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## **THE U.S. SUBMARINE FLEET: INCREASINGLY VULNERABLE TO SOVIET ATTACK**

### **INTRODUCTION**

Recent revelations of Soviet espionage efforts concerning U.S. naval capabilities thus far have exposed weaknesses in U.S. security regulations. For the longer term, however, the most damaging aspects of this case may have to do with U.S. vulnerability to a Soviet nuclear attack. The Kremlin is devoting substantial resources to submarine detection efforts. Through a combination of research, espionage, and improved and increased numbers of attack submarines, the Soviets may well be gaining the means to destroy a substantial number of U.S. nuclear subs in a surprise attack. Combined with its already existing and growing ability to wipe out much of the U.S. land-based missile and bomber inventory, and its potential to defend against whatever nuclear weapons remain in the U.S. arsenal after an attack, the Soviets are approaching a true first strike capability which would leave the U.S. without an adequate response to a Soviet nuclear attack.

To deal with the threat of submarine vulnerability, the Reagan Administration should develop a comprehensive response which includes:

- 1) Strategic Defense Initiative (SDI)-related programs to help protect submarines in port and at sea;
- 2) research to counter Soviet non-acoustic detection of U.S. submarines;
- 3) intensive intelligence analysis of the Soviet threat to U.S. submarines;
- 4) increased modernization of the air and land-based legs of the U.S. strategic triad so that the U.S. is not forced to rely only on potentially vulnerable submarines; and

5) appointment of a team of experts to report to the President periodically on U.S. triad vulnerability and the adequacy of steps being taken to respond. It is particularly important that the President receive information and advice from experts who are not part of the Administration--and thus have no stake in defending past mistakes or errors.

## SOVIET FIRST STRIKE REQUIREMENTS

### The Soviet ICBM Buildup

To successfully attack or threaten an attack on the U.S. and its allies, the Soviets must have enough accurate nuclear warheads to wipe out 3,000 to 4,000 targets that house the West's deterrent capacity. Those targets include missile silos, submarines, air bases, and command and control centers. Since there is no point in Moscow's launching a strike that leaves it unarmed, a reserve, of about one-third of the needed total would be required. Thus a plausible Soviet first strike arsenal would probably require 9,000 very accurate warheads and perhaps 3,000 warheads in reserve for a total of 12,000 warheads.

Early this year, Defense Secretary Caspar Weinberger told the Senate Armed Services Committee that the Soviet land-based missile force alone comprises not 6,500 warheads as was thought, but probably an extra 2,500 covertly deployed warheads, for a total of 9,000. Submarine warheads and intercontinental bombers bring the Soviet nuclear warhead force to at least 12,000.

According to closed briefings on National Intelligence Estimate (NIE) 11-3-885 delivered early this year,<sup>1</sup> the real figure, by the end of this year, will be closer to 15,000, for it includes warheads contained on such systems as 100 mobile secretly deployed SS-16 missiles, and rapid production of the new SS-24 and SS-25 missiles. Senate arms aide David Sullivan, a respected analyst of Soviet arms violations, says the Soviet force today may be as high as 20,000 warheads.<sup>2</sup> Even the more cautious public NIE estimate shows the

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1. As distinct from sanitized versions of the NIE estimate reported in the press.

2. Quentin Crommelin and David Sullivan, "Soviet Military Supremacy," Defense and Strategic Studies Program, University of Southern California, 1985.

Soviet force growing to 11,500 warheads by this year's end and 16,000 to 20,000 by 1990.<sup>3</sup>

Liberals and conservatives alike see present U.S. land-based missiles as vulnerable. But neither the President nor his major critics propose doing anything to enhance the survivability of U.S. missiles before the 1990s. They thus rely primarily on the survivability of submarines and secondarily on bombers and cruise missiles to maintain a credible U.S. deterrent.

## SUBMARINE VULNERABILITY

U.S. strategists of varying political ideologies long have viewed submarines as a kind of strategic ace-in-the-hole. Jimmy Carter smugly noted that one U.S. submarine was enough to ensure deterrence, while Ronald Reagan's panel on strategic vulnerability, the Scowcroft Commission, concluded that the U.S. need not worry about the erosion of its land-based missile survivability since the submarine leg would preserve deterrence for as far as the eye could see.

And indeed, NIE 11-3-885 suggests both the Soviets and the U.S. need a technology breakthrough in order to locate strategic submarines at sea. Yet, as intelligence officials warned in testimony on NIE 11-3-885 before a House-Senate hearing, "We are concerned about the energetic Soviet research and technology efforts" aimed at precisely this problem. That warning, formulated on reports filed in late 1984, acquires greater urgency in the light of the spectacular revelations in the Walker submarine spy case of 1985.

## SUBMARINE DETECTION

### Current Capabilities

A submarine's invisibility--water filters out most kinds of light--is virtually its sole asset as a strategic delivery vehicle. Submarines are slower than bombers; they lack the protective silos of missiles and thus are vulnerable to attack if spotted; and they are much less accurate than most other modern nuclear weapons. They have difficulty communicating without betraying their positions. They must fire their missiles off seriatim, requiring as much as 30 minutes to unload 16 or 20 missiles; the resulting phased attack makes it much easier for anti-ballistic missile defenses to protect the target from

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3. Peter Samuel, "Big Soviet Buildup Foreseen," Defense Week, June 17, 1985; Walter Pincus, "Soviets Said to Hurry Missiles," The Washington Post, June 10, 1985.

the submarines' attack. Furthermore, submarines are based in water, a ready conductor of shock waves. Thus, according to Reagan Science Advisor George Keyworth, a nuclear explosion anywhere in a 100-mile radius may knock out a U.S. strategic submarine.

The ideal in an attack is to wipe out an opponent's forces before they can respond. Thus the ideal, though not necessarily essential, anti-submarine capability is an oceanwide detection system that robs submarines of their chief asset, concealment. (A second-best option, more plausible in the short run, is an improved detection capability combined with an effective defense to "mop up" missiles from any surviving U.S. subs.)

Present submarine warfare concentrates on "acoustic" detection using underwater sensors. Since the oceans may conduct sound waves produced by submarines for thousands of miles, acoustic detection can achieve some impressive results. But the oceans are also "noisy," filled with shipping, marine life, and other distortions. And sound waves can be altered by underwater mountains, currents, and dozens of other disruptions that enable submarines to hide. The technology for making submarines more quiet, and for hiding them amid background noise, has kept pace in the past two decades with advances in acoustic sensors. Acoustic detection, moreover, is a piecemeal affair, relying upon large numbers of individual sensors scattered throughout the oceans.

For these and other reasons, traditional acoustic methods are not likely to provide the detection to allow simultaneous attack on all U.S. submarines at sea.<sup>4</sup> Some experts even argue that the more that is learned about the variability of ocean conditions, the "more opaque" the oceans become to acoustic detection.<sup>5</sup> The problem is that the U.S. has concentrated so much on avoiding acoustic detection, making its submarines bigger and quieter, that it may be rendering a large portion of its fleet vulnerable to other detection methods. And as the size of U.S. submarines has grown, the number has shrunk.

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4. For capable summaries of the difficulties of acoustic detection, See Kosta Tsipis, "Underwater Acoustic Detection," in The Future of the Sea-Based Deterrent (Cambridge, Massachusetts, MIT Press, 1973), p. 182; Richard Garwin, "Will Strategic Submarines be Vulnerable?," International Security, Fall 1983, p. 66; and R. K. Geiger, "Remote Sensing in Ocean Surveillance," Advisory Group for Aerospace Research and Development, Lecture Series No. 88, London, 1977.

5. Admiral James Watkins, statement before the House Appropriations Committee, Department of Defense Appropriations for FY 1984, 98th Congress, First Session, 1983, part 2, p. 653.

## NON-ACOUSTIC DETECTION

An oceanwide detection system would almost certainly be based in space, where it becomes possible to scan large swaths of ocean. From space, it would rely on non-acoustic detection. And non-acoustic, space-based detection is precisely where Soviet Anti-Submarine Warfare (ASW) research has been concentrating. This is in sharp contrast to the U.S.'s emphasis on acoustic detection using underwater sensors.

More than a dozen schemes for non-acoustic detection have been suggested. The Soviets may use blue-green lasers to follow changes in plankton behind a submarine. They may spot the thermal "scars" which the submarine leaves, using either infrared radiometers or passive microwave radiometers already used in oceanographic research. Still other devices may trace a submarine's disruption of ocean magnetic patterns. Then too, submarines give off a number of contaminants: antifouling paint flakes off, lubricants leak from the engine, and waste products, such as neutrons from the nuclear reactor, are released into the seawater.<sup>6</sup>

The most available technology, however, is the "synthetic aperture radar" (SAR) on which the Soviets have been hard at work since the mid-1970s.<sup>7</sup> This radar operates by reading the subsurface ocean waves as they are manifested in minute surface disturbances. Submarine warfare expert Donald C. Daniel explains:

SAR takes advantage of the forward movement of its platform...as it approaches, goes over, and leaves behind some earth location. It takes multiple looks at the same spot, and by exploiting the shifts it integrates them together to produce what is analogous to a composite picture or hologram much richer in detail....<sup>8</sup>

### Soviet Non-Acoustic Detection Capability

Dartmouth physicist Robert Jastrow asserts flatly that "it is a question of when, not if" the SAR will render U.S. submarines more

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6. For a readable layman's summary of these different options, see any of the following: Richard Wohl, "Ocean Transparency: Impossible or Inevitable?," Defense Science 20002-Plus, February 1984; Joanthan B. Tucker, "Cold War in the Ocean Depths," High Technology, July 1985; and the Office of Technology Assessment, "MX Missile Basing," Government Printing Office, 1981, p. 177.

7. For examples of early concerns on the issue, see Henry Bradshear, "Vulnerability Growing for U.S. Sub-Based Missiles?," The Washington Star, December 12, 1977; Thomas Burns, "The Secret War for the Ocean Depths," Rowson, 1978.

8. Donald C. Daniel, "Antisubmarine Warfare in the Nuclear Age," Orbis, Fall 1984.

visible and vulnerable. Lowell Wood, the Lawrence Livermore National Laboratory laser researcher, echoes that it "is just a matter of time" before submarines are rendered visible, possibly by 1990, likely by 1995. Skeptics argue, equally flatly, that this assessment is wrong.

### SAR Technology

Conceptually, there is debate even over what an SAR image "means." Christopher Garrett and Walter Munk<sup>9</sup> write that internal waves which SARs read are a "ubiquitous phenomenon in the ocean." There is as yet "no model" to account for all these movements. Yet, while there is no single, integrated model, there are many models that explain some internal wave phenomena. There are general theories of internal wave mechanisms in basic textbooks. Finding a fixed number of submarines at sea does not involve resolving all of these general theories, merely answering specific problems relating to submarines.

Some experts take a pessimistic view of whether these specific problems can be solved. They argue that ambiguities involving the SAR images themselves would lead to a "high false alarm rate."<sup>10</sup> But what is a "high rate" for Soviet submarine warfare? If there were ten false alarms for every real submarine detected, the number of warheads the Soviets would have to expend attacking 15 to 20 submarines at sea would simply rise from, say, 60 warheads to 300. With a nuclear arsenal of 13,000 warheads or more, 300 is not a large share to wipe out an entire leg of the U.S. strategic triad.

Some analysts suggest there are "geometric constraints" which would "seem to limit the coverage" of an SAR to swaths of about 100 miles "without major design changes." In low orbit, where the image from the SAR would be the sharpest, "a great number" of satellites would be required for such extensive coverage. (Satellites in low orbit move around the earth quickly. Thus, for each satellite imaging some relevant portion of the ocean, several might be elsewhere.)

Yet, the chief "major design change" required would be to place the SAR satellite in a higher orbit, where it could stand back and get

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9. Christopher Garret and Walter Munk, "Internal Waves in the Ocean," in M. Van Dyke ed., Annual Review of Fluid Mechanics (Palo Alto, California: Annual Reviews, Inc., 1979).

10. Daniel, op.cit., p. 541.

a wider perspective. In the right orbit, only 25 to 50 satellites would be required.<sup>11</sup>

In a higher orbit, an SAR would need a large power supply to achieve a high resolution view of internal waves. Yet the Soviet satellite program has placed a great emphasis on finding means to boost the power to the SAR.

### Soviet SAR Capability

The Soviets are alone in investing great efforts and money in using nuclear power in space. Only they have tested systems capable of orbiting nuclear weapons. Only they have nuclear-powered satellites in orbit; the U.S. feared the obloquy of world opinion and dared not emulate the Soviet program. The Soviets already have an operational nuclear-powered ocean surveillance satellite, the RORSAT (Radar-Equipped Ocean Reconnaissance Satellite) system. RORSAT, and the related FORSAT, according to U.S. intelligence experts, points to "a breakthrough...in Soviet anti-submarine warfare capabilities."<sup>12</sup> This clearly raises questions about the survivability of U.S. nuclear submarines. Nuclear power not only helps produce sharp images, but enables the Soviets to keep near-earth satellites in orbit for weeks and months rather than days. RORSAT may also play a role in targeting U.S. surface ships and submarines at sea for attack by cruise missiles fired from Soviet Backfire bombers.<sup>13</sup>

### U.S. Intelligence Agency Disagreement

In repeated tests in recent years, the Soviets used an SAR from the Salyut 7 space station and from airplanes to track their own Delta Class submarines, operating at depths of about 300 feet. This is

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11. Those who have followed the strategic defense debate will note a parallel to the "constellation size" issue fought out between members of the Union of Concerned Scientists (Richard Garwin, Hans Bethe, Carl Sagan) and those at Livermore and Los Alamos defense labs (Lowell Wood, Gregory Canavan). See Robert Jastrow, "The War Against Star Wars," Commentary, December 1984; also, "Real Whistle Blowers," Review and Outlook, The Wall Street Journal, April 5, 1985.

12. Defense Electronics, E.W. Communications, Inc., October 1983.

13. The Washington Post, October 9, 1983.

roughly the depth in which U.S. submarines operate as they communicate and prepare for launch.<sup>14</sup> In 1978, a U.S. SAR mapped the ocean bottom near Woods Hole, Massachusetts, at depths of 500 feet.<sup>15</sup> The satellite that made that map became inoperative or "disappeared" three months later, according to public accounts. In its public pronouncements, Navy officials have said the Soviet SAR program does not pose a substantial threat. And even some studies performed by more independent intelligence services, such as a 1983 Defense Intelligence Agency report, seem to concur. But the independent studies are often extremely dependent on the Navy for raw data.

Then, too, joint intelligence agencies such as the DIA are under intense pressure to adopt bland, consensus assessments in their final reports. This is particularly so when one service feels its interests strongly threatened--as the Navy would by a paper saying that U.S. submarines may be becoming more vulnerable. "Our assessments are that synthetic aperture radars cannot detect (passage deleted for classification) submarines," Dr. Edward Harper, technical director of the Navy's missile submarine security program, told the Senate Armed Services Committee in 1984, summarizing the 1983 DIA report.<sup>16</sup> But the Central Intelligence Agency dissented strongly from that finding. And last year, the National Security Agency, which intercepts worldwide communications traffic, filed a report that said the Soviet SAR had already successfully tracked some of its own submarines.<sup>17</sup>

Though NIE 11-3-885 paints an optimistic picture of U.S. submarine survivability, this too produced a dissenting CIA footnote. And when one Senator pressed the CIA's Robert Gates in a joint House-Senate hearing, Gates said the NIE judgment "reflects some bureaucratic factors." Gates refused to identify these factors, but when asked whether U.S. strategic policy should proceed on the assumption U.S. submarines are relatively immune from Soviet attack, he answered, "No." In 1984, the Defense Intelligence Agency echoed this, siding with an "Air Force view that the Soviet space-based SAR is in the early testing stages for a broad-ocean ASW system aimed primarily at U.S. ballistic missile submarines."<sup>18</sup> The SAR, the

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14. William Kucewicz, "Spotting Soviet Strategic Advances," The Wall Street Journal, September 5, 1984; and "Soviets Test Sub Detection from Space," Military Space, Poscho Publications, August 20, 1984.

15. Edgar Ulsnmer, "Penetrating the Sea Sanctuary," Air Force Magazine, September 1984.

16. Bob Woodward and Charles R. Babcock, "CIA Studies Sub Vulnerability," The Washington Post, June 6, 1985

17. Ibid.

18. Military Space, op. cit.



report concluded, along with a rapid Soviet buildup of fast and quiet attack submarines, "is a matter of concern because it demonstrates that the Soviets are determined to destroy all three legs of the U.S. deterrent Triad...."<sup>19</sup>

There is evidence that the Navy itself is beginning to share the concern over its submarines. One piece of indirect evidence is the money devoted to ASW itself, which by 1983 had grown to about \$13 billion, or 15 percent of the Navy's budget. According to an analysis by the firm of Frost and Sullivan (which advises clients on trends in defense spending), ASW spending will grow to roughly \$28.6 billion in 1987, an annual growth rate of 19.8 percent.<sup>20</sup>

### Implications of Soviet Espionage

The Walker submarine spy case produces a new and alarming twist to Soviet ASW advances. Until Walker, U.S. intelligence officials could more or less assume the Soviets were mainly testing detection of their own submarines. But Walker and company, it is alleged, over 15 to 20 years, leaked to the Soviets the exact location of U.S. submarines at thousands of different times, under widely varying conditions. Notes one observer: "Now we know they may have been conducting some far more useful tests with the SAR--using our subs, which, on specific occasions, they could pinpoint precisely."

Information obtained through the alleged Walker leaks would not only be of use in testing and improving a Soviet SAR network. As damaging, since the reports allegedly passed along by the Walkers cover many years, they could be fed through computers to produce an extensive pattern of U.S. submarine movements. This may allow the Soviets to concentrate detection satellites or aircraft at high probability points. It would at least enable them to ignore large areas where they have learned U.S. strategic submarines, for whatever reason, do not patrol.

Observes one veteran Navy intelligence officer: "Soviet intelligence and research, indeed a lot of U.S. intelligence, is a lot like we picture the Japanese economically. They hunt around for individual nuggets, check out assumptions, fill little holes in their knowledge. Everybody likes breakthroughs. But the Soviet approach is to patiently deal with a matrix of capabilities, to nibble at the problem. They deploy a few SAR satellites. Nibble. They learn that they can rule out another 50 percent of the ocean space where they once thought we could patrol. Nibble. They figure out a way to disrupt communications with our subs for an extra 12 hours. Nibble.

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19. Ibid.

20. Tucker, op. cit.

They often take our technical building blocks and then simply try to assemble the whole capability factor--knowing that they do not have to deal with Congress, the Freedom of Information Act, and The New York Times."

#### SOVIET ATTACK-SUBMARINE THREAT

From 1965 until the Carter presidency, the U.S. had 41 strategic submarines. The number shrank to 33 by 1983 and is limited in the short-term by the SALT II restraints. The maximum number of U.S. Trident submarines to be built between now and the late 1990s is 20. Thus the U.S. strategic submarine fleet will shrink from 33 to 20 over the next 15 years.<sup>21</sup> Except during a crisis alert, the number of submarines at sea at any given time will seldom exceed 12. Of these, only three are in communication with U.S. national command authorities at any moment. Thus, three submarines with 480 warheads may constitute at any moment the U.S. deterrent force.<sup>22</sup>

Meanwhile, the Soviets have been expanding their fleet of attack submarines which can track and target U.S. strategic submarines. According to the 1985 Jane's Fighting Ships, Soviet submarines may have been equipped with new propulsion systems which make them faster, quieter, and harder to detect.<sup>23</sup> The Soviet Navy has 370 submarines compared to the U.S. Navy's 135. At least 200 of the Soviet submarines are attack submarines, 130 of very long range. Soviet Alpha class submarines, introduced in 1980, have a superstrong titanium hull and tremendous power source, enabling them to reach speeds of 42 knots and dive to 3,000 feet. This is considerably faster and deeper than the best U.S. submarine. "With such a large share of U.S. strategic power concentrated in a few SSBNs, the Soviets will find it irresistably attractive to trail U.S. subs" with several trailers each.<sup>24</sup> Here again the suspected Walker leaks assume a frightening aspect, greatly enhancing Soviet efforts to test and perfect a "trailer" strategy for targeting U.S. strategic submarines.

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21. Stephen P. Gilbert and Loren B. Thompson, "Our Underwater Fleet is Vulnerable," The Wall Street Journal, September 19, 1983.

22. Sullivan and Crommelin, op. cit.

23. Washington Times, August 22, 1985, p. 83.

24. Stephen P. Gilbert and Loren B. Thompson, "Our Underwater Fleet is Vulnerable," The Wall Street Journal, September 19, 1985.

## U.S. RESPONSE

In recent years, Navy Secretary John Lehman has admitted there may be a submarine vulnerability problem. In the summer of 1985, Lehman warned that a one-time U.S. advantage in acoustic detection technologies of perhaps 15 years had dwindled to no more than five years. Lehman also said that Soviet tactical submarines, armed with the Walker-supplied information on avoiding U.S. detection, were boldly creeping up to range of U.S. submarine ports--a position from which they could trace U.S. strategic submarines as they leave port.<sup>25</sup>

## POLICY RECOMMENDATIONS

Present U.S. deterrent strategy can be simply put: Build enough offensive systems so that the Soviets can never blow up enough U.S. forces in a first strike to prevent the U.S. from delivering a devastating retaliatory blow.

Building almost exclusively offense, any new U.S. strategic weapon can be countered with a simple linear expansion in Soviet warheads. If the U.S. builds two missiles, the Soviets can knock them out with four warheads, since it takes roughly two warheads per target to be relatively sure of scoring a hit. The problem is even smaller than this arithmetic suggests, since most weapons carry multiple warheads. Thus, ten Soviet SS-18 missiles with ten warheads each can attack 50 MX missiles with a total of 500 warheads. As the Soviets perfect submarine detection techniques, one missile could threaten five submarines each carrying 20 missiles.

To protect itself from this, the U.S. should:

- 1) Continue and accelerate the Strategic Defense Initiative programs that offer the short-term possibility of making the U.S. retaliatory triad more secure from Soviet attack. The President should request a study of systems that might be deployed by 1990 in order to strengthen triad survivability.

- 2) Begin investigating ways to protect U.S. submarines from detection by Soviet advanced technology systems. Serious consideration should be given to ignoring the voluntary SALT II limits and developing small-diesel submarines less vulnerable to non-acoustic detection, as advocated by critics of present strategy.

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25. John Bosma, Military Electronics, July 29, 1985.

3) Assure that the upcoming CIA report and other intelligence community assessments present a full report that includes input from critics of current submarine programs (such as Capitol Hill aides William S. Lind and Anthony Battista).

4) Pursue modernization of the air and land-based elements of the U.S. strategic triad so that a Soviet breakthrough in submarine detection would not be as significant an upset in the strategic balance;

5) Appoint a team of experts to report periodically directly to the President on the state of U.S. submarine vulnerability and the adequacy of the U.S. response.

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