

AD-A253 131



NAVAL WAR COLLEGE
Newport, R. I.

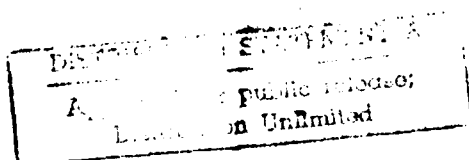
ANTISUBMARINE WARFARE:
STILL A VITAL MISSION

by

David S. Magill
Commander USN

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.



Signature: D. S. Magill

18 May 1992

92 7 27 045

92-20135



REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b. RESTRICTIVE MARKINGS	
1. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION/AVAILABILITY OF REPORT DISTRIBUTION STATEMENT A: Approved for Public Release; distribution is unlimited.	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE		5. MONITORING ORGANIZATION REPORT NUMBER(S)	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)			
6a. NAME OF PERFORMING ORGANIZATION OPERATIONS DEPARTMENT	6b. OFFICE SYMBOL (If applicable) C	7a. NAME OF MONITORING ORGANIZATION	
6c. ADDRESS (City, State, and ZIP Code) NAVAL WAR COLLEGE NEWPORT, R.I. 02841		7b. ADDRESS (City, State, and ZIP Code)	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code)		10. SOURCE OF FUNDING NUMBERS	
		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) ASW: STILL A VITAL MISSION (U)			
12. PERSONAL AUTHOR(S) DAVID S. MAGILL CDR USN			
a. TYPE OF REPORT FINAL	13b. TIME COVERED FROM TO	14. DATE OF REPORT (Year, Month, Day) 18 MAY 1992	15. PAGE COUNT 28
16. SUPPLEMENTARY NOTATION A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Operations. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.			
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	ANTISUBMARINE WARFARE, DIESEL SUBMARINES,	
		THIRD WORLD SUBMAINE THREAT, ASW STRATEGIC ASSESSMENT	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) SEE ATTACHED			
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
a. NAME OF RESPONSIBLE INDIVIDUAL CHAIRMAN, OPERATIONS DEPARTMENT		22b. TELEPHONE (Include Area Code) 841-3414	22c. OFFICE SYMBOL C

Abstract of
ANTISUBMARINE WARFARE: STILL A VITAL MISSION

Antisubmarine Warfare, once the number one priority of the United States Navy, seems to have faded into the background amidst the clamor over the demise of the Soviet Union and military operations in Southwest Asia. Despite perceptions to the contrary, ASW is still a vital mission in the post Cold War world. The former Soviet Union continues to operate a formidable submarine fleet, albeit at a reduced tempo, and Third World navies collectively possess an enormous conventionally powered submarine fleet. Emerging technology and the continued proliferation of sensors and weapons, project the ASW problem well into the future. Antisubmarine Warfare must be kept in the forefront of military planning as the Navy builds down in size. Acquisition strategies, training and tactical doctrine must keep pace with the reality of the submarine threat in the new regionally focused National Military Strategy.

Abstract of
ANTISUBMARINE WARFARE: STILL A VITAL MISSION

Antisubmarine Warfare, once the number one priority of the United States Navy, seems to have faded into the background amidst the clamor over the demise of the Soviet Union and military operations in Southwest Asia. Despite perceptions to the contrary, ASW is still a vital mission in the post Cold War world. The former Soviet Union continues to operate a formidable submarine fleet, albeit at a reduced tempo, and Third World navies collectively possess an enormous conventionally powered submarine fleet. Emerging technology and the continued proliferation of sensors and weapons, project the ASW problem well into the future. Antisubmarine Warfare must be kept in the forefront of military planning as the Navy builds down in size. Acquisition strategies, training and tactical doctrine must keep pace with the reality of the submarine threat in the new regionally focused National Military Strategy.

DTIC QUALITY INSPECTED 4

Accession For	
DTIC	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

TABLE OF CONTENTS

CHAPTER	PAGE
ABSTRACT	11
I INTRODUCTION	1
II BACKGROUND	3
The Mission	3
The Changing Arena	4
III THE THREAT	6
The Former Soviet Union	6
The Third World	7
Technology	9
The Future	11
IV A REGIONAL FOCUS	14
V CONCLUSIONS AND RECOMMENDATIONS	18
The Response	18
Recognize the Problem	19
Training	20
Building Down	20
NOTES	22
BIBLIOGRAPHY	24

ANTISUBMARINE WARFARE: STILL A VITAL MISSION

CHAPTER ONE

INTRODUCTION

The United States Navy, along with the rest of the uniformed services, stands today at a crossroads. The emerging realities of a greatly debilitated threat from the former Soviet Union and a rapidly dwindling Defense Department share of the Budget, are at odds with the enduring realities of the Navy's mission of maintaining control of the sea. As our focus shifts from the menacing but predictable threat of the Cold War USSR to a more diffused regional approach, we must be cautious in planning our courses of action toward perceived new realities.

The overwhelming victory of the United States led coalition in Desert Storm has led to an almost euphoric rebirth in the nation's confidence in our military capabilities. But while this confidence is well deserved, it must be tempered by the sobering reality that there was one foe that the coalition did not have to deal with - the submarine. Professional military analysts are well aware of the significance of this fact. But in the bureaucratic and political arena, where budget battles are fought, the answer to the question, "What have you done for me lately?" is often the driving factor in which programs get funded and which do not.

This paper will examine the threat faced today, and in

the future, as posed by the submarine. The first order of business will be to examine briefly the ASW posture of the United States Navy in the recent past, in order to understand where it stands today. Secondly we shall describe the ASW challenge that faces us today and what that threat will probably be in the future, both in terms of technology and geopolitics. Finally conclusions will be drawn and recommendations made for a current and future course of action to address the ASW problem.

The entire nature and character of the campaign waged in Operation Desert Shield/Desert Storm would have been entirely different if Iraq had had even a modest submarine capability. The next crisis we face could very easily require a significant Anti-Submarine Warfare (ASW) force. It must be well equipped and well trained.

CHAPTER TWO

BACKGROUND

THE MISSION. "The mission of the U. S. Navy, as set forth in Title 10, U.S. Code, is to be prepared to conduct prompt and sustained combat operations at sea in support of U. S. national interests; in effect, to ensure continued maritime superiority for the United States."¹ In order to accomplish that mission, the Navy strives to perform the two interrelated functions of sea control and power projection. The ability to achieve either one of these conditions is usually dependent on successful accomplishment of the other.²

For the past 45 years the accepted measure of effectiveness of the Navy has been its ability to measure up to the only other nation on the globe that could even remotely challenge our maritime superiority, the USSR. This mindset applied across the entire spectrum of warfare capabilities, but nowhere was it more acutely defined than in ASW. In fact, by the mid-80s, when Soviet technological accomplishments brought their submarine force qualitatively closer to our own, ASW was declared the number one priority in the Navy. With the monolithic menace of the Soviet Navy challenging us across the globe, it was easy to let any other threats be relegated to

side show status. As one prominent Naval ASW authority phrases it, "We have generally rationalized that any other threat was a "lesser included case" of a general war."³

THE CHANGING ARENA. But three developments in the last few years have shifted the focus of military thinking away from ASW. First, the collapse of the USSR and the revelations of weakness and disorder throughout both its government and military, has removed the immediacy of that threat. Secondly, the resounding success of our military efforts in South West Asia, which were primarily land and air oriented, has pushed those warfare areas into the forefront of our national consciousness. And thirdly, our own economic woes, coupled with the universally acknowledged necessity to draw down our military expenditures, has focused a glaring spotlight on big ticket military programs.

The combination of these factors has left the Navy in a precarious position. With the demise of the USSR, many feel that ASW is now no longer a priority, and absent the Soviet threat, the Navy is in the embarrassing position of having to justify its concern about a threat which it had previously dismissed as insignificant. In constructing its own force structure, the Navy has said, "All submarines should be nuclear powered, because with nuclear power the submarine attains the ultimate capabilities of the true submersible."⁴ One U. S. nuclear submariner went so far as to state, "...possession of nuclear powered submarines will be the sine

qua non of maritime power...They presently have no real opposition, and no effective opponent other than another nuclear submarine can be envisioned."⁵

In the face of such arrogance, the argument that there really is reason to fear the conventional, non-Soviet submarine threat rings hollow in the ears of some, especially those wielding the budget cutter's axe. In the next chapter we shall examine exactly what the post Cold War world looks like in the way of ASW challenges to United States maritime superiority.

CHAPTER THREE

THE THREAT

THE FORMER SOVIET UNION. August 1991's aborted coup attempt against Mikhail Gorbachev exposed the precariousness of that leader's control over his vast country. But fears of a return to hardline Communist control proved unfounded and the USSR and the world's largest Communist government had ceased to exist by year's end. The threat of a global confrontation between the two nuclear superpowers declined to its lowest point since the beginning of the Cold War. But the stability and intentions of the Commonwealth of Independent States (CIS) remains a huge unknown. And more pertinent to the point under discussion, the huge Soviet submarine fleet remains a force in being. Whatever the intentions of the current or future owners, the capability of this fleet remains a threat which can not be dismissed.

Strategically, there are 59 nuclear powered ballistic missile submarines with 912 SLBM launchers in the Northern and Pacific fleets. In 1990 the seventh Delta IV SSBN became operational, a new liquid fueled SLBM is believed to be under development and the first Typhoon SSBN entered overhaul and modernization.⁶

"Antiship and antisubmarine warfare capabilities were

strengthened by production of additional Victor III-, Sierra-, Kilo-, and Akula-class attack boats and Oscar II-class cruise missile submarines."⁷ The much publicized scrapping of Russian submarines consists primarily of aging first generation diesel and nuclear units, leaving a somewhat smaller but more modern and highly capable force. Tactically as well as strategically, the development of an SSBN "bastion defense" concept with SSBN patrol areas in well protected coastal areas ringed by layers of defense which would include nuclear and conventional powered attack submarines,⁸ presents a formidable ASW problem. Until such time as the uncertainty surrounding the control of these forces is resolved, the United States must retain the capability to put them at risk should the need arise. However unlikely that need may appear at present, the risk involved in ignoring it is untenable.

THE THIRD WORLD. According to Rear Admiral Thomas Brooks, Director of U. S. Naval Intelligence, "Third World powers are no longer "third rate" threats, causing the U. S. Navy to reassess the threat confronting it."⁹ Not including the USA and former USSR, there are 393 submarines operated by 41 countries around the globe. Additionally, some 19 countries have either already built or are in the process of building their own submarines. Three or four other countries are assessed to be ready to commence a submarine construction program. In the same article a leading U. S. analyst is quoted as saying, "...the prime subject of new U. S. ASW-related

scrutiny is India, ...India has acquired a large submarine force which is relatively well-maintained and which routinely operates at sea."¹⁰

China has a large force of 90-100 diesel submarines as well as four Han-class SSNs. North Korea, which has the fifth largest submarine fleet in the world (about two dozen), is also a leading producer of mini-submarines, which, if placed in the hands of terrorists, could represent a major ASW problem in the realm of Low Intensity Conflict (LIC), as well as in conventional warfare scenarios.

Nor is this litany of proliferation likely to cease anytime soon. If anything, the world's submarine order of battle is more likely to increase. The former Soviet Union, desperate for hard currency and productive work for its people, is exporting its most modern diesel electric submarine, the Kilo, to India, Libya, Syria and Algeria. In the West, Germany, the United Kingdom, France, the Netherlands and Sweden all have active export programs to a variety of Third World navies.¹¹

With the exception of one decrepit Charlie-class SSGN exported to India by the Soviet Union, submarine proliferation in the Third World has been limited to conventionally powered boats. But the arrival of the nuclear powered submarine in the export market may not be too far distant. Both Argentina and Brazil already have the ability to enrich uranium as fuel for submarine reactors. Brazil is planning to begin construction

on a prototype SSN in the late 90s. In Argentina, the Domecq Garcia shipyard, considered to be one of the best submarine construction facilities in the Western hemisphere, is fully capable of a nuclear sub building program. Although difficult economic problems in both countries could hamper funding for these projects, the motivation remains high. The possibility of a joint venture has generated much speculation since the two countries signed a 1986 agreement to cooperate on a number of nuclear projects.¹² The expense, infrastructure, training and support required to mount an effective nuclear submarine program is probably beyond the means of a majority of Third World nations, but there are a few, particularly in the oil-rich, arms-hungry and highly unstable Middle East that have both the resources and the desire to cause ASW problems for the United States.

TECHNOLOGY. Thus far we have addressed principally the number and location of submarines in the Third World. But these numbers, formidable as they are, don't tell the whole story. In addition to the sheer volume of the threat, modern technology has turned the diesel electric submarine of the 90s into a much more difficult opponent than its slower, noisier, less capable predecessor. Consider for example the TR 1700, built by Thyssen Nordseewerke of Germany. This submarine is advertised to have a patrol endurance of 70 days, submerged top speed of 25 knots and ability to dive to a depth of 270 meters. It also has a Signal Sinbads fire control system and

Krupp Atlas Elektronik and Thomson Sintra sonars capable of detecting medium size surface contacts at ranges of up to 62 kilometers, depending on environmental conditions.¹³ The Kockums Type 471 built in Sweden will feature the world's first fiber optic linked submarine combat system, designed by Rockwell International.¹⁴

Weapon technology has also kept pace with other improvements in submarine design. Modern submarine torpedoes use a wire guided fire control system which, "...accept(s) additional inputs from the torpedo's seeker, and in effect it turns the torpedo into an off-board sensor."¹⁵ Using multiple weapons in different modes (passive or active), and updating fire control solutions based on data input after the weapon has been fired, dramatically increases torpedo effectiveness and probability of hit. Soviet export submarines are equipped with long range, thermal propulsion torpedoes which carry a 400 Kilogram (KG) warhead. Most western export torpedoes have 250 KG warheads. To put the killing power of these weapons in perspective, consider that the World War I vintage mine that nearly broke the USS Samuel B. Roberts in half had a warhead in the vicinity of 100-125 KG.¹⁶ In summary, a modern diesel electric submarine using state-of-the-art weapons, sensors and propulsion systems is a truly formidable naval weapon. Additional improvements such as anechoic coating, acoustic damping tiles, raft mounts and active noise cancellation make this submarine border on the

undetectable. All of the above mentioned technological improvements are either in production or operating in active submarines today. Future technology promises to bring even greater sophistication to Third World submarines.

THE FUTURE. A major limitation and vulnerability of the diesel electric submarine has been its slow submerged speed and its requirement to snorkel or surface in order to recharge batteries. A number of systems currently under development will make the diesel submarine "air independent". This independence is provided by means of stored oxygen, stored reactants or by a small nuclear battery charger. Briefly, the systems on the near horizon fall into four categories; closed cycle diesel engines, stirling engines, fuel cells and low power nuclear reactors.¹⁷

- Closed cycle diesel engines. Two different systems are currently under development by western manufacturers, an Italian gas storage toroidal system and a Dutch system based on an exhaust scrubber using liquid oxygen, originally developed by the British firm Cosgrove Engineering. The Italian system, developed for a commercially used 30 ton submersible, compresses and stores exhaust products. The Dutch process has made a technological breakthrough which allows overboard discharge of exhaust products at depths of up to 300 meters, a significant tactical advantage. Whether the Italian system will be adaptable to submarines large enough for full military application is not known at this time, and the Dutch

system is limited by the liquid oxygen storage capacity and overall system efficiency. Up to three weeks submerged endurance is envisioned using this technology.

- Stirling Engines. This is a reciprocating, external combustion engine currently being tested at sea aboard a 1000 ton Nacken-class submarine by the Swedish Navy. The Stirling engine uses continuous burning in an overpressured external combustion chamber, also capable of exhaust discharge down to 300 meters. It is extremely quiet due to lack of explosions and moving parts, low vibration and low engine RPM. Current testing goals include reducing size, weight, complexity and cost, as well as improving reliability. Submerged endurance of up to two weeks is considered realistic.

- Fuel Cells. The German Navy effort at AIP is centered on high efficiency chemical fuel cells using liquid oxygen and hydrogen stored as a metal hydride. This system is purported to be able to produce five times the net energy density of lead-acid batteries. A 450 ton Type 205 submarine has been used to demonstrate this technology, although unspecified "technical difficulties" have been reported. If these problems can be overcome, up to one month of submerged operations is possible.

- Low-Power Nuclear Reactors. The Canadian ECS group is working on an Autonomous Marine Power Source (AMPS), the goal for which is to provide unlimited endurance at low speeds. The first attempt to use AMPS technology aboard a submarine is

tentatively scheduled for 1995 with a 545 ton French submersible. This program is hobbled by questionable government backing and lack of any military sales.

Questions remain to be answered concerning which of these technologies will prevail, how they will perform, how safe they will be, and whether affordability and reliability will make them a feasible solution for military application in submarines. But it seems a safe bet that technological innovations will continue to increase the effectiveness, tactical utility and lethality of the Third World submarine force, thereby greatly complicating the ASW part of the equation in achieving maritime superiority.

CHAPTER FOUR

A REGIONAL FOCUS

Thus far we have considered what nations of the world have a submarine force likely to pose a significant threat to the United States Navy, what capabilities the submarine of today has and the submarine of tomorrow is likely to have. But under what circumstances will this submarine threat be likely to come into conflict with United States Naval forces? For the answer we again turn to the National Military Strategy. The new regional focus of the Strategy dictates that we have "the ability to project power and decisively use military force when and where the national leadership determines it is needed...Thus we are focusing our planning efforts on regions of potential conflict. We must be able to project power to Europe, the Middle East, and Asia..."¹⁸

In each of these regions, the Navy will be required to operate in restricted or bounded seas for protracted periods of time, in shallow water, and pass through straits or other chokepoints which "greatly simplifies the encounter problem for nonnuclear submarines."¹⁹

In order to support the southern flank of Europe from the Mediterranean, U. S. Naval units must pass through the Strait of Gibraltar, an eight mile wide stretch, bordered on either

side by some of the noisiest, most acoustically difficult water in which to conduct ASW in the world. At the other end of the Mediterranean lies the Suez canal, the Red Sea, the Strait of Bab el Mandeb and finally the Strait of Hormuz. The Strait of Malacca, Pacific gateway to the Indian Ocean, is one of the most heavily travelled waterways in the world and is well within reach of the growing submarine force of the Navy of India.

Closer to home, the Panama Canal represents another chokepoint vital to the economic and political interests of the United States and her allies. The straits at the southern tip of South America and the Atlantic narrows between Brazil and Western Africa are also significant areas of concern for sea control. The latter two areas are especially vulnerable in that there is very little cuing, intelligence or regular U. S. Naval presence. This is an area of the globe to which the Navy has paid very little attention, a situation sorely in need of redress. "When one takes into consideration that about half of Latin American exports and a significant portion of U. S. shipping travel through inter-American waters, specifically through the three chokepoints mentioned above, the idea of a maritime defense strategy becomes more focused."²⁰

In open ocean "blue water" operations the diesel submarine is totally ineffective against the speed and maneuver of a Naval Battle Group. But when they pass through chokepoints or straits, the tactical advantage passes to the

diesel submarine, ideally suited to creep at slow speed (1-2 knots), 3-4 meters above the bottom, and when required, to achieve submerged sprint speeds in excess of 20 knots.²¹ If shallow water is added to the equation the balance tips even further in favor of the diesel sub. Even the vaunted "queen of the seas", the SSN, is at a disadvantage in this arena.

"Although the SSN can operate almost anywhere, it cannot operate effectively in shallow coastal waters."²² Although relatively quiet, the SSN is still noisier than a diesel operating on batteries. The diesel's smaller displacement makes it more difficult to detect by active sonar or magnetic anomaly. Reactor coolant water exhaust also makes the SSN more vulnerable to Infrared detection. In the high ambient noise, high reverberation environment of shallow water, detection of the diesel submarine is an extremely challenging problem for even the most tactically sophisticated and technologically advanced ASW forces.

The most oft cited example, the experience of the British in dealing with a single conventionally powered Argentinean submarine during the Falklands War in 1982, graphically makes the point. "More than 200 pieces of ordnance were expended in all, including numerous depth charges and a large number of homing torpedoes, the majority of which exploded amidst a sea full of false contacts."²³ The fact that the Argentine sub did not sink a British ship was due to poor training, not the British ASW effort. Poor training and incompetent performance

may well be common place in some Third World navies, but this is an element upon which we can never rely. The problem is difficult but not insoluble. How to solve the submarine problem within the context of our new National Military Strategy will be addressed in the following chapter.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

THE RESPONSE. All of the above is not meant to imply that we can not defeat the diesel submarine threat. The United States Navy has the most capable, well trained, technologically superior ASW force in the world. Surface, subsurface and air ASW platforms combine to form an exceptionally effective layered defense of the Battle Group and designated Mission Essential Units (MEU). Environmental conditions which make the submarine so difficult to detect apply to him as well in his task of locating his target. Aggressive, offensively oriented search tactics can be used to flush the diesel out of restricted waterways prior to the arrival of MEUs, thus sanitizing the operating area. Deception, decoys, noise reduction systems such as Prairie Masker and radar-flooding hold down tactics can all be used to complicate and confuse the submarine's targeting solution. But this is not a paper on ASW tactics. I will not attempt to present specific actions to be taken on station, but rather talk to the issues which will give the ASW Warfare Commander the correct mix of forces and personnel to execute those tactics.

RECOGNIZE THE PROBLEM. In order to solve the problem, the first and most important step is to recognize that there is a problem. As I hope I have demonstrated in this paper, there is indeed a serious and significant submarine threat which will have to be dealt with in future conflicts. But in the current budget climate, our previous fixation on the Soviet threat has come back to haunt us. "Up to the failed Kremlin coup in August, the U. S. Navy had been accelerating ASW programs. Congress, however, searching for budget-reducing peace dividends, is now reexamining virtually every big-ticket Navy program."²⁴ Compounding this problem is the "What have you done for me lately?" syndrome. Navy professionals are keenly aware of the fact that the most important lesson to be learned from DESERT SHIELD/DESERT STORM may well be that we did not learn a great deal. Among other things, ASW was not tested at all in the entire conflict. The important question to ask is, "How would the presence of a credible submarine threat have affected our ability to conduct the naval mission?"

"Over 90% of all cargo was transported into theater via sealift;"²⁵ Would we have been able to accomplish the early arrival of Maritime Prepositioning Ships (MPS) and Fast Sealift Ships (FSS)? Would Carrier Battle Groups have been able to operate in the Arabian Gulf had there been an Iraqi submarine fleet to deal with? In the blizzard of post-war analysis conducted in the public forum, little if any mention is made of this issue. We must not allow superficial analysis

of a unique, very atypical conflict to drive decisions concerning acquisition, and present and future force structure. Internecine budget competition among the services can not blind us to the fact that ASW remains a critical component of our national military strategy.

TRAINING. ASW is not like riding a bicycle. Our skills have been kept sharp by constant meaningful training. The reduction of Soviet out of area submarine operations must not be allowed to cause a reduction in ASW training. In addition to working against our own nuclear submarine force, we must pursue every opportunity to exercise ASW forces against diesel submarines operated by our allies. In addition to valuable interoperability experience in coalition warfare, we need to build the data base of experience against the conventionally powered submarine that has been virtually ignored for so many years. We must continue to push the envelope of sensor and simulator technology. Next generation ASW systems will be extremely complex, incorporating higher quality and more inter-sensor signal processing, and dealing with far more complex characteristics, such as shallow water, marginal ice zones, thermal fronts and eddies and variable ocean floors.²⁶ ASW forces must be trained and equipped to deal with any threat in any environment.

BUILDING DOWN. As the Navy gets smaller, tactics and doctrine must also change to reflect the size and type of force being called upon to perform a given mission. CVEGs will

have fewer escorts, the Maritime Patrol Aircraft force has already been reduced, and the concept of multi-mission capable platforms will require the ASW Commander to compete for scarce assets with other Warfare Commanders. On the plus side, increased integration of the SSN into the Battle Group proper would provide a formidable asset to increase the ASW prowess of the Battle Group. In any case, the concept of a layered, multi-platform defense in depth must take into account the fact that there may be fewer, if perhaps more capable, layers and that the traditional ASW only platform will have other missions to consider as well.

The submarine threat is real. It hasn't gone away with the USSR, the Warsaw Pact and the Berlin Wall. Like the submarine itself, it lies below the surface ready to strike those who are not aware of and willing to counter its presence.

NOTES

1. U. S. Office of Naval Operations, Strategic Concepts of the U. S. Navy, NWP 1 (Rev. A) p. 1-3-1.
2. Ibid.
3. Fitzgerald, James and Benedict, John, "There is a Sub Threat," U. S. Naval Institute Proceedings, August 1990, p. 58.
4. NWP 1 (Rev. A), p. 1-4-9.
5. Holland, W. J. Jr., "SSN: The Queen of the Seas," Naval War College Review, Spring 1991, p. 113.
6. U. S. Department of Defense, 1991 Military Forces in Transition, Washington 1991, p. 34.
7. Ibid., p. 24.
8. Ibid., pp. 34, 54.
9. Lok, Joris Jansen, "USA Revises Third World Threat," Jane's Defence Weekly, 23 March 1991, p. 431.
10. Ibid.
11. Fitzgerald and Benedict, p. 58.
12. Martins, Dean, "Running the SSN Race," Jane's Defence Weekly, 13 July 1991, p. 59.
13. Ibid.
14. Zimmerman, Stan, "Modern Nonnuclear Subs Are Cheap and Deadly," Armed Forces Journal International, June 1991, p. 76.
15. "ASW Tactics and Weaponry For the 1990s," Asian Defence Journal, September 1991, p. 64.
16. Fitzgerald and Benedict, p. 61.
17. Ibid., pp. 60-62.
18. Office of the Chairman, Joint Chiefs of Staff, National Military Strategy of the United States, January 1992, p. 11.

19. Fitzgerald and Benedict, p. 62.
20. Stetson, Jeanne H., "Defense of Shipping in the Western Hemisphere A Second Look," U. S. Naval War College Review, Spring 1992, p. 109.
21. Thamm, Gerhardt B., "Shallow Water Antisubmarine Warfare," U. S. Naval Institute Proceedings, February 1991, p. 94.
22. Ibid.
23. Fitzgerald and Benedict, p. 63.
24. Michelson, Chad, "Changing Undersea Threat Roils ASW Training Waters," Armed Forces Journal International, November 1991, p. 46.
25. Office of the Chief of Naval Operations, The United States Navy in Desert Shield Desert Storm, Washington, 15 May 1991. p. vi.
26. Ibid.

BIBLIOGRAPHY

Bolger, Daniel P., Americans at War, 1975-1986: An Era of Violent Peace, Novato CA: Presidio Press, 1988.

Fitzgerald, James and Benedict, John, "There is a Sub Threat", U. S. Naval Institute Proceedings, August 1990.

Lawton, Frank C., "The Third World Submarine Threat - Another Great Equalizer", Unpublished Research Paper, U. S. Naval War College, Newport R. I.: 1991

Holland, W. J. Jr., "SSN: Queen of the Seas", Naval War College Review, Spring 1991.

Lok, Joris Jansen, "USA Revises Third World Threat", Jane's Defence Weekly, 23 March 1991.

Martins, Dean, "Running the SSN Race", Jane's Defence Weekly, 13 July 1991.

Michelson, Chad, "Changing Undersea Threat Rolls ASW Training Waters", Armed Forces Journal International, November 1991.

_____. Office of the Chairman, Joint Chiefs of Staff, National Military Strategy of the United States, January 1992.

_____. Office of the Chief of Naval Operations, The United States Navy in Desert Shield Desert Storm, Washington, 15 May 1991.

Preston, Anthony, "Naval Lessons of the Gulf War", Asian Defense Journal, January 1992.

_____. "ASW Tactics and Weaponry for the 1990s", Asian Defense Journal, September 1991.

_____. "Submarine Armaments", Asian Defense Journal, November 1991.

Sharpe, Richard, Editor, Jane's Fighting Ships 1991-92, Surrey, UK.

Stetson, Jeanne H., "Defense of Shipping in the Western Hemisphere A Second Look", Naval War College Review, Spring 1992.

Thamm, Gerhardt B., "Shallow Water Antisubmarine Warfare", U. S. Naval Institute Proceedings, February 1991.

_____. U. S. Department of Defense, 1991 Military Forces in Transition, Washington, 1991.

_____. U. S. Office of Naval Operations, Strategic Concepts of the U. S. Navy, NWP 1 (Rev A).

Zimmerman, Stan, "Modern Nonnuclear Subs are Cheap and Deadly", Armed Forces Journal International, June 1991.