RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								DATE February 2002	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development				R-1 ITEM NOMENCLATURE Marine Technology PE 0603763E, R-1 #50					
COST *(In Millions)*	FY 2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	Cost To Complete	Total Cost
Total Program Element (PE) Cost	25.290	36.497	33.000	47.638	74.367	84.116	92.828	Continuing	Continuing
Advanced Ship-Sensor Systems, MRN-02	25.290	36.497	33.000	47.638	74.367	84.116	92.828	Continuing	Continuing

(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: Undersea Littoral Warfare (ULW), Buoyant Cable Array Antenna (BCAA) program, the Robust Passive Sonar (RPS), the Vortex Combustor Demonstration program, and the Loki Systems Development Program.

(U) The Undersea Littoral Warfare (ULW) program is completing the Netted Search, Acquisition and Targeting (NetSAT) system, a networked approach for improved attack performance that exploits the use of a sonobouy field during the weapon run to identify, locate and mitigate the impact of countermeasures and target evasion tactics on torpedo operation. A bi-directional fiber optic link enables return of torpedo information to a processor servicing the other sensors on the network in addition to providing a command link for the weapon. The ability to rapidly discern the geographic picture from multiple viewpoints is expected to provide major (ten-fold) torpedo performance improvements in strong countermeasure environments while requiring only modest modification of existing torpedo inventories. The NetSat effort completed in FY 2001. Beginning in FY 2003, the ULW program is developing approaches to undersea warfare that will revolutionize the ability to classify and identify underwater objects

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such as mines. The ULW program will also investigate: 1) technologies and demonstrations for locating and tracking maritime targets of interest; 2) innovative sensor and array technologies; 3) technologies and demonstrations enabling unique weapons or payload concepts for potential deployment on submarines and other undersea vehicles; 4) technologies for buried mine identification and classification in the littoral; and 5) technologies and demonstrations enabling small, autonomous, undersea vehicle conceptual designs.

(U) The Buoyant Cable Array Antenna (BCAA) program is developing an antenna capable of supporting full duplex (transmit and receive) connectivity for voice and data with communications satellites while floating on the ocean's surface. Towed behind a submarine, this capability will enable high quality, high data-rate connectivity with other military assets, even while operating at speed and depth. Supporting technologies to be developed include photonic signal and power links, enhanced antenna loading materials, processing algorithms for blind adaptive array calibration and wash over mitigation, advanced communications protocols and signature minimization techniques.

(U) The Robust Passive Sonar (RPS) program is an outgrowth of the successful experiments performed under the Undersea Littoral Warfare Program. The RPS program will investigate the ability of innovative, adaptive processing approaches, coupled as appropriate to arrays providing external information, to suppress the acoustic interference generated by surface shipping. At the lower acoustic frequencies that increasingly dominate submarine detection, 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. A data-driven program of algorithmic development and performance demonstration will be conducted.

(U) The Loki program has two major elements: The Vortex Combustor Development and the Loki Systems Development Programs. These will investigate revolutionary technologies assessed to have high military payoff into coherent functional technology prototypes. Included in these programs are: 1) the development of an energy-dense air dependent underwater power source program as a potential propulsion system for an underwater fighter, and 2) the supporting systems development 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. Specific sensor, payload, structural materials, and propulsion concepts, generated in part under the Submarine Payloads and Sensors Program (PE 0602702E, Project TT 03) and the Future Submarine Payloads program in this project will also be investigated for possible implementation in both the Vortex Combustor Development Program and the Loki Systems Development Program.

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(U) Program Accomplishments and Plans:

(U) FY 2001 Accomplishments:

- Undersea Littoral Warfare (ULW). ($19.925 Million)
  - Conducted final NetSAT operational demonstration.
  - Continued development of adaptive processing algorithms for advanced surface shipping interference rejection.
  - Commenced development of noise-rejection algorithms exploiting external information.
  - Conducted preliminary Robust Passive Sonar (RPS) performance assessment using existing datasets.
  - Created baseline integrated RPS interference rejection processing stream.

- Buoyant Cable Array Antenna (BCAA). ($4.065 Million)
  - Completed algorithm and software development for space-time adaptive communications link processor.
  - Completed design of BCAA prototype antenna; conducted critical design review.
  - Fabricated BCAA prototype antenna.

- Future Submarine Payloads Program. ($1.300 Million)
  - Commenced conceptual designs for future payloads.
  - Transferred findings for use by the Loki program in FY 2002.

(U) FY 2002 Plans:

- Buoyant Cable Array Antenna (BCAA). ($10.277 Million)
  - Complete at-sea technical validation of BCAA prototype from surface platform.
  - Conduct operational demonstration of BCAA prototype from submarine.
  - Transition BCAA technology to Navy for follow-on development.

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- Robust Passive Sonar (RPS). ($21.220 Million)
  - Conduct initial at-sea collection of high quality mobile multi-line array acoustic and ancillary data.
  - Initiate development of end-to-end prototype signal processing architecture and algorithms for advanced surface shipping interference rejection, extended target detection and external information exploitation.
  - Conduct initial performance assessment based on collected data.
  - Conduct preliminary sizing for real-time processing system.
  - Initiate system trade studies for alternative acoustic aperture concepts.

- Vortex Combustor (VC). ($5.000 Million)
  - Conduct analysis and develop detailed design.
  - Fabricate test units.
  - Develop supporting fuel feed system.
  - Develop start and restart system.
  - Conduct supporting engineering studies.
  - Conduct preliminary tests.

(U) **FY 2003 Plans:**

- Robust Passive Sonar (RPS). ($17.000 Million)
  - Complete initial development of end-to-end prototype signal processing architecture and algorithms.
  - Conduct non real-time performance assessment using RPS sea-test data.
  - Initiate real-time processing architecture and algorithm development.
  - Initiate planning of real-time at-sea system demonstration.
  - Continue system trade studies for alternative acoustic aperture concepts.

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- Vortex Combustor (VC). ($6.000 Million)
  - Develop control system.
  - Conduct testing of the control, start, and restart systems.
  - Demonstrate submerged light-off and operation.
  - Verify VC combustion at various feed rates.
  - Demonstrate VC restart submerged after loss of combustion.
  - Demonstrate sustained operation.

- Loki Systems Development. ($4.000 Million)
  - Conduct concept of operations and military utility studies.
  - Initiate structural, material and architectural trade studies, including:
    -- Hydrodynamic performance modeling.
    -- System structural materials explorations.
    -- Advanced personnel pod design.
  - Initiate sensor guidance and control design studies.
    -- Simulation modeling of high agility, full speed control authority.
    -- Concept development of autonomous control systems.

- Undersea Littoral Warfare (ULW). ($6.000 Million)
  - Investigate technologies for classification and identification of buried mines and other underwater objects in the littoral.
  - Assess technologies for locating and tracking maritime targets of interest.
  - Pursue novel and innovative acoustic array technologies.
  - Investigate unique weapons payload concepts for potential deployment on submarines and other undersea vehicles.
  - Conduct conceptual design studies for small, autonomous, undersea vehicles.

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(U) Program Change Summary: (*In Millions*)

	FY2001	FY 2002	FY 2003
FY02 Amended President's Budget	27.937	41.497	31.896
Current Budget	25.290	36.497	33.000

(U) Change Summary Explanation:

FY 2001	Decrease reflects the SBIR reprogramming and the transfer of funding for the Counter Proliferation Support Program to WHS.
FY 2002	Decrease reflects program repricing and congressional reductions.
FY 2003	Increase reflects funds to continue the Vortex Combustor program.

(U) Other Program Funding Summary Cost:

- Not Applicable.

(U) Schedule Profile:

Plan	Milestones
Undersea Littoral Warfare (ULW):	
Apr 02	Conduct SAS data collection exercises.
May 02	Report on innovative undersea vehicle technologies.
Oct 02	Report on buried mine detection.
FY03	Determine viable technologies and concepts for future development.
Buoyant Cable Array Antenna (BCAA):	
Jun 02	BCAA multi-element antenna prototype system complete.
Aug 02	Conduct surface ship system test.

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Nov 02 Conduct submarine system demonstration.

Robust Passive Sonar (RPS):
Mar 02 Complete Initial data collection field exercise.
Apr 03 Demonstrate non real-time end-to-end system processing.

Vortex Combustor (VC) Demonstration Program:
Aug 02 Fabricate VC test units.
Sep 02 Fuel feed system design, fabrication, and testing complete.
Nov 02 Commence exploratory system performance testing.
Mar 03 Complete exploratory system performance testing.

Loki System Development:
Feb 03 Conduct concept of operations and military utility studies
Jun 03 Initiate structural, material and architectural trade studies, including:
- Hydrodynamic performance modeling
- System structural materials explorations
- Advanced personnel pod design