assemble new mission scenarios from existing data sources.
 - Develop techniques to infer data needed by the simulations but not available at mission time.
 - Exercise these technologies.

	FY 2003	FY 2004	FY 2005
Precision Urban Combat System (PUCS)	0.000	0.000	4.000

(U) The Precision Urban Combat System (PUCS) program will develop and validate a suite of advanced lethal and non-lethal precision and area capabilities for use by joint dismounted forces in urban combat operations. This program will consider the overall requirements for detection of potential enemy targets, discrimination and identification of friendly versus enemy units, sorting of enemy from neutral personnel, improved lethal and non-lethal response options, and assessment of results; and will develop a system response to the problem. Example technologies include: precision munitions with greatly improved accuracies (centimeters), individual area effect munitions with greater range and flexibility, sensors with the capability to detect hidden human targets, improved weapon sights and weapon enhancements to provide greater accuracy and Identification of Friend or Foe, multi spectral designation / marking systems for improved flexibility and covertness, deterring or incapacitating agents, precision demolitions, hands-free weapons, and robotic applications. These systems will be developed within the framework of both legacy forces and expected future forces. The result will be to move precision munitions accuracies from meters to centimeters thus allowing very small weapons to be effectively employed; and to provide dismounted soldiers with increased capability and flexibility. The program will be a multi-phase program with frequent user reviews to ensure that the resulting products are meaningful and affordable. The program will culminate with a series of prototype demonstrations of the capabilities in a surrogate urban combat environment.

- (U) Program Plans:
- Define system architecture and constraints in conjunction with user group.
 - Develop and demonstrate technologies and evaluate to determine system effectiveness.
 - Initiate second phase to improve selected technologies and integrate them into the overall PUCS system.

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

- Not Applicable.

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COST (In Millions)	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Maritime Systems NET-02	0.000	13.253	29.327	34.586	38.482	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 Mobile Undersea Distributed System (MUDS), which includes the Sea Sentry program, the Persistent Ocean Surveillance program, the Warfighting in the Littoral program, and Hologram. The MUDS concept represents the transformation of the LOKI concept (originally budgeted in PE 0603763E in FY 2003) into a more effective, distributed, networked capability.

(U) **Program Accomplishments/Planned Programs:**

	FY 2003	FY 2004	FY 2005
Mobile Undersea Distributed System (MUDS) Program (formerly Loki Program)	0.000	13.253	25.927

(U) The Mobile Undersea Distributed System (MUDS) originated from the Loki Program in PE 0603763E, Project MRN-02. Preliminary results from the Loki program and its associated studies (including the Vortex Combustor testing) indicated that the program goals (enhancing operations in the littorals to counter asymmetric threat posed by diesel submarines and other forces operating in the littorals) would be best obtained by distributing efforts (development of a revolutionary "fighter-like" submersible and development of associated supporting systems) throughout a networked system. Therefore, the investment in the Loki program transitioned in FY 2003 into the Mobile Undersea Distributed Systems (MUDS) program. The network-centric MUDS program includes the Sea Sentry program, the Persistent Ocean Surveillance program, Warfighting in the Littoral program, Hologram, and Piranha.

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(U) The Sea Sentry will investigate and demonstrate an underwater, distributed sense and effect system to detect and localize difficult undersea targets such as submarines employing advanced air-independent propulsion technologies. Using covert, mobile, and energy-efficient vehicles, the tactical gain available from the collective intelligence behavior of a swarm of individual agents will be demonstrated. This effort will develop technologies in the areas of agent-based autonomous control; vehicle navigation; high data rate/low-power underwater communications; network management and optimization; sustainable energy concepts; and low power sensing/signal processing enabling covert persistent underwater surveillance in denied areas. The military utility of underwater gliders will be demonstrated in a sensor system that is configurable in 3D, adaptable to the physical environment for sensing and communications, sustainable by getting its on-station locomotion and ‘staying power’ from the environment, self-configurable using sensory feedback, and self-optimizing using efficient dynamic network management techniques.

(U) The Persistent Ocean Surveillance program will combine geolocation techniques such as the global positioning system with station keeping and intra-sensor communication technologies to provide long-term station keeping ocean environment sensing buoys. These technologies when applied with state-of-the-art undersea warfare sensors will result in a floating field of smart sensors capable of observing the undersea environment in an area, including the presence of submarines and other undersea vehicles. A range of technologies will be considered including those that rely on the local environment (such as wind, solar energy, temperature differentials, etc.) for their power, miniature geolocation technologies, and technologies for sensor data storage, transmission, and intra-field communications.

(U) The Warfighting in the Littoral program will explore potential technologies for successful operation in the littoral. It is the vehicle for investigating and developing technologies recommended by the joint DARPA/Navy Littoral Naval Force Architecture Study to explore future concepts and potential technologies for successful operation in areas defended by forces ashore, mines, submarines, small craft, and anti-ship missiles. Its principal focus is rapid access into contested littorals. The technologies developed will directly affect the ability of Naval Forces to accomplish missions in the world’s littorals—some may involve significant technical obstacles that, if overcome, would lead to dramatic improvement in capability. Potential transition targets include a broad spectrum of existing and future naval programs.

(U) Hologram is an effort to demonstrate technologies necessary for a completely disruptive approach to littoral warfare. This is follow-on from previous efforts including Loki systems development and the Littoral Naval Force Architecture study. The program will include investigating and developing Micro-Autonomous Ocean Craft (MAOC) to spectrally emulate platforms comprising U.S. maritime expeditionary forces. The MAOC will operate in a networked/synchronized fashion, serving as a multi-dimensional counter measure for naval forces.

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Hologram will emphasize non-traditional approaches to naval warfare, focusing on emerging littoral operations and missions, and will focus on delivering capabilities vice platforms.

(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. 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 effort 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 off board 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.

(U) Program Plans:

- Mobile Undersea Distributed Systems.
 - Continue investigation into novel communications and networking concepts.
- Sea Sentry.
 - Assess concepts employing swarms of undersea gliders with acoustic and non-acoustic sensing modalities for detecting and tracking submarines with air-independent propulsion (AIP) systems.
 - Demonstrate autonomous control approaches for individual and groups of undersea gliders.
 - Develop prototype low-cost, low-power, and glider based sensor/signal processing system, undersea sensor communications, and an underwater sensor localization and navigation capability.
 - Perform design trade studies, including: hydrodynamic performance modeling for advanced undersea glider concepts and advanced propulsion systems concepts.
 - Assess concepts for precise sensor localization and glider navigation systems.

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- Design and prototype a system of undersea autonomous gliders with sensor modalities, communications, and navigation for detecting and localizing submarines equipped with AIP technology.
- Demonstrate system performance at-sea.
- Persistent Ocean Surveillance.
 - Explore the scientific/engineering issues associated with station keeping.
 - Develop a long endurance oceanographic sized buoy using exploitable local environmental effects for station keeping.
 - Develop a long endurance tactical sized ocean surveillance buoy using exploitable local environmental effects for station keeping.
 - Demonstrate performance at sea.
- Warfighting in the Littoral
 - Continue investigation into technologies for detection, precision identification, tracking and destruction of elusive surface, subsurface and air targets.
 - Refine and update impact assessment of introducing networked manned and unmanned systems, cognitive systems, and robust, secure self-forming tactical networks into the Navy's future warfighting capability concepts.
- Hologram.
 - Develop technologies to enable access and sustain expeditionary forces.
 - Assess concepts for using the technology to deny enemy sanctuary, initiative and tactical opportunity.
 - Develop prototype sensor systems.
- Piranha.
 - 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 closed-loop submarine engagement of a moving ground surface vehicle by a submarine using off-board and traditionally non-available sensors.

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- 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.

	FY 2003	FY 2004	FY 2005
Jet Blast Deflector	0.000	0.000	3.400

(U) The Jet Blast Deflector program will use multifunctional materials to construct a passively cooled jet blast deflection that increases reliability and meets weight reduction requirements for current and future classes of aircraft carriers.

- (U) Program Plans:
- Demonstrate that multifunctional materials can reduce weight by 15-50% and will save operations and support costs by 26%.
 - Test and validate performance and savings.

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

- Not Applicable.