RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								DATE June 2001		
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development					R-1 ITEM NOMENCLATURE Marine Technology PE 0603763E, R-1 #49					
COST *(In Millions)*	FY 2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	Cost To Complete	Total Cost
Total Program Element (PE) Cost	21.845	27.937	41.497	31.896	45.700	57.500	60.200	72.600	Continuing	Continuing
Advanced Ship-Sensor Systems, MRN-02	21.845	27.937	41.497	31.896	45.700	57.500	60.200	72.600	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), Water Hammer, Buoyant Cable Array Antenna (BCAA), Robust Passive Sonar (RPS), and Loki 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. In addition, the ULW program is developing approaches to undersea warfare that will revolutionize the ability to classify and identify underwater objects and improves search rates more than an order of magnitude greater than is possible with current techniques.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE June 2001
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Marine Technology PE 0603763E

(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 washover 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 ULW 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 Water Hammer program conducted concept development for a standoff mine neutralization system consisting of a phased array of shock tubes to generate, focus and transport to militarily important distances (tens of meters) a pressure pulse of sufficient energy to neutralize the threat.

(U) Specific sensor, payload, structural, materials, and propulsion concepts, generated in part under the Submarine Payloads and Sensors Program (PE 0603763E, Project MRN-02), will be investigated for implementation into Loki- a revolutionary new underwater fighter program. The Loki program is complementary to planned naval forces and is intended to develop and demonstrate the critical technologies needed to provide the U.S. with a lethal, stealthy, high-speed underwater fighter. The Loki program will provide the U.S. with an asymmetric operational advantage in the littoral regions analogous to those enjoyed by U.S. fighter aircraft in air combat. It will rely on advanced sensor systems to provide the pilot with immersive, highly automated, and robust situational awareness, a power and energy system capable of low speed, cruise and high-speed operations.

(U) Program Accomplishments and Plans:

(U) FY 2000 Accomplishments:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE June 2001
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Marine Technology PE 0603763E

- Undersea Littoral Warfare (ULW). ($ 16.189 Million)
  - Completed development of prototype NetSAT system.
  - Conducted NetSAT follow-on technical demonstration, improved endgame coordination with existing systems for final target updates to improve overall effectiveness.
  - Conducted mine target strength and target structure studies in support of advanced classification techniques for Synthetic Aperture Sonar (SAS) systems; compared predictive models with laboratory measurements.
  - Assessed Robust Passive Sonar (RPS) performance improvements in passive sonar from exploitation of external information (overhead surveillance and acoustic monitors).
  - Commenced RPS development of adaptive processing algorithms for advanced surface shipping interference rejection.

- Buoyant Cable Array Antenna (BCAA). ($ 4.931 Million)
  - Conducted component technology risk reduction and maturation.
  - Initiated design and development of a full duplex (transmit/receive) submarine BCAA prototype antenna.
  - Completed system definition for prototype; conducted preliminary design review.

- Water Hammer. ($ 0.725 Million)
  - Completed and tested 4x4 source array.
  - Validated nonlinear numerical model from test results

(U) FY 2001 Plans:

- Undersea Littoral Warfare (ULW). ($ 19.496 Million)
  - Conduct final NetSAT operational demonstration.
  - Continue development of adaptive processing algorithms for advanced surface shipping interference rejection.
  - Commence development of noise-rejection algorithms exploiting external information.
  - Conduct preliminary Robust Passive Sonar (RPS) performance assessment using existing datasets.
  - Create baseline integrated RPS interference rejection processing stream.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE June 2001
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Marine Technology PE 0603763E

- Buoyant Cable Array Antenna (BCAA). ($ 5.341 Million)
  - Complete algorithm and software development for space-time adaptive communications link processor.
  - Complete design of BCAA prototype antenna; conduct critical design review.
  - Fabricate BCAA prototype antenna; commence integration with submarine deployment and retrieval systems.

- Future Submarine Payloads Program. ($ 3.100 Million)
  - Conduct structural, material, and architectural trade studies to allow storage and launch of existing payloads in an underwater environment.
  - Commence conceptual designs for the underwater launch and recovery of future payloads.
  - Transfer findings for use by the Loki program in FY 2002.

(U) FY 2002 Plans:

- Buoyant Cable Array Antenna (BCAA). ($ 7.733 Million)
  - Complete integration of BCAA prototype antenna with submarine deployment and retrieval systems.
  - Complete at-sea technical validation of BCAA prototype from surface platform.
  - Conduct at-sea operational demonstration of BCAA prototype from submarine.
  - Transition BCAA technology to Navy for follow-on development.

- Robust Passive Sonar (RPS). ($ 14.653 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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE June 2001
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Marine Technology PE 0603763E

- Loki Program. ($ 19.111 Million)
  - Initiate structural, material and architectural trade studies, including:
    - Interface descriptions and explorations,
    - Hydrodynamic performance modeling, and
    - System structural materials explorations.
  - Component technology development.
  - Assess impact of concept on existing platforms including launch and recovery.
  - Initiate sensor guidance and control design studies.
    - Simulation modeling of high agility, full speed control authority.
    - Conduct investigations into novel communications and sensing modalities.
    - Commence development of autonomous control systems; assess performance in an adverse environment without a priori training.
    - Component technology development for integrated electronics and software systems.
  - Begin investigations into advanced propulsion systems.
    - Demonstrate submergence performance of vortex combustors.
    - Demonstrate performance rates for advanced propulsion system.
  - Conduct concept of operations and military utility studies.

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

	FY2000	FY 2001	FY 2002
Previous President's Budget	21.681	30.304	38.257
Current Budget	21.845	27.937	41.497

(U) Change Summary Explanation:

FY 2000 Decrease reflects minor repricing and SBIR reprogramming.

FY 2001 Decrease reflects the Section 8086 reduction, government-wide rescission and deferral of Friction Drag Reduction efforts based on results of the 6.1 Drag Reduction efforts that led to establishment of a 6. 2 program in

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE June 2001
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Marine Technology PE 0603763E

PE 0602702E, Project TT-03. The funding decrease associated with this deferral was partially offset by cost increases in the Buoyant Cable Array Antenna and Undersea Littoral Warfare programs.

FY 2002 Increase reflects additional funds for the Loki program, which was also funded by reapplication of related efforts from Undersea Littoral Warfare program, Future Submarine Payloads program and Advanced Maritime Propulsion.

(U) Other Program Funding Summary Cost:

- Not Applicable.

(U) Schedule Profile:

Plan	Milestones
Undersea Littoral Warfare (ULW):	
Jun 01	Conduct sensor-to-shooter operational demonstration including surveillance detection, handoff, targeting and attack in a countermeasure environment.
Dec 01	Complete SAS classification performance assessment.
Apr 02	Conduct SAS data collection exercises.
Buoyant Cable Array Antenna (BCAA):	
Nov 01	BCAA multi-element antenna prototype system complete.
Apr 02	Conduct surface ship system test.
Sep 02	Conduct submarine system demonstration.
Robust Passive Sonar (RPS):	
Sep 01	Baseline interference rejection processing stream for passive sonar created.
Mar 02	Complete Initial data collection field exercise.
Apr 03	Demonstrate non real-time end-to-end system processing.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE June 2001
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Marine Technology PE 0603763E

Loki Program:

Jul 02	Issue initial baseline report.
Sep 02	Hydrodynamics performance testing.
Sep 02	Report on advanced propulsion experiments.
Oct 02	Report on advanced sensing guidance and control modality investigations.
Jan 03	Conduct Initial Design Review for prototype system.
Jul 03	Issue technical design report for critical navigation and communications systems.
Sep 03	Sensor, guidance and control systems testing.
Sep 03	Advanced propulsion endurance and economy testing.
Sep 03	Personnel pod qualification.