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Interagency Intelligence Report

Prospects for Soviet Success in Improving Detection of Submarines in Open Ocean Areas

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PROSPECTS FOR SOVIET SUCCESS IN IMPROVING DETECTION OF SUBMARINES IN OPEN OCEAN AREAS

PREFACE

This Interagency Intelligence Report was prepared by the Defense Intelligence Agency with the collaboration of the Central Intelligence Agency and the Naval Intelligence Command. It was reviewed by the National Security Agency and the Bureau of Intelligence and Research, Department of State.

The report was prepared at the request of the National Intelligence Officer for Strategic Programs. It assesses Soviet R&D in antisubmarine warfare (ASW) detection techniques and its implications for the survivability of the US nuclear-powered ballistic missile launching submarine (SSBN) force.

The report describes current Soviet ASW detection capabilities and their limitations, examines identified and suspected R&D efforts in ASW, and provides an assessment of the potential for Soviet solution of the open ocean submarine detection problem by acoustic and nonacoustic methods. Information cutoff date of this report is September 1, 1974.

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KEY JUDGMENTS

The principal continuing weakness in Soviet ASW is the lack of a capability to detect submarines at long ranges within the broad expanse of open oceans. Soviet systems for detecting submarines using passive acoustic arrays which are permanently emplaced in the water have a limited range.[

]Geographic and technical considerations generally militate against the use of a long-range passive acoustic system similar to the US Sound Surveillance System (SOSUS).

There are indications the Soviets believe that non-acoustic techniques have potential for improving their capabilities in the open ocean. We know that their R&D in non-acoustic detection primarily involves mobile sensors, but we lack information on many aspects of these programs. There is no evidence that the Soviets are investigating

detectable submarine effects which have not already been considered in the US; however, US investigation of these effects has not, in all cases, conclusively ruled out their potential in ASW. Available information, both US and Soviet, concerning non-acoustic detection methods indicates that none offers a capability for detecting submarines at long ranges comparable to that of SOSUS, although some could improve the potential of mobile units.

Over the next ten years, we expect improvements in Soviet ASW capabilities which may permit detection of US SSBNs during limited area searches of the open ocean or in confined areas the SSBNs must transit. We do not believe Soviet advances in either acoustic or non-acoustic techniques will provide them with an effective capability to detect US submarines at long ranges, although we do not rule out the possibility that they may be able to detect a few.[1]

[1] The Director of Naval Intelligence believes that the potential for the development of even short range [ ] sensors, when deployed on multiple platforms, may provide a partial solution to the Soviets' open ocean detection problem, and consequently could constitute a threat to at least some portion of the US SSBN force.

SUMMARY

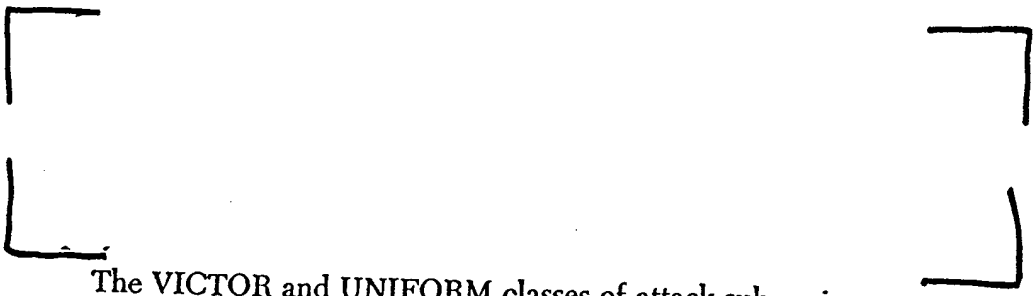
There are several conventional methods for detecting submerged submarines. Historically, *acoustic* systems have been predominant; these can be active or passive, fixed in the water or carried by ships and aircraft. Current *non-acoustic* techniques include the use of radar, visual observations, intercept of electronic emissions, magnetic anomaly detection, and detection of the wakes made by the movement of submarines.

Present Capabilities

The Soviet Navy's submarine detection capabilities lag those of the US by a wide margin. The principal weakness lies in the lack of a capability to detect submarines at long ranges within the broad expanse of open ocean areas.

Geographic considerations in most instances inhibit Soviet deployment of an acoustic system comparable to the US SOSUS arrays, which require sound channels found generally in water greater than 2 kilometers in depth. Moreover, the effectiveness of SOSUS depends on the high-radiated noise levels made by the movement of Soviet nuclear submarines; US submarines are relatively quiet.

The Soviet effort in acoustic systems, which are fixed in the water, is concentrated on moored sensors. These are now primarily in coastal waters and are effective only at short ranges.



The VICTOR and UNIFORM classes of attack submarines now are the Soviets' most effective Soviet ASW platforms. They have the latest Soviet sonar systems. VICTOR Class submarines have tried to trail US SSBNs leaving their bases. None of these activities has resulted in a known trail. The Soviets have employed their active sonar in this type of operation. This technique would facilitate overt trail once contact is established.

Most surface combatants in the Soviet Navy have some type of sonar. Combined ship and aircraft exercises, involving both helicopters and land-based patrol aircraft, are increasing. New construction and fitting of some older ships with modern sonars will generally improve the capabilities of the surface ASW force, although this force will not solve the open ocean detection problem.

Present R&D

Despite improvements in ASW capabilities, the Soviets still lack a solution to the fundamental problem of detecting US SSBNs in the open ocean. Recognizing this, they continue extensive R&D efforts in both acoustic and non-acoustic methods of submarine detection. This R&D activity appears to have high priority.

Acoustic systems which operate passively—i.e., as "listeners"—are sharply limited because of the quietness of US nuclear submarines. This limitation will become even more severe when noise levels are reduced even further in new US SSBNs and when larger operating areas, permitted by future longer-range missiles in present and new SSBNs, are used.

Present Soviet R&D efforts should produce improvements in passive acoustic systems to include lower frequencies, some reduction of submarine self-noise, and advanced signal processing techniques, but these improvements are likely to be offset by US developments. Im-

provements are expected in Soviet platform-mounted active sonars also; however, power requirements for long-range active sonar systems apparently preclude their use in long-range open ocean detection.

Non-acoustic R&D efforts on *microwave radar* are aimed at detecting the effects on the water's surface caused by the passage of a submerged submarine. This method of detection is less susceptible to degradation from weather condition, although less so than most other non-acoustic methods.

If the Soviets succeed in developing an operational radar system for the detection of surface effects, it could significantly improve aircraft search rates.

There is evidence of Soviet R&D involving *infrared detection* by an aircraft of the heat in a submarine's wake. The Soviets have the technical competence to deploy equipment for this purpose within the next ten years.

Lasers carried by aircraft have a potential application in submarine detection. There is no evidence that the Soviets are developing a laser as an ASW sensor, but Soviet competence in laser technology is sufficient to initiate such research.

The Soviets are investigating the detection of the *turbulence in the wakes* produced by a submarine

It is unlikely that any of these methods will enable detection of submarines at long ranges.

A detection program under way in the USSR

relies on the detection of *electromagnetic fields* generated by a submarine in the extremely low frequencies (ELF).

indicate that it

probably is limited to short ranges[

]system could be deployed in the late 1970s.

Prospects

There are many uncertainties regarding Soviet R&D efforts in ASW, but there appears to be a considerable investment devoted to the development of both acoustic and non-acoustic means of submarine detection.

Technical limitations make it unlikely that the Soviets will achieve a long-range capability in the open oceans through *acoustic* methods. However, these efforts should result in improved capabilities of their ASW forces. Development of towed linear arrays using narrow band signal processing, for example, is well within Soviet capabilities. We can also expect to see continued improvements of sonobuoys, low-frequency, high-power sonars, moored acoustic sensors, and signal processing.

Some of the improved acoustic detection systems could be effective in choke points such as the Greenland-Iceland-UK gap. This has implications in terms of possible Soviet attempts to trail transiting US SSBNs. Data obtained by fixed systems in these restricted areas might be relayed to attack submarines in the area which might then attempt to trail transiting US SSBNs using passive sonar. However, because US SSBNs will probably continue to be quieter than Soviet nuclear submarines, a covert trail would be unlikely. Active sonar might be required to establish contact in any trailing operations. If contact were gained, evasive maneuvers by a US SSBN would probably preclude an overt trail for more than a few hours.

The Soviets' R&D in *non-acoustic* detection offers some prospect of improving their ASW capabilities, including trailing, but none of the known methods will solve the problem of detection in the open

oceans.[3] The most promising non-acoustic method is detection of surface effects by radar in aircraft. Despite the improved search rates that could result, substantially more aircraft than are now available would still be needed for sustained coverage, even in a limited area such as the Norwegian Sea. Coverage of US SSBNs in the North Atlantic, the Mediterranean and the Pacific would be still more difficult because of the lack of bases and the size of the areas.

Table I summarizes present and projected Soviet ASW systems, and indicates the areas where each might be employed. If the R&D programs succeed, the Soviets will be much more capable of detecting SSBNs in the choke points of the Mediterranean Sea and the Greenland-Iceland-UK gap leading into the Norwegian Sea, mainly by mooring many passive acoustic sensors. To achieve real-time detections, the Soviets must develop a data relay system such as a satellite. In the Norwegian Sea, these fixed sensors could be supplemented by aircraft using improved sonobuoys and radar, as well as infrared detection. Information from fixed sensors could help Soviet submarines operating near the choke points make contact on transiting SSBNs. Surface units could assist in these efforts.

We do not expect that Soviet detection capabilities in the Pacific, Atlantic, or Indian oceans will improve significantly during the next decade because they will still lack a system capable of monitoring broad expanses. The advent of longer-range US submarine-launched ballistic missiles (SLBMs) and expansion of SSBN operating areas will further complicate Soviet detection problems.

The Soviets are continuing to search for a solution to their open-ocean detection problem, and some of the non-acoustic sensors we see in their extensive R&D effort may have potential for development into an operational short-range, mobile system. While we can foresee an overall improvement in Soviet ASW capabilities, the available evidence does not suggest that the Soviets will achieve an effective open ocean submarine detection capability within the next ten years—that is, there is a low probability that they will be able to detect patrolling US SSBNs, although we do not rule out the possibility that they will develop a capability to detect a few.[3]

[3] The Director of Naval Intelligence believes that the potential for the development of even short range [redacted] sensors, when deployed on multiple platforms, may provide a partial solution to the Soviets' open ocean detection problem, and consequently could constitute a threat to at least some portion of the US SSBN force.

TABLE I

PRESENT AND POTENTIAL SYSTEMS

System	Deployment Mode	Possible Locations	Status	Capabilities	Limitations	Initial Operational Availability
			ACOUSTIC			
[redacted]	Moored passive	Choke points	Operational	Short range [redacted]	Large numbers required	1964
	Moored passive	Choke points Norwegian Sea	Operational	Short range [redacted]	Large numbers required	Late 1960s
[redacted]	Moored passive	Not in US SSBN patrol areas	Operational	Short range [redacted]		1967
SONOBUOYS (BM series)	Aircraft/ship delivery Passive/active	Dependent upon availability of forward bases	Operational, R&D continuing	Short range [redacted]	Large numbers required	1969 (BM-1&2)
			NON-ACOUSTIC			
RADAR (Surface effects)	Airborne	Dependent upon availability of forward bases	R&D [redacted]	Short range [redacted]	Weather limited	Mid-1980s
INFRARED	Airborne	Dependent upon availability of forward bases	R&D [redacted]	Short range [redacted]	Weather limited	1975-1980
LASERS	Airborne	Dependent upon availability of forward bases	Unknown	Short range [redacted]	Weather limited	Not prior to 1984
ADVANCED MAD	Airborne	Dependent upon availability of forward bases	No evidence of R&D	Short range [redacted]	Small area search and localization only	Unknown
WAKE Detection Turbulent	Submarine	All areas	Some evidence of R&D	Short range		Prior to 1980
[redacted]						
ELF Electromagnetic sensor	Fixed or mobile	Choke points (fixed)/all areas (mobile)	R&D	Short range [redacted]	Large numbers required	1977-1980