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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 Marine Technology PE 0603763E, R-1 #45 | | | | |
| COST (In Millions) | FY 2003 | FY2004 | FY2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 |
| Total Program Element (PE) Cost | 26.164 | 13.751 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Advanced Ship-Sensor Systems, MRN-02 | 26.164 | 13.751 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

(U) **Mission Description:**

(U) The objective of the Marine Technology program is to identify, develop and rapidly mature critical advanced technologies and system concepts for maritime applications that support the following goals: 1) maintenance of U.S. naval force access to the littoral by countering the threat created by the worldwide spread of increasingly sophisticated technology; 2) enhancement of the ability of U.S. naval forces to interrogate and dominate the maritime battlespace, particularly in the littoral arena; 3) advances in the ability of U.S. naval assets to conduct operations as a seamlessly networked and integrated theater level force; and 4) improved power projection capabilities of U.S. naval forces, particularly with respect to their ability to influence the land battle. Proliferating threats such as modern cruise missile technology, commercially available overhead surveillance, advanced undersea mine capabilities, and modern, quiet diesel/electric submarines, pose major challenges for operations in the restricted water, near-shore regimes that are of growing importance to U.S. strategic considerations, necessitating continued development of increasingly affordable far-term solutions for enhancing the operating capability and survivability margins of U.S. naval forces in the littoral. This program element funds the Advanced Ship-Sensor Systems project (MRN-02), comprised of the following programs: the Robust Passive Sonar (RPS) program; the Loki Systems Development Program/the Mobile Undersea Distributed Systems; the Undersea Littoral Warfare thrust which includes the Littoral Force Architecture and the Submarine Design Studies (formerly known as the Piranha effort), and the Smart Actuators and Marine Projects Demonstration effort. This project draws to an end in FY 2004. Programs traditionally budgeted in this project will instead be budgeted in PE 0603766E, Project NET-02 to better reflect today's emphasis on network centric warfare.

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

| | FY 2003 | FY 2004 | FY 2005 |
|----------------------------|---------|---------|---------|
| Robust Passive Sonar (RPS) | 14.567 | 9.095 | 0.000 |

(U) The Robust Passive Sonar (RPS) program is developing innovative, adaptive signal processing algorithms for passive submarine and surface ship towed arrays that suppress the acoustic interference generated by surface shipping and increase the detectability of threat submarines. At the lower acoustic frequencies, shipping interference represents the primary noise background limiting the performance of existing sonar systems in littoral areas. Precise notching of shipping interference could result in net system performance gains of 10-20 dB, and the algorithms and array geometries used to accomplish this will dictate future tactical sonar designs. The program has successfully collected high quality, mobile, multi-line, towed array acoustic and ancillary data and utilized this data to develop and assess signal processing architectures and algorithms. Initial performance assessments indicate significant suppression of acoustic interference is achievable.

(U) Program Plans:

- Complete processing architecture and algorithms development.
- Evaluate algorithms in laboratory testing.
- Complete system trade studies for alternative acoustic aperture concepts.

| | FY 2003 | FY 2004 | FY 2005 |
|--|---------|---------|---------|
| Loki / Mobile Undersea Distributed Systems | 3.945 | 0.000 | 0.000 |

(U) The Loki program evaluated technologies that had the potential to enable a revolutionary “fighter-like” submersible to counter the asymmetric threat posed by diesel submarines and other forces operating in the littorals. Loki examined two major technology component elements: The Vortex Combustor propulsion technology and the Loki Systems technology development efforts. Objectives included: 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

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future underwater fighter. Preliminary results from the Loki and other studies, and the Vortex Combustor testing indicated that while the capabilities of the Loki vehicle may be revolutionary, they could be best obtained by distributing them throughout a networked system. Therefore, the investment in the Loki program transitioned in FY 2003 into the Mobile Undersea Distributed Systems (MUDS) program. The truly network centric MUDS program continues in PE 0603766E, Project NET-02 in FY 2004.

- (U) Program Accomplishments:
- Vortex Combustor (VC).
 - Conducted several test firing of the Vortex Combustor system.
 - Conducted analysis and performance evaluation.
 - Loki Systems Development/Mobile Undersea Distributed Systems.
 - Conducted concept of operations and military utility studies.
 - Initiated system structural materials explorations.
 - Completed studies indicating that a distributed system concept known as the Mobile Undersea Distributed System (MUDS) was the most optimized way to achieve the goal of the Loki program.
 - Initiated concept of operations and military utility studies for the MUDS concept.

| | FY 2003 | FY 2004 | FY 2005 |
|---------------------------------|---------|---------|---------|
| Undersea Littoral Warfare (ULW) | 7.652 | 4.656 | 0.000 |

(U) The ULW program is developing approaches to undersea warfare that will revolutionize the ability to classify and identify underwater objects such as mines. The ULW program seeks to provide the Navy with technologies that will allow U.S. submarines to dominate in the littoral battlespace and transform the submarine's role in littoral warfare. In doing so, the program will investigate: technologies and demonstrations for locating and tracking maritime targets of interest; innovative networking; sensor and array technologies; technologies and demonstrations enabling unique weapons or payload concepts for potential deployment on submarines and other undersea vehicles. The following specific efforts are included.

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(U) Two studies examine both platform specific and the overall architecture necessary for current and future maritime systems to effectively operate. These studies (originally conceived as part of the Piranha effort) are the Littoral Force Architecture Study and the Submarine Design Study. The Littoral Force Architecture Study is an effort with the Navy to identify the individual and collective technologies necessary for successful operation in areas defended by forces ashore, by mines, submarines, small craft and anti-ship missiles, to define the desirable and achievable performance characteristics of various manned and unmanned systems usable in a Littoral Naval Force.

(U) The forward-based littoral Naval force will enable unimpeded joint force access through a contested littoral in less than 96 hours. The Submarine Design Study explores innovative future submarine design concepts predicated on a distributed pump-and-jet propulsion (DPJPS) system concept, with the goals of reduced (50%) displacement, acquisition cost and equivalent operational performance relative to VIRGINIA Class.

(U) The Smart Actuators and Marine ProjectS demonstratiON (SAMPSON) effort is a systems level demonstration of the application of Smart Materials/Structures to enable vehicles to change the way they operate and take on new missions. By employing this technology aircraft will achieve dramatically improved range, maneuverability and enhanced survivability, and marine vehicle turbo-machinery will operate with improved performance characteristics. SAMPSON core technology efforts have produced several new concepts and designs for high force, large displacement, low rate actuation using both shape memory alloys (SMAs) and piezoceramics. Preliminary designs for a high force and high stroke SMA tendon actuator that will considerably exceed the force/stroke capabilities of any SMA actuator known to date have been completed.

(U) Program Plans:

- Littoral Force Architecture Study.
 - Explore connectivity relationships between elements of a Littoral Naval Force within this context.
 - Identify important scaling relationships for various platforms and systems.
 - Identify potential technology investments.
 - Develop a Concept of Operations for a Littoral Naval Force.
- Submarine Design Study.
 - Commence submarine concept design studies.
 - Conduct supporting displacement, cost engineering, technology and operational analyses.

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- Smart Actuator and Marine ProjectS demonstratiON (SAMPSON).
 - Demonstrate Smart Structures benefits by maximizing the integration of actuators with structures.
 - Develop smart materials based actuator performance.
 - Explore actuator performance.
 - Conduct SAMPSON performance testing and demonstration.
 - Model recent advances in low cost nanofluids shown to reduce friction.
 - Design, fabricate and test novel parasitic energy devices and associated supporting concepts/technologies.

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| (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 | 32.224 | 13.898 | 0.000 |
| | Current Budget | 26.164 | 13.751 | 0.000 |
| | Total Adjustments | -6.060 | -0.147 | 0.000 |
| | Congressional program reductions | 0.000 | -0.147 | |
| | Congressional increases | 0.000 | 0.000 | |
| | Reprogrammings | -3.250 | 0.000 | |
| | SBIR/STTR transfer | -2.810 | 0.000 | |

- (U) **Change Summary Explanation:**
- FY 2003 Decrease reflects SBIR transfer and minor repricing.
- FY 2004 Decrease reflects congressional undistributed reductions.

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

- Not Applicable