ARCHIVED REPORT

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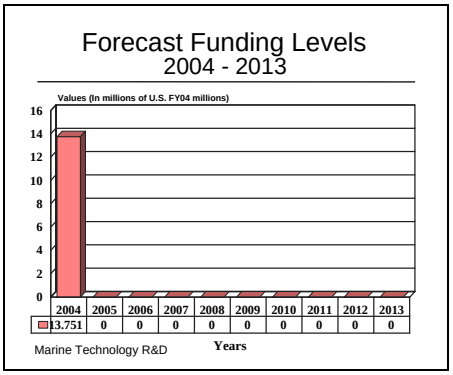
Marine Technology - Archived 7/2005

Outlook

- Program ends in FY2004
- Efforts transferred to PE#0603766E Project NET-02
- New emphasis being placed on network-centric warfare
- This report will be archived next year, July 2005



Orientation

Description. The Marine Technology program was a U.S. Defense Advanced Research Projects Agency (DARPA) effort that identified, developed, and rapidly matured critical advanced technologies and system concepts for maritime applications; i.e., U.S. Navy submarines in the littoral warfare arena. Efforts have been transferred to other programs in favor of network centric warfare development.

Sponsor

U.S. Defense Advanced Research Projects Agency (DARPA)
Special Projects Office
3701 N Fairfax Drive
Arlington, VA 22203-1714
USA
Tel: +1 703 248 1500
Fax: +1 703 516 7360
Web site: http://www.darpa.mil

Status. Program transferred to NET-02 project for more emphasis on network centric warfare.

Total Produced. A few prototype models only.

Application. Littoral and undersea warfare.

Price Range. Not applicable.

Contractors

BAE Systems North America, Advanced Power Technologies Inc. (APTI), http://www.apti.com, 1250 24 Street SW, Suite 850, Washington, DC 20037 United States, Tel: + 1 (202) 223-8808, RDT+E (Water Hammer Mine Neutralization)

Information Systems Laboratories (ISL), ISL Surveillance & Communications R&D, http://www.islinc.com, 8130 Boone Boulevard, Suite 500, Vienna, VA 22182 United States, Tel: + 1 (703) 448-1116, Fax: + 1 (703) 356-3103, Email: ptechau@islinc.com, RDT+E (Buoyant Cable Array Antenna)

Technical Data

Design Features. The Marine Technology program sought to identify, develop, and rapidly mature critical advanced technologies and system concepts to enable U.S. naval forces to dominate the maritime battlespace,

particularly in the littoral arena. It aimed to improve both the power-projection capabilities of the U.S. naval forces (particularly their ability to influence land battles), and their ability to counter threats. The threat from quiet diesel-electric submarines, the worldwide proliferation of advanced submarines and weapons, and the easy availability of modern underwater mines all represent the unique challenges encountered in the maritime arena. These threats necessitated the continued development of affordable methods of enhancing the U.S. Navy's operating capability in the shallow-water arena. However, new threats such as global terrorism, as well as advances in technology, have shifted this program to the bottom of the priority list for now.

Advanced Ship Sensor Systems (ASSS). The goal of the ASSS project was to develop innovative sensing and communication technologies that would allow U.S. naval forces to maintain and improve their effectiveness in dangerous tactical operations. This project had three principal objectives: 1) improvement of maritime battlespace awareness through the development of advanced sensors capable of more thoroughly interrogating the surrounding environment; 2) development of advanced communications capabilities for expanded information networking; and 3) exploration of platform system approaches for enhancing survivability.

Undersea Littoral Warfare (ULW). The ULW project was responsible for developing the Netted Search, Acquisition, and Targeting (NetSAT) system. NetSAT sought to improve attack performance by exploiting the use of a sonobuoy field during the weapon run in order to identify and locate countermeasures and to mitigate their impact on torpedo operations.

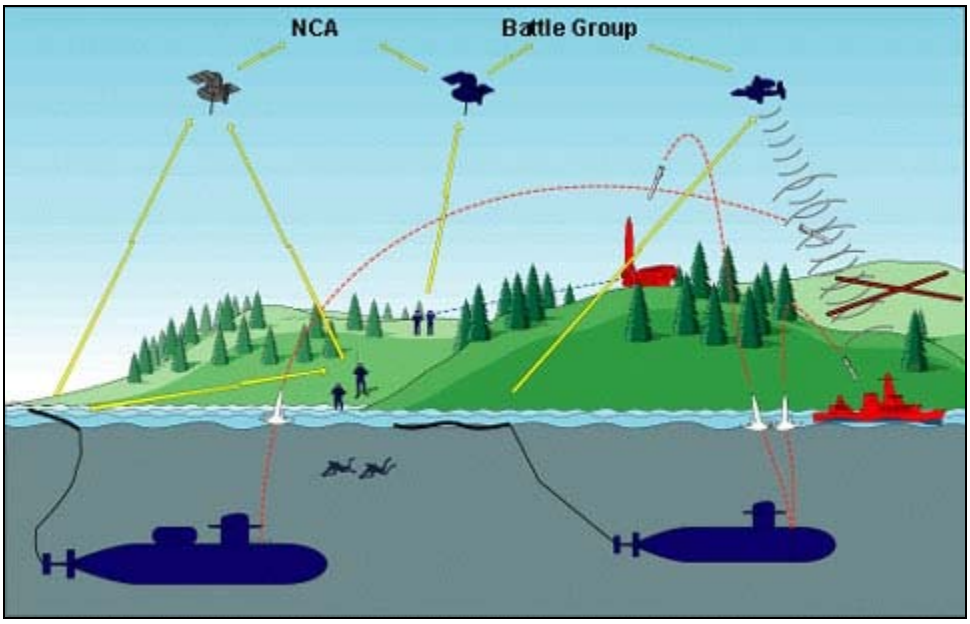
The ULW effort also examined: the ability of innovative multidimensional receiver arrays, when coupled with optimal processing approaches, to provide Robust Passive Sonar solutions in shallow water; the use of an unmanned aerial vehicle-based system to detect non-acoustic submarine signatures; and the use of advanced synthetic aperture sonar processing techniques to identify and classify underwater mines at much greater search rates than current systems allow.

Water Hammer. The unique Water Hammer project was responsible for concept development of a standoff mine neutralization system consisting of a phased array of shock tubes. The tubes generate, focus, and transport a pressure pulse of sufficient energy (tens of meters) to neutralize the threat. The Water Hammer has the potential for rapid, precise, in-stride lane clearance in deep or shallow water, thus reducing the need for high-fidelity detection and classification. Although the initial project focused on mine and obstacle clearance, the Water Hammer also has general utility use as a close-in defense system for ships against multiple classes of subsurface threats.

Buoyant Cable Array Antenna (BCAA). Under the BCAA project, focus was on the development of a full duplex link (transmit and receive) for data transfer and communications to and from submarines operating at speed and depth technologies which may be employed to achieve high data-transfer rates while submerged. These include photonic signal and power links, enhanced antenna loading materials, adaptive array calibrations, and enhanced communications protocols.

Robust Passive Sonar (RPS). This program was an outgrowth of the successful experiments performed under the ULW effort. It investigated the ability of innovative optimal processing approaches, coupled as appropriate to multi-dimensional receive arrays and external information, to precisely cancel the acoustic interference generated by surface ships.

Loki Program. The Loki Program had two major elements: the Vortex Combustor development program and the Loki systems development program. The goals of these two efforts were to develop revolutionary technologies assessed to have high military payoff into functional technology prototypes. Included in these two programs were the development of an energy-dense air-dependent underwater power-source as a potential propulsion system for an underwater fighter, and the development of support systems necessary for the operational viability of a future underwater fighter. Such an underwater vehicle would have had the potential to revolutionize military and commercial undersea operations, and the operational agility of maritime operations in the littoral warfare environment.



The Buoyant Cable Array Antenna (BCAA) will combine signals from multiple floating interconnected antenna elements to provide high data-rate submarine connectivity

Source: U.S. DARPA

Variants/Upgrades

As this is a technology development effort, variants and upgrades are always in the works.

Program Review

Originally set up to develop the U.S. Navy's Arsenal Ship concept (discontinued in 1997), the Marine Technology program focused on many of the auxiliary projects that were to be part of the Arsenal Ship.

In FY97, development of the Netted Search, Acquisition, and Targeting (NetSAT) system for littoral surveillance was initiated. Other work included assessing the prototype design of an acoustic mine-detection and classification system for coverage of a large area (10 square nautical miles per hour); the development of space/time adaptive processing techniques and ocean tests to enhance long-range active coherence and the performance of towed arrays; demonstration of a standoff pulse mine-neutralization system; the development of advanced signal detection and processing algorithms to mitigate the effects of torpedo acoustic countermeasures; and the development of a high-resolution synthetic aperture sonar towed-array system for mine detection and classification from high-speed platforms. Development and testing of NetSAT continued through FY98.

By the end of FY99, the prototype NetSAT system had been completed and field-tested against a submarine target. Under the Water Hammer project, efforts were under way to develop explosive underwater energy-projection technology for mine neutralization, including fabrication and component testing for the 4x4 source array test article. The Buoyant Cable Array Antenna (BCAA) effort was conducting comparative testing of DARPA-generated BCAA concepts and Navy-generated single element approaches in the ultra-high-frequency (UHF) band, as well as assessing the cost/performance tradeoffs of differing approaches.

Program activity for FY00 focused on updating and completing development of the prototype NetSAT system, and conducting a follow-on technical demonstration that emphasized endgame coordination with existing systems for final target updates. Under the BCAA project, component technology risk-reduction and maturation efforts were under way, along with the design and development of a full duplex (transmit/receive) submarine prototype antenna, and the conduct of a Preliminary Design Review. Under the Water Hammer effort, the 4x4 source array and test subsystem were completed.

During FY01, the final NetSAT operation demonstration was conducted, followed by the transition of NetSAT technologies to the Navy. Synthetic aperture

sonar data-collection exercises were also conducted. The BCAA effort focused on designing and fabricating a prototype antenna, as well as assessing the feasibility of remotely operated antennas for increasing submarine stealth while providing around-the-clock two-way communications. Additionally, a new effort was added, the Future Submarine Payloads program. It studies the storage and launch of existing payloads in an underwater environment. Conceptual designs for the underwater launch and recovery of submarine payloads were initiated during the year.

By the end of FY02, the BCAA prototype completed at-sea technical validation, as well as an operational demonstration from a submarine. BCAA technology was transitioned to the Navy for follow-on development. At the same time, high-quality, mobile, multi-line-array acoustic and ancillary data were collected at sea as part of the Robust Passive Sonar (RPS) effort. Additionally, end-to-end prototype signal-processing architecture and algorithms were developed.

The Vortex Combustor development program began in earnest in FY02. A detailed analysis was conducted, test units were fabricated, a supporting fuel feed system was developed, start and restart systems were developed, and supporting engineering studies were conducted.

Among the many efforts under way in FY03, the initial development of end-to-end prototype signal-processing architecture and algorithms was completed under the RPS effort, a real-time at-sea system demonstration was planned, and system trade studies for alternative acoustic aperture concepts were conducted.

Various structural, material, and architectural trade studies were conducted under the Loki program. Included in these studies were hydrodynamic performance modeling, an examination of system structural materials, and advanced pod design. In addition, sensor guidance and control design studies were initiated, and simulation models designed.

Finally, efforts were started to develop technologies for classifying and identifying buried mines and other underwater objects, and for locating and tracking maritime targets of interest. In addition, innovative acoustic array technologies were explored, unique weapons-payload concepts pursued for potential deployment on submarines and other undersea vehicles, and conceptual design studies for small, autonomous undersea vehicles were conducted.

At the end of FY04, this program will be ended and efforts budgeted in this program will be transferred to PE#0603766E Project NET-02 to better reflect the current emphasis on network-centric warfare.

Funding

U.S. FUNDING

	FY03		FY04		FY05		FY06	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (U.S. DoD)								
PE#0603763E								
Marine Technology	-	16.1	-	13.7	-	0	-	0

All US$ are in millions.

Source: U.S. DARPA FY2005 RDT&E Programs (R-2)

This program ends in FY2004. Efforts budgeted in this program are being transferred to PE#0603776E Project NET-02 to better reflect the current emphasis on network-centric warfare.

Recent Contracts

Specific contracts for this program have not been identified through public source information at this time.

Timetable

Year	Major Development
1997	Arsenal Ship concept canceled; program focus shifts to auxiliary projects; NetSAT project starts
1999	NetSAT prototype complete
2000	NetSAT update and follow-on technical demonstration

Year	Major Development
2001	Final NetSAT operational demonstration; conceptual design of Future Submarine Payloads program
2002	BCAA prototype antenna complete; BCAA surface ship system test complete; BCAA submarine system demonstration; Vortex Combustor units fabrication
2003	RPS real-time signal-processing demonstration; performance testing of Vortex Combustor exploratory system complete; development of Loki system concept of operations complete, along with military utility studies
2004	Program efforts to transfer to PE#0603756E Project NET-02 at end of year

Worldwide Distribution

This was **U.S. Department of Defense**-led effort, run through the **Defense Advanced Research Projects Agency** (DARPA) in part for the **U.S. Navy** submarine fleet.

Forecast Rationale

The goal of the U.S. Defense Advanced Research Projects Agency's (DARPA) Marine Technology program was to accelerate critical advanced technologies and systems concepts for maritime applications, especially those involved in littoral warfare. The aim was to improve both the power-projection capabilities of the U.S. naval forces (particularly their ability to influence land battles), and their ability to counter threats. Projects encompassing the program included Advanced Ship Sensor Systems (sensing and communication technologies), Undersea Littoral Warfare (Netted Search, Acquisition, and Targeting systems), Water Hammer (mine neutralization), Buoyant Cable Array Antenna (submarine communications), Robust Passive Sonar (acoustics), Vortex Combustor, and Loki system development.

Originally, funding for the Marine Technology program was expected to increase over the forecast period; however, the high costs of the war in Iraq and the war on terrorism have meant severe funding cuts for the program. Additionally, the current U.S. focus on network-centric warfare will likely reduce funding in several other technology programs not directly related to it. (Network-centric warfare involves how the U.S. can make the best strategic and tactical use of all the information it gathers. It is not a new concept at all, just a new name.)

This report will be archived in 2005 in favor of a new report to be developed at a later date on PE#0603766E Project NET-02 which is absorbing many of the efforts from the Marine Technology program and redesigning them with a new emphasis on network-centric warfare.

Ten-Year Outlook

Note: For the purposes of this market intelligence report, the funding history for this effort starts in 1998, when the Arsenal Ship concept was advanced.

ESTIMATED CALENDAR YEAR FUNDING ($ in millions)

				High Confidence Level			Good Confidence Level			Speculative			
Designation	Application	Thru 03	04	05	06	07	08	09	10	11	12	13	Total 04-13
MARINE TECHNOLOGY	NAVAL WARFARE (U.S. NAVY)	173.258	13.751	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13.751