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INSTITUTE FOR DEFENSE ANALYSES

Naval Mining and Technology

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19981026 038

April 1997

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IDA Document D-2058

Log: H 97-002250

This work was conducted under contract DASW01 94 C 0054, Task T-E1-1443, for Deputy Director, Naval Warfare, Strategic and Tactical Systems in the Office of the Under Secretary of Defense for Acquisition and Technology. The publication of this IDA document does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official position of that Agency.

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PREFACE

This IDA Document is one of a set of six such publications written in support of an IDA study sponsored by the Deputy Director for Naval Warfare within the Office of the Under Secretary of Defense (Acquisition and Technology), Strategic and Tactical Systems.

The central activity of Phase I of the study was an all-day meeting by a panel of nationally known experts, civilian and formerly military. The panel brought their knowledge and experience to bear upon the question of whether the nation should develop a modern naval mining capability. The Documents were prepared as short working papers to assist the panel as it developed its position on the issue.

NAVAL MINING AND TECHNOLOGY

This paper briefly reviews some of the traditional pros and cons of maintaining a mining capability, lists areas of advancing technology that are relevant to that warfare area, and discusses the implications of these technologies for the traditional issues.

A. ADVANTAGES OF MINING

Mines can be used to shape the maritime battle space: to deny access in or out of ports, to close narrow passages, or to establish "keep out" zones. They can also be used to slow the pace of hostile maritime operations, or reduce the number of enemy ships and submarines over time. Their two key advantages over manned systems are efficient, around-the-clock operation and minimal risk to personnel.

Mines also provide a means of restricting the activities of the enemy during "other-than-war" contingencies, or of neutrals during conflicts (as in the mining of Haiphong). This can often be done without "direct" confrontation and with minimal risk to life on either side. Such a capability exploits the psychological advantage of an unseen, "hands-off" weapon, which is a characteristic feature of mines.

The United States relies on its world-wide ability to use the seas and project power onto hostile shores. The potential use of mines by opposing forces threatens this capability. By being on the forefront of mine technology, the U.S. would be in a better position to anticipate and counter such threats.

B. DISADVANTAGES OF MINING

There are limited opportunities to use mines. Before hostilities, mining may be prohibited by international law or by the rules of engagement. During hostilities, time is of the essence; direct action may be more appropriate. Also, situations change rapidly; one may wish to restrict access to an area one day, but have it open to friendly forces the next.

Mines are traditionally indiscriminate and uncontrolled. They may restrict operations of both enemy and friendly forces. There is risk of unintended damage to neutrals. When hostilities are over, clearance is risky, expensive and time-consuming.

Because of their indiscriminate and uncontrolled nature, mines tend to be held in low regard as weapons both within the Navy and outside.

C. SOME KEY TECHNOLOGIES APPLICABLE TO MINES

Advancing technologies are making it possible for mines to become "smarter" and more controlled. They could also be mobile and have a range of "less-than-lethal" payloads. Some of the relevant areas of technology are listed here.

1. Undersea Communications

Communications with mines can be established using either fiber-optic cable and/or acoustic modems. Links to floating wires, buoys or on-shore transmitters may be used for remote monitoring and control. Networking techniques may be used to link mines either to other mines or to sensors, thereby enhancing their capability to detect, localize, identify and track a target. Direct control may be established: mines may be turned on or off; their settings may be changed; or they may be temporarily disabled by a passing friendly unit using coded messages. Finally, when no longer needed, the mines may report their positions for clearing, or be automatically disabled or destroyed.

2. Navigation

GPS enables the positions of mines (and targets) to be known with high accuracy.

3. Sensors

The miniaturization of sensors and signal processing hardware makes possible much more sophisticated detection and identification capabilities. Also, the acquisition of empirical data and improved modeling capabilities are leading to a better understanding of acoustic propagation and background noise, especially in the littoral environments which have become a main focus of study.

4. Stealth

Stealth technology contributes to mine warfare in two ways. First, it enhances the survivability of delivery platforms and conceals the location of mine laying activity from

the enemy. Both submarine and aircraft stealth contribute in this regard. Second, the use of stealthy materials in the mines themselves makes them difficult to counter, even when located in enemy-controlled waters.

5. Robotics

Advances in micromechanical systems and power supplies greatly improve the potential of mobile mines. The current Submarine-Launched Mobile Mine (SLMM) has a rudimentary capability to travel from the submarine before settling into position. However, it is possible to develop mines that have longer range, more detailed transit capabilities, and which could be reactivated and repositioned as the situation changes. Also, continuously mobile mines that patrol a given area are feasible. Such mines could threaten even stationary targets.

6. Non-lethal Payloads

Land forces are actively pursuing the development of non-lethal weapons as they become increasingly involved in "operations other than war". The development of non-lethal payloads for sea mines could create some unique options in such contingencies. For example, mines that disable their targets rather than sink them could be used for port blockade with less risk of escalation or loss of life. "Propeller-fouling" warheads have been proposed for this purpose. Another example is the use of mines that "tag" potential combatants during a pre-conflict period. Should conflict erupt, the tags could be selectively activated to enhance the detectability of the hostile ships or submarines. Such tagging could deter a potential enemy from escalating the conflict.

D. CONCLUSIONS

Advances in technology could enable modern mines to dramatically exceed the capabilities of their World War II counterparts. Such mines could avoid many of the drawbacks associated with the indiscriminate and uncontrolled nature of the old mines, which tend to influence views of such weapons.

In the new world, the United States seeks opportunities to leverage its technological advantage over lesser developed adversaries to enforce its position with minimal risk of life to either side. Undersea technology is one such area that, if exploited, could offer a number of unique options to the National Command Authority.

The potential value of mine warfare to the Nation should be assessed in light of the promise of these new technologies and not on an outdated image of these weapons.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
April 1997

3. REPORT TYPE AND DATES COVERED
Final

4. TITLE AND SUBTITLE
Naval Mining and Technology

5. FUNDING NUMBERS
DASW01 94 C 0054
Task T-E1-1443

6. AUTHOR(S)
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7. PERFORMING/ORGANIZATION NAME(S) AND ADDRESS(ES)
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1801 N. Beauregard Street
Alexandria, VA 22311

8. PERFORMING ORGANIZATION REPORT NUMBER
IDA Document D-2058

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
OUSD(A&T)
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DepDir Naval Warfare
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Washington, DC 20301

FFRDC Programs
2001 N. Beauregard Street
Alexandria, VA 22311

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
In April 1997 a senior panel convened at IDA to address the future of the U.S. naval mining program. This short paper was prepared as background reading for the panel. It briefly reviews some of the pros and cons of maintaining a traditional mining capability, lists areas of advancing technology that are relevant to this warfare area, and discusses the implications of these technologies for the traditional issues. It is stressed that the potential value of mine warfare to U.S. interests should be assessed in light of the promise of the new technologies and not on an outdated image of these weapons.

14. SUBJECT TERMS
mines, mine warfare, naval mines, new technology

15. NUMBER OF PAGES
6

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
UNCLASSIFIED

18. SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

19. SECURITY CLASSIFICATION OF ABSTRACT
UNCLASSIFIED

20. LIMITATION OF ABSTRACT
UNLIMITED