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ASW AND SUPER POWER STABILITY - THREE YEARS ON

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STRATEGY AND CAMPAIGN DEPARTMENT

REPORT 8-89

06 DECEMBER 1989



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REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION / AVAILABILITY OF REPORT Distribution Statement A. Approved for Public Release; Distribution Unlimited.	
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE		5. MONITORING ORGANIZATION REPORT NUMBER(S)	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)		7a. NAME OF MONITORING ORGANIZATION	
6a. NAME OF PERFORMING ORGANIZATION Center for Naval Warfare Studies Strategy & Campaign Department	6b. OFFICE SYMBOL (If applicable) 30	7b. ADDRESS (City, State, and ZIP Code)	
6c. ADDRESS (City, State, and ZIP Code) Naval War College Newport, RI 02841-5010		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8a. NAME OF FUNDING / SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	10. SOURCE OF FUNDING NUMBERS	
8c. ADDRESS (City, State, and ZIP Code)		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) ASW AND SUPERPOWER STRATEGIC STABILITY--THREE YEARS ON (U)			
12. PERSONAL AUTHOR(S) Donald C.F. Daniel			
13a. TYPE OF REPORT FINAL	13b. TIME COVERED FROM TO	14. DATE OF REPORT (Year, Month, Day) 1989 DEC 06	15. PAGE COUNT 28
16. SUPPLEMENTARY NOTATION The contents of this paper reflect the personal views of the author 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	SUB-GROUP	
		Anti-Submarine Warfare (ASW), Strategic ASW, Anti-SSBN Operations, Strategic Stability.	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) A paper prepared for delivery to the Annual Convention of Dutch Naval Officers of the Operational Branch at Den Helder, Holland. The author discusses his 1986 book, "Anti-Submarine Warfare and Superpower Strategic Stability" which addresses whether American or Soviet ASW developments would so threaten each other's ballistic missile submarines as to be strategically destabilizing. The author wrote this paper from the perspective of new information which has become public in the three years since the book was written.			
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
22a. NAME OF RESPONSIBLE INDIVIDUAL Peter A. Rice, Dep. Dir., Strategy & Campaign		22b. TELEPHONE (Include Area Code) (401) 841-4208	22c. OFFICE SYMBOL 30A

ASW AND SUPERPOWER STRATEGIC STABILITY -
THREE YEARS ON

A Paper Prepared for Delivery to the
Annual Congregation of Dutch Naval Officers
of the Operational Branch at
Den Helder, Holland

6 December 1989

by

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Three years ago I published a book entitled *Antisubmarine Warfare and Superpower Strategic Stability*, and in it I addressed whether American or Soviet ASW developments would so threaten each other's ballistic missile submarines (or SSBNs) as to be strategically destabilising.⁽¹⁾ I have been asked to speak to you about that topic today, but to do so from the perspective of new information which has become public in the three years since the book appeared.

Let me begin by defining what I mean by a strategically destabilising threat. It is one which significantly increases the prospect of nuclear war between the two military superpowers. Those who fear that ASW developments are potentially destabilising usually focus on one or two scenarios. In the first or surprise strike case, one of the superpowers becomes so good at ASW that it becomes tempted to engage in a disarming surprise attack against the other's ballistic missile submarines and land-based strategic forces. In the second scenario, termed the "use or lose" case, the superpowers are in a conventional war, and one of them is losing SSBNs at such a rate that it fears the slow but sure loss of its entire sea-based deterrent. As a result, according to the scenario, it becomes tempted to fire to use the missiles on its remaining submarines

1. Donald C. Daniel, *Anti-Submarine Warfare and Superpower Strategic Stability* (London: Macmillan, 1986; No. 24 in the Studies in International Security sponsored by the International Institute for Strategic Studies).

rather than risk losing more to its opponent's conventional ASW operations.

Whatever the scenario, very few American and Soviet submarines need survive to guarantee strategic stability, especially since both superpowers possess numerous land-based mobile strategic forces. Each American SSBN, of which there are now 35, has 16 or 24 missiles, and each missile is MIRVed, i.e., each is fitted with multiple independently-targetable re-entry vehicles or warheads. Any one boat could easily have 100 to 200 warheads with each warhead having from two to eight times the destructive power of the Hiroshima weapon. Similarly Soviet boats, of which there are 62 in the SALT-accountable category, can have from 12 to nearly 200 warheads with even greater destructive power. As the USSR modernizes its force, the SSBNs with single-warhead missiles are being retired in favor of those with MIRVs.

The international events which have transpired since the book was published make consideration of scenarios for the destruction of SSBNs seem more and more incredible, but when I was researching and writing in the first half of the 1980s, many people from the right to the left end of the political spectrum took such scenarios very seriously indeed. My study concluded, however, that superpower ASW developments were not strategically destabilising and would not be for the foreseeable future. I continue to believe that for reasons which have to do more with superpower capabilities than with intentions; nevertheless, it is

useful to begin by considering intentions. In other words, if a general war were to break out between the superpowers soon, incredible as it seems, would either engage in a large-scale, dedicated campaign to eliminate the other's SSBNs?

A review of Soviet literature shows unquestioning acceptance of the view that warfare against strategic missile submarines --which I shall term "strategic ASW"-- is both legitimate and necessary to "prevent or minimize the damage which can be inflicted on a state by nuclear missile strikes by submarines".⁽²⁾ The Navy's mission statements characteristically give highest priority to two tasks. One is blunting enemy nuclear attacks against the homeland from the direction of the sea, and the other is insuring that the USSR's own strategic submarines are ready to execute orders to launch their missiles. For about two decades the task of insuring that the USSR's own submarines are ready to launch has had pride of place in being listed first in Russian writings,⁽³⁾ but one recent major naval book, entitled *The Navy: Its Role and Prospects for Development and Employment*, reversed the order consistent with the Gorbachevian emphasis

2. R. Adm. N.P. V'yunenkov, Captain 1st rank B.N. Makayev, and Captain 1st rank V.D. Skugarev, *The Navy: Its role, Prospect for Development, and Employment* (Moscow: Military Publishing House, 1988; transcript of private translation). Citation is from section, "The Navy in Repelling an Enemy Aerospace Attack", in chapter entitled "Problems of the Navy's Employment".

3. See, e.g., Adm. Sergei Gorshkov, *Sea Power of the State* (Moscow: Military Publishing House, 1976), pp. 360-361.

on a defensive military strategy.⁽⁴⁾ That is, strategic ASW was given pride of place. It remains to be seen whether this indicates a new trend and what it may mean for the operations of Soviet forces.

The priority which writings assign the strategic ASW mission suggests that considerable resources would be devoted to its performance should war break out in the near term. There may indeed be considerable effort to destroy or disrupt the facilities, forces, means, or installations which support the activities of enemy strategic submarines in order to force them to abandon or alter planned strikes. As far as immobilizing deployed submarines, however, the expectation in Western intelligence circles is that this would be primarily the task of the Soviet Navy and that few of the Navy's resources would actually be dedicated to it. The reason is simply that present Soviet prospects for success are so small as to make it nonsensical to devote many resources to the task.

My point here is that there is a disconnect between what might be called the declaratory strategy with its high priority on strategic ASW and the actual low operational priority presently assigned to destroying deployed Western SSBNs. How is one to explain this inconsistency? In this writer's mind, it is partly a question of comparing what the Soviets would like to do--and have talked of doing for over two decades--with what they would settle with for lack of

4. V'yunenko et al., *The Navy*, op.cit. note 2, section entitled "The Navy in Repelling an Enemy Aerospace Attack".

better capability. The declaratory strategy constitutes a goal to strive for not only operationally but also in the programming and budgeting decisions which must precede the development of the necessary operational capabilities. Soviet ASW research is regarded as both extensive and intensive, investigating a wide range of possibilities. According to Western intelligence specialists, it simply has not to date produced the kinds of results that would justify dedicating considerable operational resources to strategic ASW.

As for the Americans, they said relatively little officially about strategic ASW from the mid-1960s through the early 1980s, but beginning in 1983 US naval leaders increasingly raised the possibility of an anti-SSBN campaign. For example, the then CNO, Admiral James Watkins, announced to the press that US ASW submarines had begun training to hunt out Soviet SSBNs seeking wartime sanctuary under the Arctic ice, but he refused to discuss what priority might be assigned to this task: "All I'm saying is that if there are forces up in that area..., we'd better know how to fight them."⁽⁵⁾

Following through on an initiative begun by his predecessor, Watkins oversaw the formal codification of the US Maritime Strategy. He published an unclassified version of the strategy in January 1986 where he justified going

5. As quoted in G.C. Wilson, "Navy Is Preparing for Submarine Warfare Beneath Coastal Ice", *Washington Post*, May 19, 1983, p. 5.

after the SSBNs.⁽⁶⁾ A major reason, he said, is that this would force the Soviet Navy to devote general purpose submarines to protecting the missile boats, thereby denying tactical submarines the opportunity to interdict Western sea lines of communications.

Watkins' successor, Admiral Carlisle Trost, has eschewed specific references to anti-SSBN warfare. He fully supports putting the Soviet Navy on the defensive so as to keep it away from Western sea lines, but he also cautions against being wedded to specific options. He argues for flexibility, for being prepared to do whatever circumstances demand, and, for the sake of deterrence as well as wartime advantage, he emphasizes as well the value of keeping the Soviets uncertain about how US naval forces might be employed.⁽⁷⁾ Thus, unclassified Maritime Strategy presentations prepared by Trost's staff make no explicit mention of anti-SSBN operations, but the possibility that they could occur is implied just enough to fuel uncertainties in the minds of Soviet planners.

Consistent with the Trost approach is a recent article by two naval officers, one a submariner rear admiral serving as senior military assistant to the Secretary of Defense. In "The Maritime Strategy: Looking Ahead," the authors state:

6. Watkins, "The Maritime Strategy", in special supplement to the *US Naval Institute Proceedings*, January 1986, pp. 2-17.

7. Trost, "Strategic Options: Bringing Down the Bird of Thought", Speech delivered at the Current Strategy Forum, US Naval War College, Newport, RI, June 18, 1987.

The U.S. ability and intent to attack Soviet SSBNs may or may not be the principal element of U.S. strategy, but weakening the Soviet SSBN system by reducing communications, sinking supporting surface and submarine warships, and generally degrading the security of Soviet [SSBN] bastions will keep their navy at home, away from Western SLOCs.⁽⁸⁾

In short, there is a definite hedging in this statement about the priority assigned to attacking SSBNs themselves.

In the end it not naval officers in the Pentagon who decide how the Navy is used in a war. The Chief of Naval Operations, e.g., is not an operational commander, and the Maritime Strategy is not a war plan. Rather, it is an advisory set of guidelines offered for the benefit of those, from the President on down, who do decide how forces will be employed. It is impossible to predict what a President might decide about strategic ASW, but there is nothing in the recent posture statements of the present and previous commanders of NATO's Atlantic forces and US Pacific forces to suggest that they intend to conduct or to advocate a strategic ASW campaign.

The best indicator of where US policy stands may possibly be found in the writings of retired Navy Secretary John Lehman who, while in office, strongly advocated a forward aggressive campaign to tie down the Soviet submarine

8. R. Adm. William Owens and Commander J.A. Moseman, "The Maritime Strategy: Looking Ahead", *US Naval Institute Proceedings*, February 1989, p. 29.

fleet in a conflict. In his recently published memoirs he addressed those who said that the US Navy ought not to seek out Soviet SSBNs in war. He replied that "Soviet missile submarines are very difficult to distinguish from other...Soviet...submarines" and that they all carry tactical weapons and sensors which they could use against American ASW forces.⁽⁹⁾ Hence, he concluded, "[i]f the Soviet strategic submarine is encountered by an American [ASW] attack submarine once hostilities have begun, it will be taken under attack...." In short, Lehman was articulating the policy that all submarines are fair game, and that policy has been reiterated by so many other spokesmen that it probably does constitute operational doctrine which would be applied if war occurred in the near term.

As for the possibility of a more "active campaign to hunt Soviet missile boats", Lehman adds that this "is another matter entirely. While a commander in chief could order this, it is not something that the [US] maritime strategy would normally do because that would subtract SSNs from the primary conventional tasks of the strategy."¹⁰

In sum, US policy accepts that all submarines are fair game. While public presentations of the USN's Maritime Strategy through the mid-1980s went further and explicitly raised the possibility of a dedicated strategic campaign

9. Lehman, *Command of the Seas* (New York: Charles Scribner's Sons, 1988), p. 149.

10. *Ibid.*

against Soviet SSBNs, recent official statements have been more muted. In addition, John Lehman's post-retirement position is that such a campaign is not now official policy.

If war should occur ten years or so from now, however, both Moscow and Washington will make their decisions about the priority for strategic ASW dependent, among other things, upon their evaluation of the prospects and consequences of success. What are those prospects?

If success is defined as eliminating most if not all of an adversary's deployed SSBNs, then both Soviet and American prospects are very poor against an enemy vigilantly determined to insure the survivability of its strategic submarines.

Three arguments underlie this proposition:

**The first is that antisubmarine warfare, which is already difficult enough against general purpose submarines, is exponentially more difficult against ballistic missile submarines.*

**The second is that the much-talked about revolutionary breakthrough in ASW detection has not yet materialized, and the probability is low that it will in the foreseeable future.*

**The third reason is that, even if there were a detection breakthrough, there are countermeasures available to ballistic missile submarine forces to minimize its impact.*

I will deal with each reason in turn. The first is simple and needs little explication. My contention is that *antisubmarine warfare, already difficult enough against general purpose submarines, is exponentially more difficult against ballistic missile submarines.* Most general purpose submarines have to approach to within several thousand meters of their target in order to attack it. This leaves them open to potential detection by tactical ASW forces which may be screening or operating in the target's vicinity. In contrast, US and Soviet ballistic submarines can stand off thousands of kilometers from their targets and still strike at them. Additionally, beyond launching their missiles, their main mission is to evade detection; unlike tactical submarines tasked with seeking out and engaging enemy naval forces, SSBNs actively avoid areas of hostile naval activity. They seek out safe havens and hide behind the oceanic equivalent of trees and bushes.

There were many expressions of concern, in the mid-1970s through the mid-1980s in particular, that one or both of the superpowers might well be on the way to a submarine detection breakthrough that would minimize the difficulties of finding SSBNs. *Such a breakthrough has not materialized, and the probability is low that it will in the foreseeable future.* Indeed, compared with the early to mid-1980s, fewer people in the West argue today that Soviet or US technology will soon or inevitably make the oceans transparent. This is probably due to an increase in appreciation of the

physics of detection phenomena and of the economic, engineering, operational difficulties which must be overcome before a speculatively plausible scheme for detection can be actualized into a reliably practical way of doing business. Since the publication of my book, others have appeared and they too focussed on the physical and operational factors conditioning prospects for success or failure of anti-SSBN warfare.⁽¹¹⁾ While each author approached the question in his own way, we all generally reached the same conclusions. Space does not allow a review of all the evidence, but I can give abbreviated representative arguments.

Let us consider first the question of the oceans becoming acoustically transparent since acoustic signals which can travel long distances are still the only basis today for wide area detection of submarines. A consideration of relying upon acoustics is that--as all of you know--the signal propagates in a complex environment where it is scattered, echoed, absorbed, ducted, refracted, blocked, and generally attenuated, and where, to be heard, it must compete with ambient or background noise which is increasing due to oil drilling and other factors. Generally the shorter the distance the acoustic signal travels, the less significant is the impact of the environment upon its

11. Most notable are Tom Stefanick, *Strategic Antisubmarine Warfare and Naval Strategy* (Lexington, MA: Lexington Books, 1987), Mark Sakitt, *Submarine Warfare in the Arctic: Option or Illusion* (Palo Alto, CA: Center for International Security and Arms Control, 1988), and George Lindsey, *Strategic Stability in the Arctic*, Adelphi Paper No. 241 of the International Institute for Strategic Studies (Oxford: Brassey's, 1989).

ability to be heard and upon the ability of processing systems to determine the path which it travelled. Thus one method for achieving a transparent ocean is to blanket it with acoustic sensors placed very closely together. For example, Richard Garwin has offered that the only foolproof acoustic detection system would be based on short-range direct-path hydrophones placed in interlocked ten kilometer grids.⁽¹²⁾ As Garwin himself points out, deploying such a system is simply not practical. It would also be extremely expensive, and there is no indication that any state is considering it. Rather the thrust behind developing wide-area acoustic monitoring systems has been and remains taking advantage of the long-range propagation of sound. If that route is to serve as a basis for making the oceans transparent, however, it is necessary to have the data and models that explain and predict that propagation.

The United States remains the world's leader in long-range acoustic detection, and it was claimed as early as 1974 that its modelling and prediction were (or would soon be) good enough to allow it to track all deployed Soviet SSBNs. This has not occurred. Instead, scientists readily acknowledge that the more they know about long-range acoustic propagation, the more they realize how complex is the ocean environment conditioning it. Over the course of the 1970s oceanographers modified the "classic view of the ocean...used by acoustic engineers for listening to

12. Garwin, "Will Strategic Submarines Be Vulnerable?", *International Security*, Fall 1983, p. 66.

subs."(13) The classic view characterized the oceans as a "relatively stable mass... --turbulent at the surface...and criss-crossed by great currents..., but generally constant and predictable, especially in deep waters." In the modified view there is heightened appreciation for the degree to which physical ocean processes can be unstable, inconstant, and difficult to model as well to predict. Scientific progress in developing a dynamic three dimensional picture of interacting ocean processes will almost certainly remain incremental. For example, it is only in recent years that "enough has been learned...to show that descriptions of ocean circulation in current textbooks are erroneous or grossly incomplete. Broadly speaking, the surface currents have been mapped, but even major deep currents may remain undiscovered."(14) The development and relating together of acoustic models relevant to submarine detection, furthermore, is itself a complex process, for each model is

characterized by 'domains of applicability.' That is, because of the underlying physics and the assumptions imposed in order to achieve a tractable mathematical solution, a...model is...limited to certain acoustic frequencies and certain environmental geometries (e.g., ...deep versus shallow water).(15)

13. J. Tierney, "The Invisible Force", *Science*, November 1983, p. 74.

14. Walter Sullivan, "Vast Effort Aims to Reveal Ocean's Hidden Patterns", *The New York Times*, July 28, 1987, p. C3.

15. Paul C. Etter, "Underwater Acoustic Modeling for Antisubmarine Warfare", *Sea Technology*, May 1989, p. 36.

All the above considerations affect not only passive acoustics, but also active acoustics as well. In addition, severe problems of reverberations and naturally-produced false alarms mitigate against active acoustics ever becoming an effective long-range wide-area search mechanism.

In short, whether one is talking of active or passive measures, considerations of physics and nature alone put into doubt the prospect of acoustically transparent oceans in the foreseeable future. The same applies with non-acoustic technologies.

As far as wide area search is concerned, there is a fundamental difference between acoustic and non-acoustic methods. Wide-area acoustic detection relies on the signal traveling some distance, often considerable, to a sensor which is either stationary or moving only slowly through the water. In contrast, wide-area non-acoustic detection would require that the sensor move quickly to cover as much search area as possible since non-acoustic signals generally do not propagate long distances. In short, one must think in terms of taking the sensor to the signals, some of which can persist for quite some time in the submarine's track. Thus, all wide-area nonacoustic detection schemes involve the use of aircraft or satellites as sensor platforms.

Numerous non-acoustic signal and sensor alternatives have been suggested: e.g., the use of low-light image intensifiers to detect biological luminescence, the use of blue-green lasers to detect a submarine's hull or turbulent

wake, and the use of infrared or passive microwave radiometers to find thermal anomalies. Of the non-acoustic alternatives there is one which seems particularly attractive upon initial consideration and which continues to receive significant attention. This is the use of satellite-based synthetic aperture radars to detect ocean surface phenomena associated with internal waves produced by submerged submarines. The Soviets are often viewed as posing the potentially greater threat here. A satellite-based system is attractive, especially for a country such as the Soviet Union which has no foreign basing network for ASW aircraft, because a satellite can quickly overfly any part of the globe. A radar is attractive because it is less affected by clouds, rains, or other atmospheric conditions compared to devices relying on the infrared or optical portions of the electromagnetic spectrum. A synthetic aperture radar or "SAR" is attractive because it is an exception to the rule that the farther away a sensor is from an observable, the more difficult it is to sense and discriminate it. A SAR takes multiple looks at any one spot and by exploiting the Doppler shifts, it produces what is analogous to a composite picture with a resolution "of perhaps one foot".⁽¹⁶⁾ Ocean-surface phenomena are attractive because nearly all satellite-based electromagnetic sensors can essentially surveil only the surface. Finally, internal wave surface phenomena are

16. Daniel Charles, "Spy Satellites: Entering a New Era", *Science*, March 24, 1989, p. 1541.

attractive because: (1) submarines leave behind them a wake of internal waves (i.e., vertical oscillations of water beneath the surface); (2) naturally-produced internal waves can persist for hours or days; (3) they can cause changes in the reflectivity of the ocean surface; and (4) those changes can be detected by SARs as well as other sensors.

Evidently it remains unclear to what degree and under what conditions submarines generate persisting surface effects which are readily and consistently distinguishable from those produced by nature. Additional research is also needed to understand fully the mechanisms which allow SARs to image the surface manifestations.

Assuming that submarines do produce readily and consistently distinguishable phenomena, there would still be the problem of having enough satellites and enough communication and processing capability to image and identify them. For instance, a satellite sweeping a ground track of 148 km could take as much as 18 days to revisit the same spot. SAR sweep widths are on the order of 100 km and geometric constraints limit the possibilities of significantly increasing that coverage. Thus many satellites would be required for a true wide-area search capability. For example, please imagine a proposed ballistic missile submarine deployment area encompassing waters off both US coasts out to 1000 to 1500 nautical miles. This would allow the submarines two to three million nautical miles in which to patrol. Imagine also a satellite

with roughly a 100 kilometer sweep width circling the earth every 90 minutes. One satellite would cut across the area six or seven times a day, and each overflight would be four to five minutes long for a daily total of only 24-35 minutes. In other words, there would be 23 and 1/2 hours of no coverage. Eight satellites would spend 8 of every 90 minutes or slightly over two hours per day over the area; 12 satellites spend 16 of every 90 minutes for 4.5 hours; and 24 satellites, 32 out of every ninety minutes or roughly one-third of each day. Even with multiple satellites, please recall that the width of water surveilled by any one satellite remains only 100 km.

In short, many satellites would be needed, but there are constraints on how many any country would be willing to deploy. One is that each satellite is enormously expensive. In addition, the greater the number in orbit, the greater the coordination difficulties and the greater the strain on communication and signal processing support facilities. SARs are prodigious producers of data. For example, one expert compared a recently-launched SAR, termed "Indigo-Lacross", to space telescope instruments in order to emphasize the impact that SARs have upon supporting communication and computing systems:

The peak rate, he said, at which [space telescope] instruments will send data through [data relay satellites]--1 million bits per second--is a mere trickle compared with the flood of data generated by

new spy satellites. Synthetic aperture radars like Indigo-Lacrosse, in particular, tend to swamp any available data relay, because transmission capacity and available computing power, not the radar itself, generally limit the quality and size of the images that the system can produce.⁽¹⁷⁾

In sum, as a means of turning the oceans transparent, the much-vaunted SAR/internal wave alternative is a prime example that pursuing the non-acoustic route means, as a Congressional panel put it, "pressing the outer limits of science and technology--from an understanding of the underlying physics of the various phenomena, all the way to highly advanced sensors and data-processing equipment and techniques."⁽¹⁸⁾ "Apart from the Strategic Defense Initiative," the Panel went on, "this work is probably the greatest technological challenge facing the Department of Defense."

Let us assume, however, that some technological acoustic or non-acoustic breakthrough does occur. Would this necessarily be destabilizing? I do not think so, for even if there were a detection breakthrough, there are countermeasures available to ballistic missile submarine forces to minimize its impact.

17. *Ibid.*

18. V. Adm. E.A. Burkhalter, Dr. John S. Foster, Jr., Dr. George H. Heilmeyer, et al., *Report of the Advisory Panel on Submarine and Antisubmarine Warfare to the House Armed Services Subcommittees on Research and Development and Seapower and Critical Materials*, March 21, 1989, p. 6.

This argument subsumes three overlapping points. One is that there are two sides to the ASW research coin. That is, as a nation learns what it takes to make an adversary's submarines vulnerable, it learns also how to minimize the vulnerabilities of its own submarines to the same threat. Second: as it learns about an adversary's actual ASW capabilities and methods, it can tailor a program against them. For example, the Walker and Whitworth spy ring provided the USSR with information which directly affected the design and operation of its submarines, considerably setting back advantages the US had in the ASW battle. Third: even if a country does not fully understand all the dimensions of an adversary's ASW threat, it can still take active measures to degrade it.

Let me take you through six categories of countermeasures. One which has well served both Western and Soviet strategic submariners is staying away from areas monitored by adversary wide-area ASW sensors. The USSR's capabilities for wide-area ASW surveillance do not extend very far beyond waters adjacent the homeland, and unless it develops an overhead non-acoustic system for open-ocean search, its capabilities should remain geographically-limited. The range of the missiles on US SSBNs insures that the submarines should never for the foreseeable future have to approach so close to the Soviet homeland as to run the risk of wide-area detection. The US boats have tens of

millions of square miles in which they can patrol and still be within range of their targets.

Similarly, the Soviets have equipped their submarines with missiles whose ranges are long enough to allow the submarines to remain in protected havens, including under ice, near or directly adjacent the homeland where communication and navigation support is facilitated. In an Adelphi paper published just this year and entitled, *Strategic Stability in the Arctic*, the author, George Lindsey, concludes, "As regards oceanographic conditions..., the seas on the periphery of the USSR provide ideal bastions" for SSBNs.⁽¹⁹⁾ This is particularly true if the submarines are in shallow waters under or on the edge of the ice where there is high ambient noise and greatly variable oceanographic conditions. Even low-frequency acoustic signals, which generally travel farthest, attenuate quickly there and propagate only short distances. If ordered to fire, the under-ice submarines would exit to open water or seek holes or ice thin enough to break through. The distribution of holes and thin ice is random, but even in winter "they seem to appear with sufficient frequency to satisfy operational needs...."⁽²⁰⁾ It is not surprising that no one has ever claimed that the United States has extended its wide area acoustic detection system to those waters. It would seem impossible for it covertly to install

19. Lindsey, *Strategic Stability*, op. cit., note 11, p. 55.

20. W. Ostreng, "The Strategic Balance and the Arctic Ocean", *Co-operation and Conflict*, No. 1, 1977, p. 44.

such a system near the Soviet homeland or under the ice, much less upkeep, monitor, and adjust its operating parameters to deal with constantly changing environmental conditions. Making it even more improbable that any such system would ever be installed is that it would have to be extremely extensive and dense because of the limited acoustic propagation.

The same applies to any attempt to install any undersea non-acoustic system. None has extensive detection ranges, and, as for overhead detection, it is unrealistic to expect that US surveillance aircraft would regularly operate over Soviet adjacent seas. Even if they did, all the Soviets would need to do is keep their strategic submarines moving under the ice cover to frustrate any attempts by the aircraft to detect or attack them. The same solution would frustrate US resort to any satellite-based detection systems should they ever become operational.

A second countermeasure is designing submarines which minimize detection possibilities. There are options available here for almost any type of detection technology. Most relevant today are measures to minimize submarine self-noise so as to counter adversary listening devices. The result can be a nuclear-powered submarine so quiet at slow speeds as to make it highly difficult indeed to be heard. American submarines are already that quiet, and the Soviet trend is causing great frustration to the Western ASW community. An advisory panel to the US House of

Representatives Armed Services Committee argued earlier this year that the United States "must, in effect, 'start over' with new approaches to ASW", and it must do so "because the Soviet Union has begun to produce quiet submarines." (21)

Both active acoustic and non-acoustic techniques would render submarine quieting irrelevant. A design measure for countering active acoustics is building a small SSBN to minimize acoustic return. Having a small, highly streamlined, deep-diving boat might also mitigate the generation of internal wave, ocean surface phenomena. To date, neither superpower has found it necessary to build small SSBNs. Indeed, the trend has been in the opposite direction, suggesting either that Western and Soviet designers see no detection threat from such systems or that they believe they can counter threats in other ways.

A third countermeasure is operating submarines so as to minimize detection possibilities. Moving slowly minimizes the noise a submarine puts in the water. Moving slowly and staying deep can minimize many non-acoustic signals, including, some believe, the surface manifestations of internal wave generation. Operating in waters with a high sea state or under ice can negate detection by overhead systems. Much of the oceanographic effort carried out by the US Navy, and presumably by its Soviet counterpart as well, is finding ocean areas such as eddies where submarines can hide most effectively.

21. Burkhalter et al., *Report of the Advisory Panel*, op. cit. note 18, p. 2. of Executive Summary.

A fourth countermeasure is utilizing general purpose forces to protect strategic submarines. The US has provisions to do so when the submarines enter or leave port. The Soviets go much farther to provide what they term "combat stability" to their missile submarines. A major mission of general purpose forces is securing the havens where SSBNs patrol, and in crisis and war that objective would dovetail with their establishing a maritime defense perimeter--analogous to the land buffer provided by Eastern Europe--around the homeland. The strategic submarines deploy from Northern and Pacific Fleet ports, and the Soviets are expected to commit "virtually all available surface combatants and combat aircraft, and about 75 percent of available attack submarines," in those Fleets to operations in the perimeter.⁽²²⁾ They "would form barriers along the seaward approaches to protect the Soviet homeland and strategic submarines from enemy forces."

These operations would make it impossible for any but Western nuclear-powered attack submarines, or SSNs, to challenge the havens, and theirs would not be an easy task. They would have to contend with an echeloned ASW defense of Soviet surface, subsurface, and air ASW assets, including mines, and fixed acoustic sensors. Because US submarines are so quiet and because acoustic propagation conditions in

22. Statement of Rear Admiral William O. Studeman, US Navy, Director of Naval Intelligence, before the Seapower and Strategic and Critical Materials Subcommittee of the House Armed Services Committee, on Intelligence Issues, March 1, 1988, p. 4.

the Soviet near seas are generally poor, it makes sense that the Soviets also employ fixed non-acoustic sensors.

Lindsey, e.g., states that they have installed magnetic induction loops at narrow choke points so as to detect the passage of submerged submarines.⁽²³⁾ They also use aircraft with magnetic or other sensors which are effective in limited area or barrier operations. A recent Director of US Naval Intelligence tells us, furthermore, that the most modern and powerful of the USSR's strategic submarines might be accorded "a heavier level of dedicated escort by SSNs".⁽²⁴⁾ I agree with Mark Sakitt's conclusion in his 1988 monograph on *Submarine Warfare in the Arctic* that such Soviet countermeasures would offset the qualitative superiority possessed by the US in SSNs, which, as I said earlier, are the only ASW platforms the US has which can be expected to operate in the Soviet SSBN bastions.⁽²⁵⁾

A fifth type of countermeasure is one which is highly useful even when one does not fully understand how an adversary might conduct ASW. This is the use of decoys and the deliberate generation of false alarms. In the late 1970s, I led a team which conducted a great deal of research on the subject of military deception, and I learned that, especially if one cannot hide one's own high value units, one can still frustrate an enemy's intelligence and

23. Lindsey, *Strategic Stability*, op. cit., note 11, p. 26.

24. Statement of Rear Admiral William O. Studeman, op. cit., p. 6.

25. Sakitt, *Submarine Warfare in the Arctic*, op.cit., note 11, p. 2.

operational resources by giving them too many targets, nearly all of which are false.⁽²⁶⁾

Finally, a state with strategic submarines might implement measures, once war begins, to attack the command, control, and communication systems linking together its adversary's wide area search, analysis, and prosecution forces. These attacks can be effective even when one does not fully comprehend how an adversary is searching for submarines.

With vigilant implementation of measures such as outlined above, a state possessing strategic submarines can just about guarantee the survival of many if not most of them, and with the most modern boats carrying anywhere from 64 to about 200 warheads, the survival of even one boat is strategically significant.

I believe that my general conclusion will hold true even after the implementation of a START treaty which is expected to cause both superpower SSBN forces to drop to about 20 boats each. Having a smaller number of targets does not make any individual one easier to find. In addition, if the superpowers believe that having a larger number of SSBNs is prudent, nothing in the START agreement will prevent them from going in that direction.⁽²⁷⁾ Also

26. See Donald C. Daniel and K.L. Herbig (eds.), *Strategic Military Deception* (New York: Pergamon, 1982).

27. The reason is that each country could choose to put less than the maximum number of allowed warheads on each missile, preferring instead to allocate warheads over a larger number of missiles and subsequently over a larger number of submarines. Alternatively, each could choose to limit the number of missiles per submarine, thereby allowing

the relative significance of the SSBNs for strategic stability should decrease as the USSR adds to its mobile land-based missiles and as the USA deploys a similar force of its own.

In short, those looking for a threat to strategic stability in the foreseeable future will have to look elsewhere. They will not find it in the threat which superpower ASW will pose to superpower strategic submarines.

it to have a greater number submarines overall and still be within the ceilings allowed by a START agreement.