National Foreign Assessment Center

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The Role of Interdiction at Sea in Soviet Naval Strategy and Operations

An Intelligence Assessment

~~Top Secret~~

[redacted]

SR 78-10098CX

May 1978

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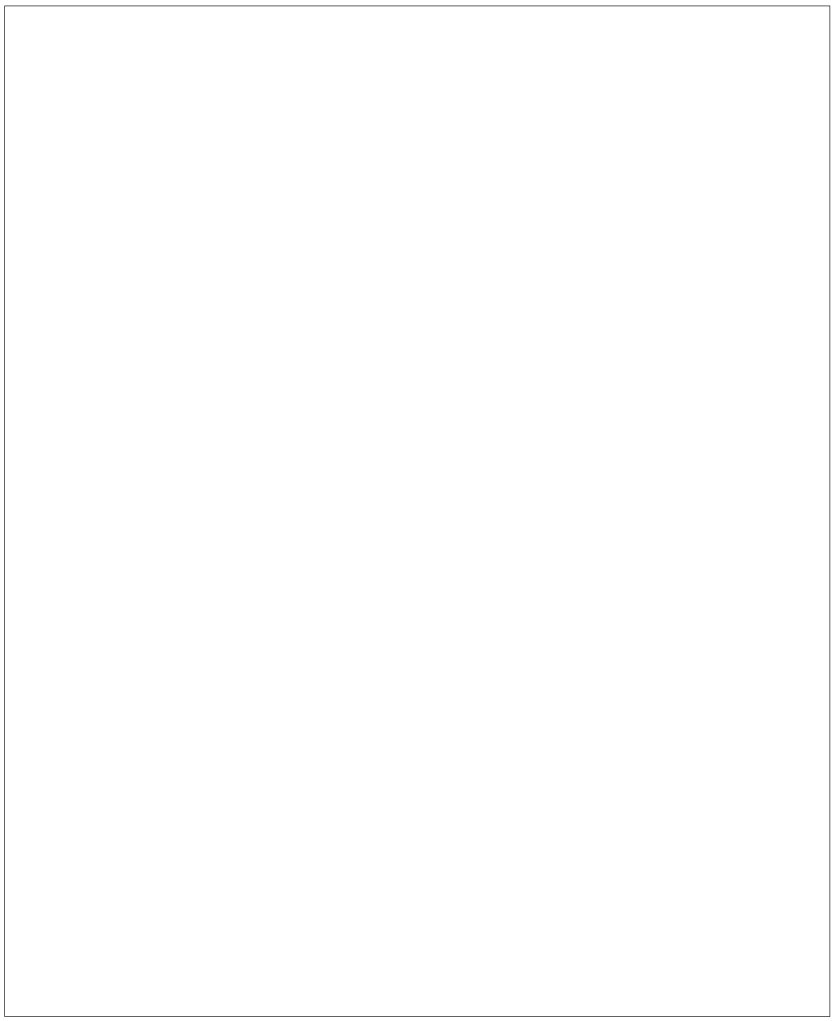

The Role of Interdiction at Sea in Soviet Naval Strategy and Operations

Central Intelligence Agency
National Foreign Assessment Center

May 1978

Key Judgments

This study assesses the Soviets' ability to disrupt Western merchant shipping in a war with NATO as well as the priority they are likely to assign to that mission.[1] Major findings are:

- The Soviet Navy's principal wartime missions are strategic strike, antisubmarine warfare, and anticarrier warfare; it would allocate most of its forces to those missions.
- Interdiction is a secondary mission to which the Soviets would probably allocate a small part (perhaps 10 percent) of their operational attack submarine force. Selected attacks on shipping, over a wide area of ocean, would in part be intended to disperse Western naval resources.
- In a protracted general war, the disruption of Western shipping would assume more importance for the Soviets, and they would attack Western ports and harbors, sink merchant ships at sea, and mine heavily traveled waters. However, they would probably not assign the submarine force to extensive interdiction operations until Western ballistic missile submarines (SSBNs) and carrier strike groups had been neutralized.
- The Soviets probably would try to cut off NATO's shipping completely in areas like the North Sea if such a move were directly relevant to the land battle. This support of Warsaw Pact ground forces would temporarily concentrate a wide variety of naval forces in a specific area.

Soviet naval writers argue against assigning large forces to attack merchant shipping in the open ocean. The Navy—especially its large fleet of

[1] Soviet writings discuss interdiction in the context of a war with NATO. They almost never mention antishipping operations during lesser conflicts, and that subject is not treated in this paper.

attack submarines—could do so, however, if ordered. Accordingly, with the aid of a computer-based model, we examined the ability of the Northern Fleet to cut the flow of merchant shipping between the United States and Western Europe, using several possible scenarios. (The assumptions used in our model and the results obtained are described in annex E.) We found that even if the Soviets were to realign naval missions in favor of interdiction, they could not reduce that flow by a militarily significant amount.

Several factors would limit a Soviet interdiction campaign at sea:

- Most classes of Soviet attack submarines carry relatively few torpedoes and are subject to materiel deficiencies, while the inefficiency of the Soviet logistic support system exacerbates the problems of resupply and maintenance and limits the submarines' availability for operations.
- Crews are not well trained in attacking maneuvering targets screened by escorts.
- Long transit routes through geographically constricted waters make the submarines vulnerable during deployment and return to base.
- Soviet Naval Aviation is not well suited to operate at the ranges necessary for interdiction of the major sea lanes.
- The West has so many merchant ships that moderate losses would be militarily insignificant, and its commerce is so extensive and diverse that the Soviets would have trouble identifying the militarily important ships—those loaded with war materiel.

Present trends in Soviet naval strategy probably will continue for at least the next decade. As long as Western SSBNs and aircraft carriers remain a credible threat to the USSR, the Soviets are unlikely to reorder their priorities for force allocations. Additional older units may be assigned to interdiction as more nuclear-powered units enter the force, but they would be few and would not significantly change Soviet capabilities against Western shipping.

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PREFACE

A number of national security issues have recently focused US attention on Soviet capabilities and intentions to disrupt Western shipping in a general war. The USSR has the world's largest fleet of general purpose submarines, which enables it to threaten the long sea lines of communication that the United States and its allies depend on economically and militarily. US intelligence analysts, however, have markedly different interpretations of how many forces the Soviets would allocate to this mission.

For this paper, interdiction is defined as the disruption of merchant shipping—of military or commercial cargoes—in the open ocean. Warships, military logistic ships, and amphibious landing forces are excluded from this definition.

The Soviets note that interdiction of sea lines of communication can be accomplished by a variety of forces used in a variety of ways, including disruption or destruction of ports of embarkation and destination, attacks on ships at sea, and the mining of straits and narrows and approaches to ports and harbors.[2]

The Soviets clearly believe that the most effective way to interdict an enemy's shipping is to attack his ports and harbors. In a general nuclear war, such attacks require the fewest forces, offer the highest probability of success, are hardest to defend against, and permit other forces capable of interdiction to be given higher priority tasks.

In a conventional war, on the other hand, the importance of attacking ships on the open ocean probably would increase if war were prolonged, partly because conventional strikes against ports are less effective than nuclear strikes. Disrupting port operations would require frequent large bombing attacks which would reduce the availability of the bombers for other missions.

This paper reviews the evidence bearing on the role of interdiction in Soviet naval policy. It examines Soviet mission priorities and estimates the composition and capabilities of the forces the Soviets would probably use for interdiction.

Analysis of Soviet plans is complicated by the scarcity of information dealing directly with interdiction. Detailed discussion of the subject in Soviet

[2] This paper discusses only the Soviet ability to mount an open-ocean interdiction campaign.

military writings is comparatively rare (except in a historical context), and the Soviets seldom practice anticonvoy tactics except in amphibious landing exercises.

Both classified and open-source Soviet and Warsaw Pact writings have provided insight into Soviet war planning. These materials, however, have certain limitations:

- Many of the classified writings were published before 1971. We consider them valid, however, because they are largely consistent with information from other forms of intelligence that continue to be available.
- Much of the material is argumentative in nature—prepared by advocates of one course or another—and may not necessarily represent official doctrine and policy.
- Certain Russian expressions are not clearly defined and seem to differ from Western usage. Thus, the Soviets sometimes use such terms as interdiction, transports, and convoy in reference to naval support ships and amphibious landing ships. They view these naval ships as important elements of the enemy's fleet because such ships can directly participate in offensive operations against the Warsaw Pact. In addition, the Soviets' use of the term naval blockade can ~~compromise~~ comprise geographically diffused interdiction operations of the kind employed by Germany during World Wars I and II. These differences introduce ambiguity into Soviet writings and occasionally appear to inflate the importance of at-sea interdiction for them. Where appropriate, these semantic difficulties are noted in this report.

The Role of Interdiction at Sea in Soviet Naval Strategy and Operations

Soviet Intentions

Soviet attack submarines, the main strike forces for use against Western merchant ships, are also needed to perform a variety of other important naval missions. Priorities among these missions reflect the level of effort that the USSR would expend on interdiction.[3]

Principal Wartime Missions

The most specific information available on Soviet naval priorities is contained in classified Soviet and Warsaw Pact documents produced before 1971. During the 1970s we have seen few such statements, but information from other sources shows no change in the main tasks.[4] In either a conventional or a nuclear war, these are antisubmarine warfare (including protection of Soviet SSBNs from Western attack submarines), anticarrier warfare, and the deployment of Soviet SSBNs to launch areas. Less critical missions include:

- Support of the seaward flanks of the ground forces.
- Interdiction of Western sea lines of communication.
- Coastal defense.
- Protection of Soviet shipping.

These secondary missions would have equal priority in the early stages of any war, but the Soviets believe that interdiction could assume greater importance after Western strike forces had exhausted most of their strategic weapons.

Military writings indicate that regardless of how a war began, the Soviets would attempt to direct their general purpose naval forces first of all toward the destruction of enemy ballistic missile submarines and aircraft carriers. Some Western analysts, on the other hand, have suggested that the Soviets might not do so in the early stages of a conventional war. They postulate that the Soviets might wish to avoid escalation to nuclear war and so might avoid attacks on Western SSBNs, which could provoke such escalation.

The Anti-SSBN Mission. Peacetime Soviet naval operations reflect the high priority of the anti-SSBN mission. The Soviets have stationed intelligence collection ships (AGIs) near Western SSBN bases since 1964—and in more recent years have attempted, apparently without success, to detect and trail Western SSBNs with some of their newer nuclear-powered attack submarines.

The Soviets consistently acknowledge the difficulty of destroying Western SSBNs and recognize that they may not be able to prevent them from launching many missiles at the Soviet Union. They assert that even after firing its missiles, the SSBN should still be a priority target, because it could be rearmed and reused. Soviet planners evidently regard the SSBN force as a threat so serious that even partial success would fully justify the concentration of resources against it.

Soviet strategy is complicated by technological difficulties. In addition to the unsolved problem of detecting the SSBN in the first place, the Soviets have only a limited ability to classify the submarines they might detect—a critical deficiency if they should wish to avoid sinking SSBNs

[3] Annex A discusses Soviet military writings on naval mission priorities.

[4] While Soviet military literature often distinguishes between "main" and "secondary" missions, analysts must infer the ranking of missions within each category from the order in which tasks are consistently listed and from rare explicit references made by authoritative writers.

in a conventional war. Because of these difficulties and the continuing threat posed by Western SSBNs, strategic antisubmarine warfare (ASW) will probably continue to occupy major Soviet naval resources for the foreseeable future.

Tactical Support for Soviet SSBNs. The Soviets place a similarly high value on securing the operating areas of their own ballistic missile units and would probably assign some torpedo attack submarines to that task in wartime. When Y-class SSBNs began to enter the fleet in large numbers in the late 1960s, some Soviet naval officers argued that protection of strategic submarines would be particularly important during the conventional and limited nuclear phases of a general war—when they would have to remain passively on station awaiting the launch order. Naval operations, writings, and exercises since that time continue to reflect that concern. The Soviets frequently use their attack submarines to delouse their SSBNs.[5] Recently, they also have assigned attack submarines to accompany SSBNs on patrol on several occasions.

Anticarrier Warfare. The Soviets continue to have great respect for the carrier's importance in NATO military strategy. They regard it as the key element of the general purpose naval forces, as a reserve strategic nuclear force, and apparently as an integral part of amphibious landing forces. Most of the Navy's cruise missile submarines and aircraft with air-to-surface missiles (ASMs) were procured primarily to counter Western aircraft carriers (although they could be used against any ships).

As the United States began to deploy large numbers of long-range strategic missiles, the strategic strike role of carriers declined. By the mid-1960s the Soviets were focusing on the Polaris submarine as the primary strategic naval threat to the USSR. Their concern over US carriers and other naval forces such as amphibious task groups that could threaten the Pact has not diminished, however. Soviet writings and exercises still indicate that the Soviets plan to attack nearby carriers and other naval forces as soon as possible after a war begins.

This emphasis, plus the Soviet view that it takes multiple hits with conventional weapons to sink a carrier, suggests that few submarines and aircraft armed with cruise missiles would be diverted from anticarrier warfare to interdiction. Evidence is mounting that Soviet cruise missile submarines carry few, if any, torpedo reloads, and this would limit their usefulness for interdiction after they had completed their anticarrier mission.

Protection of Soviet Peripheral Waters. In addition to protecting Soviet territory from sea-based missile and air attack, the Soviet Navy has the mission of securing coastal waters from enemy attack. Doctrinal literature devotes comparatively little space to this traditional mission, which has been supplanted in Soviet debate by the more difficult problem of fighting naval strike forces farther away.[6] Nonetheless, exercises have had defense of the homeland as a recurrent theme in Soviet naval training since the mid-1960s. Generally, these exercises include simulated amphibious and carrier task forces, which are subjected to attack by Soviet surface, submarine, and air forces, with missile-equipped aircraft delivering the decisive attack. These exercises suggest that in wartime large forces, including diesel-powered submarines armed with cruise missiles, would be held in or near the Barents Sea–far from major shipping lanes and from any interdiction activity.

Interdiction at Sea

Soviet military literature and exercises devote much attention to antifleet operations and little to interdiction. What information is available on interdiction suggests that from the beginning of a general war the Soviets would conduct some attacks on shipping, primarily as a means of

[5] In delousing operations, passing submarines check each other for covert trailer submarines.

[6] Many of the forces devoted to countering SSBNs and carriers would be deployed so as to fulfill both missions—those deployed to the Greenland - Iceland - United Kingdom gap and the Norwegian Sea are examples.

dispersing and tying down Western naval assets and forcing NATO shipping to take defense measures that would reduce its efficiency. They would give somewhat more importance to cutting the NATO-US lines of supply by attacking port areas. In his book *Sea Power of the State* (1976), Adm. Sergey Gorshkov states that the character of interdiction operations has changed and that interdiction is now subsumed in the "overall system of naval operations against the shore."

Our judgments on the status of interdiction rest on evidence from a variety of Soviet sources—chiefly on their writings and exercises and the structure and capabilities of their attack submarine and naval air forces.

Writings. Soviet opinion is far from unanimous, and classified and open-source Soviet writings indicate that as early as 1963 there were differing points of view within the naval command. The authoritative view seems to strike a balance between two extremes—that interdiction has no significance, and that it would play an important role in the initial period of war.[7] One writer stated that a part of Soviet naval forces, particularly diesel-powered submarines, would operate on the sea lanes to prevent NATO troops from being reinforced or evacuated but added that such an operation must not divert the main force elements from attempting to engage enemy carriers and SSBNs.

Military doctrine shifted in the late 1960s to include the possibility of a protracted war—which some authors judged would increase the importance of interdiction. No immediate shift in emphasis occurred, however; as recently as 1970 some advocates of paying more attention to interdiction believed that the USSR had not made the preparations required for effective interdiction operations.

Taken as a whole, Soviet writings suggest that the USSR is hedging its bets on interdiction. Most Soviet planners do not expect to have to fight the kind of war in which attacks against shipping would be significant. They expect the opening phases of a war to be brief and decisive, culminating in a nuclear exchange—which would destroy the ports upon which shipping depends. This belief relegates attrition-based strategies like interdiction at sea to secondary importance.

The Soviets recognize that under certain less likely circumstances—particularly a prolonged war—cutting the sea lanes could become important. They apparently believe that as such a war progresses, forces may complete their primary missions and become available for interdiction. We consider it unlikely, however, that many ASW forces could be reassigned during a conflict, mainly because they could not find the SSBNs and so could not complete their mission. Soviet forces probably also would suffer heavy losses in their attacks against Western aircraft carriers and SSBNs; and Western attack submarines, ASW aircraft, and mines probably would destroy many Soviet submarines as they funneled through the geographic chokepoints between their bases and the open ocean.

Information from Soviet writings on mission priorities became scarcer after 1970. We do have recent Warsaw Pact documents which, with evidence from other sources, suggest that no fundamental change has occurred. The mix of nuclear and conventional weapons carried by attack submarines[8] reflects the Soviets' continued belief that conflicts at sea are likely to escalate,

The Soviets would not lightly discard the basic precepts that have guided their operational planning for the last two decades. To do so would require a major break with past doctrine, a body of military thought characterized by slow, evolutionary change. Even more important, they could not allocate more assets to interdiction at sea without reducing their assets against Western SSBNs and aircraft carriers—forces capable of striking vital targets in the Soviet Union with nuclear weapons.

Exercises and training. The Soviets rarely practice attacks against convoyed merchant ships

[7] See annex A for discussion of the internal debate on the role of interdiction.

[8] See annex D.

except as part of amphibious landing exercises. Soviet writings emphasize the importance of coordinating air and submarine operations in any campaign to interdict shipping, There is no evidence, for example, of a Soviet torpedo attack submarine conducting joint search-and-attack operations with a TU-95 Bear D reconnaissance airplane—the only reconnaissance aircraft with sufficient range to fly over the North Atlantic sea routes and locate targets for submarines. If interdiction were a priority mission, such joint operations would seem to be desirable, because submarines on their own have a limited ability to find merchant ships.

We have current, detailed information on Soviet naval training activities and objectives, which makes no reference to interdiction. This omission confirms the precedence of naval over nonnaval targets in Soviet thinking. Both naval exercises and routine training have focused on ASW and anticarrier warfare.[10]

exercises held in 1970 by the Warsaw Pact illustrated the antifleet orientation of the Soviet Navy. The 1970 exercise postulated a theater conflict with NATO in the eastern Mediterranean Sea and contiguous areas. It began conventionally, for "training" purposes, and according to the scenario the Pact could have achieved its objectives without use of nuclear weapons. After three days of fighting, however, NATO was facing defeat and escalated the conflict.

From the onset of the exercise, the Pact's "main" naval forces were directed against Western aircraft carriers and SSBNs operating in the Mediterranean. (The scenario assumed a highly optimistic view of the Pact capabilities.) They also supported Pact ground forces, destroyed enemy naval forces in the Black Sea, and helped secure the Turkish Straits. The exercise apparently did not simulate strikes against merchant shipping.

[10] By contrast, Adm. Doenitz, architect of the German U-boat campaign during World War II, believed that interdiction required thorough and specialized training. He insisted that U-boat crews undergo rigid training before being sent against Allied shipping. On 1 September 1940, for example, only 27 U-boats were available for Atlantic duty, partly because many others had been detailed for training (Doenitz, *Memoirs*, pp. 107-9). Soviet naval officers appear to agree with this assessment: their writings stress that open-ocean interdiction operations would be complex and difficult and criticize the Germans for the decline in U-boat training that occurred late in World War II.

Trends in Force Procurement. The Soviets have not structured their military forces to interdict merchant ships in the open ocean.

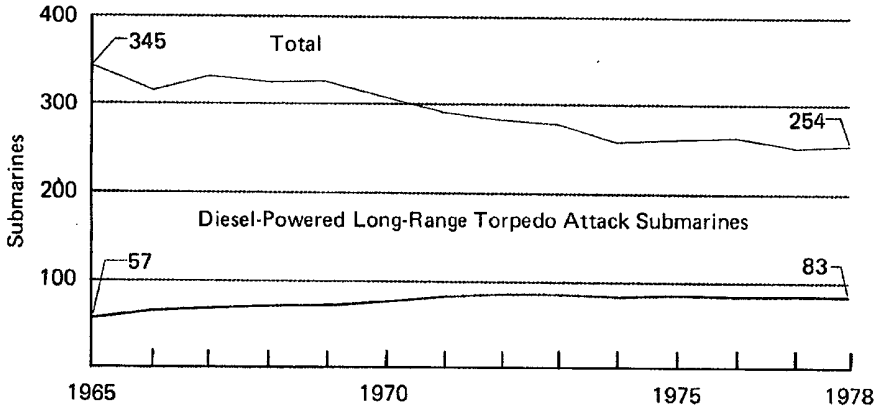
- The size of the attack submarine force has declined by nearly 30 percent since 1965, as shown in the graph, figure 1. The loss in numbers is offset somewhat, for interdiction purposes, by the greater speed and range of the newer submarines.
- The Soviets probably could not sustain their submarines in the North Atlantic sea lanes without returning them to base. Soviet officers write that distant submarine operations need logistic support for resupply at sea in wartime—but their submarine tenders are easy targets for Western aircraft and submarines. Indeed, the vulnerability of their logistic support system has been noted repeatedly in Soviet writings and is consistent with the findings of Warsaw Pact exercises.
- Most of their naval aircraft armed with ASMs lack the range to operate effectively over the major sea lanes (see map, figure 3).
- Finally, the Soviets have not mass-produced submarines primarily intended for sinking merchant ships, although they could have done so.

The Soviets could, for example, have built great numbers of submarines that combined simplicity of design, high endurance, large torpedo capacity, and relatively inexpensive diesel propulsion.[12] Instead, they have concentrated resources on fewer, more expensive submarines with relatively small torpedo loads that are specialized for ASW and anticarrier operations.

[12] The Soviets had unused construction capacity during the production run for the diesel-powered long-range F-class submarine (the second most numerous class in the Soviet submarine force). Production spanned more than a decade and averaged less than five new units a year. By comparison, production of the medium-range W-class submarine reached more than 60 units a year before the program was canceled in the mid-1950s.

Figure 1

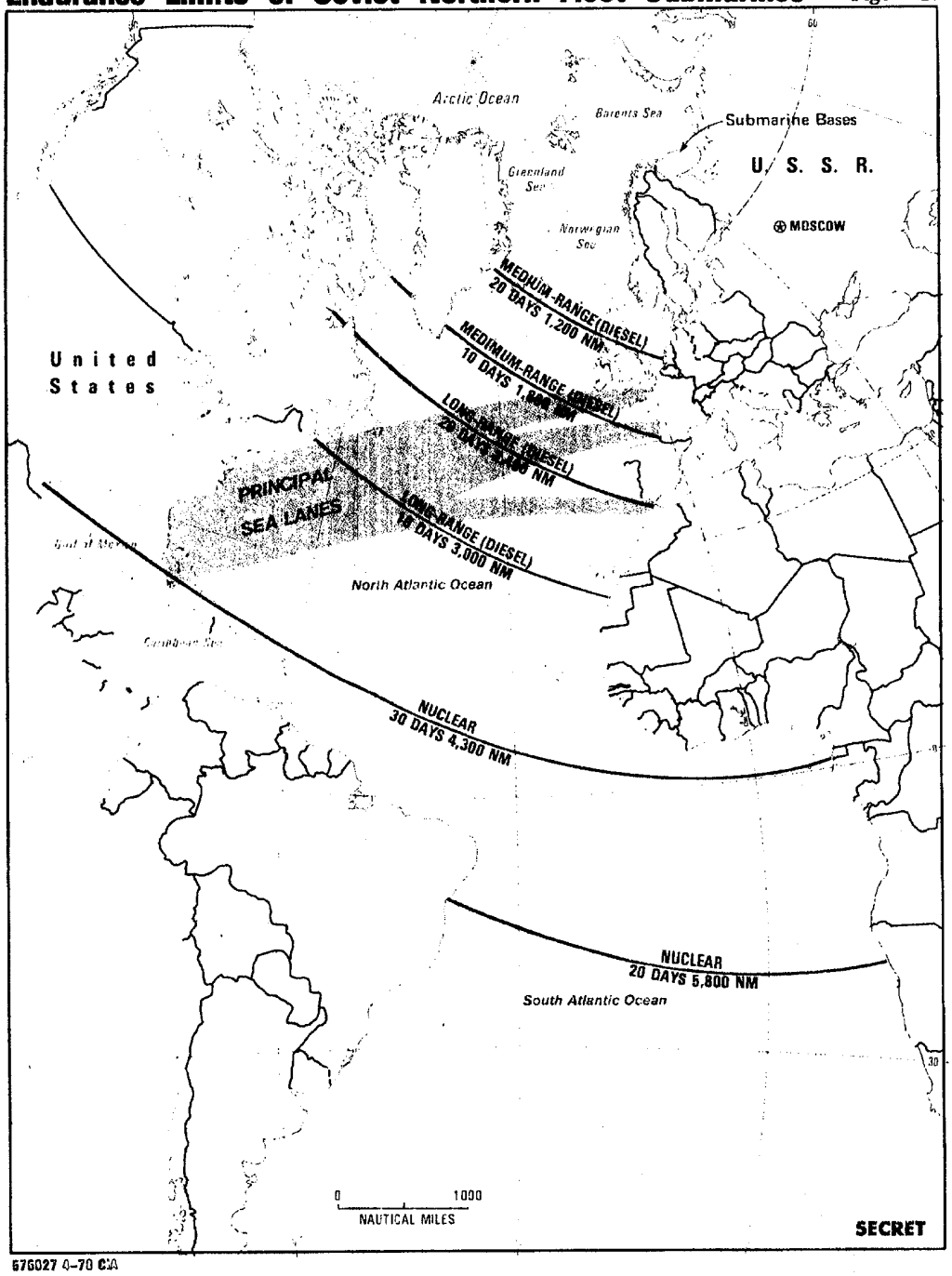
The Soviet Attack Submarine Force, Midyear 1965-April 1978*



*Excludes auxiliary, radar picket, and reserve submarines.

Endurance Limits of Soviet Northern Fleet Submarines

Figure 2.



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Classified writings of the mid-1960s indicated that the Soviets' principal interdiction weapon system would be the torpedo attack submarine with diesel propulsion. Long-range diesels (mostly of the F-class) make up about a third of their attack submarine force, a percentage that has been fairly stable in recent years. (Although the Soviets are slowly retiring obsolescent Z-class submarines, they are building new long-range diesels—of the T-class—at a near-replacement rate of about two a year.)

This type of submarine would also be heavily committed in wartime to antifleet operations, as current submarine operations [13] and Soviet doctrinal writings and exercises indicate. The slow underwater speed of the F- and T-class units dictates that they lie in wait for targets or patrol in relatively restricted areas; thus, many would be positioned in geographic chokepoints where they could intercept Western naval forces. This would leave relatively few submarines available to interdict shipping in the open-ocean sea lanes.

Soviet Capabilities for Open-Ocean Interdiction in a General War

The Soviets would try to hamper Western shipping in a variety of ways. These include making air and missile strikes against ports, sinking merchant ships in the open ocean and in coastal waters, and mining harbor entrances. This assessment, however, deals only with Soviet capabilities to destroy NATO shipping in the Atlantic and contiguous seas.

Capability of Soviet Attack Submarines

The USSR currently maintains in its western fleets an active inventory of 178 attack submarines, most of which are based in the Northern Fleet (see table 2). Of this total, 122 are long-range units with the endurance to operate on the major shipping lanes. Nuclear-powered submarines (SSGNs and SSNs), capable of operating 20 days on station with a 5,800-nm patrol radius,[14] make up nearly one-third of the force. Long-range diesel submarines, capable of operating 20 days on station with a 2,400-nm radius, constitute another third. The rest are mostly medium-range R- and W-class submarines, which have an endurance of 20 days on station when operating within 1,200 nm of their bases in the USSR. Without forward basing, these shorter range submarines would not be effective against the major shipping lanes to Europe and could be more effectively used in defensive operations in areas closer to the USSR. Submarines based in the Baltic and Black Seas probably would be denied access to the North and Mediterranean Seas—Soviet plans to gain control of these areas notwithstanding.

The focal point for a Soviet campaign against Western shipping most likely would be the North Atlantic, and the main threat would be the 107 long-range attack submarines based in the Northern Fleet, supplemented perhaps by a few long-range units predeployed from the Baltic and Black Sea Fleets. Although this force is large, several factors limit its capability against the flow of NATO merchant shipping.

Competing Mission Requirements. One of the most important factors limiting the effectiveness of a Soviet interdiction campaign would be the competing naval missions that would have a prior claim on attack submarines. Even without diverting forces to an interdiction campaign, the Soviets do not have the submarines they believe they would need to perform the critical naval missions of strategic ASW and defense against carrier strike forces.

Reliable evidence from Soviet discussions of the strategic ASW problem suggests that the Soviets estimate they would need some 80 to 100 nuclear submarines (they have 53 in the Northern Fleet) or 320 to 400 diesels if they are to have a 70-percent probability of destroying the NATO SSBNs in the Atlantic area.[15] Our own analysis of

[13] The F-class is used more extensively than other classes of Soviet attack submarines. Normally, these submarines are deployed in the Mediterranean, where they would be directed mainly against naval ships of the US Sixth Fleet. The only other F-class units routinely deployed out of area are in the Gulf of Aden and west of Africa. Long-range diesel submarines rarely operate in the major sea lanes.

[14] The endurance limits of Soviet submarines are shown on the map, figure 2.

[15] This assumes that they have located the SSBNs within 100-square-mile areas. We believe they would have difficulty accomplishing this first step, however, because of the poor quality of Soviet sensors and the low noise levels of US and UK SSBNs compared to those of Soviet submarines.

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Table 2

Distribution of Attack Submarines Among Soviet Fleets, April 1978

	Range	Estimated Torpedo Loads [1]	Northern Fleet	Baltic Fleet	Black Sea Fleet	Total in Western Fleets	Pacific Fleet
CRUISE MISSILE SUBMARINES							
Nuclear-Powered (SSGN) Class/Missiles							
C-I/8 SS-N-7	long	12	9	...	...	9	2
C-II/8 SS-N-7	long	12	3	...	...	3	...
E-II/8 SS-N-3/12	long	8	15	...	...	15	14
P/10 launchers for an unknown missile	long	Unknown	1	...	...	1	...
Total SSGN			28	...	...	28	16
Diesel-Electric (SSG) Class/Missiles							
J/4 SS-N-3	long	6	12	...	...	12	4
W Long Bin[2]/4 SS-N-3	medium	10	...	3	1	4	2
W Twin Cyl.[2]/2 SS-N-3	medium	12	...	...	3	3	...
Total SSG			12	3	4	19	6
Total Cruise Missile Submarines			**40**	**3**	**4**	**47**	**22**
TORPEDO ATTACK SUBMARINES							
Nuclear-Powered (SSN) Class							
A [3]	long	Unknown	...	...	...	...	...
E	long	8	...	...	...	...	5
N	long	18 [4]	8 [6]	...	...	8	4
V-I	long	16 [5]	12 [6]	...	...	12	3
V-II	long	16 [5]	5	...	...	5	...
Total SSN			25	...	...	25	12
Diesel-Electric (SS) Class							
B [7]	short	Unknown	1	...	2	3	1
F	long	22	36	5	...	41	19
G	long	6	...	...	...	...	2
Q [7]	short	8	...	2	2	4	...
R [2]	medium	14	10	...	2	12	...
T	long	22	3	...	5	8	...
W [2]	medium	12	5	15	10	30	15
Z	long	22	3	4	1	8	5
Total SS			58	26	22	106	42
Total Torpedo Attack Submarines			**83**	**26**	**22**	**131**	**54**
Total long-range attack submarines			107	9	6	122	58
Total short- and medium-range attack submarines			16	20	20	56	18
GRAND TOTAL			**123**	**29**	**26**	**178**	**76**

... Signifies zero.

Note: Numbers include submarines in repair, but not auxiliary, radar picket, or reserve units.

[1] Torpedo estimates assume that Soviet submarines are loaded wth standard 21-inch torpedoes. There is some evidence that submarines which lack torpedo reloads, such as the J-class, could increase their loadings by carrying two small weapons in place of a large one

[2] Without forward basing, these medium-range submarines have too little endurance to be effective against Western shipping in the North Atlantic.

[3] The Soviets have built five A-class SSNs. Of these, one has been dismantled, three are fitting out, and one is undergoing sea trials.

[4] N-class submarines can carry 20 torpedoes if they have after torpedo tubes.

[5] V-class submarines also carry two SS-N-15 rocket-assisted nuclear depth bombs for use against other submarines.

[6] Two SSNs, an N and a V-I, have been inactive for many years and are considered here to be in reserve.

[7] Submarines suited only for coastal or inland sea operations.

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Soviet ASW capabilities indicates that even these numbers would not suffice—but their planning factors show the level of effort the Soviets feel is necessary for that mission alone.

Similarly, the Soviets believe that mass forces would be required to counter Western aircraft carriers. In addition to aircraft armed with ASMs, they have estimated that three to four nuclear-powered submarines or 12 to 15 diesels would be required to detect and attack a carrier task group in time to prevent the launch of aircraft. They have estimated that they would need to salvo eight submarine-launched cruise missiles in order to penetrate the air defenses of a carrier task force and that 12 to 15 hits with conventional torpedoes would be required to sink an aircraft carrier. In a nuclear conflict, one writer noted, three SSNs—each armed with three torpedoes with nuclear warheads—would be needed to destroy a carrier group consisting of one strike carrier, an antiaircraft guided missile cruiser, and escorts. If submarines were unavailable, he noted, the number of airplanes required to attack such a group would be two regiments—more than 40 aircraft—equipped with ASMs, six of which would have nuclear warheads.

Some submarines probably would be positioned where they could attack a variety of targets, especially those in the Norwegian Sea and in the Greenland - Iceland - United Kingdom (G-I-UK) gap. Others could attack merchant ships as targets of opportunity, either while waiting for NATO naval forces to cross their path or after completing primary missions, such as attacking carriers.

Availability for Operations. Soviet submarines are often unavailable for duty—another factor affecting the Soviet ability to carry out an interdiction campaign. This limitation stems from poor quality control and inefficiencies in the design, production, and maintenance of the submarines and from block obsolescence of some types. In addition, the Soviets have expanded the nuclear submarine fleet—with emphasis on SSBNs—faster than they have built the facilities and trained the personnel for repairing them.

Empirical evidence suggests that in an emergency some 60 percent of the submarine fleet could conduct operations with varying degrees of effectiveness. The Soviets would find it difficult to sustain the initial level of deployment, however—not only because of combat attrition, but also because increased use could lead to more of the materiel failures that have plagued their submarines during routine peacetime operations.

Torpedo Reloads. Another limiting factor would be the small number of torpedoes carried by some classes of Soviet submarines. Units armed with cruise missiles, in particular, would be limited in carrying out a secondary role against shipping because they carry few torpedoes.[16] (Nuclear weapons probably would not be used against commercial targets.) In addition, all deployed Soviet submarines, regardless of class, apparently carry as part of their load at least two nuclear torpedoes and some ASW torpedoes.

In a long conventional war, the Soviets would have to return their submarines to home waters to rearm them. In the Atlantic this would force them to come and go through chokepoints where they probably would be subject to heavy attrition.

The Soviets have not stockpiled naval weapons near the Atlantic sea lanes. They do have a fleet of submarine tenders and missile support ships, which could transfer torpedoes at open anchorages and cruise missiles at sheltered anchorages and in port. If they left Soviet-controlled waters in wartime, however, these resupply ships would be vulnerable to attack, and the Soviets probably would not count on them for replenishment.

Weapons Effectiveness. Soviet weapons reliability apparently would not be a seriously limiting factor. Tests performed on recovered Soviet torpedoes suggest that they are technically reliable (about .85). Reliability, however, is only one of several factors in the effectiveness of torpedo attacks, and other factors tend to reduce that effectiveness. The Soviets appear to be fairly proficient in their routine torpedo firing exercises—but those exercises are seldom realistic, and they usually involve straight-running, unprotected ships. When they expect the target to be protected, Soviet submarines usually fire at long ranges (often 10,000 yards). This practice—

[16] See annex D.

together with the available writings on attacking surface ships with torpedoes—suggests that the Soviets plan on firing from outside a convoy's screen in wartime—a distance that would seriously reduce effectiveness.

Primarily because of this practice, the Soviet hit rate in wartime probably would be low. In Western navies there evidently would be about a .5 probability that a single nonhoming torpedo would hit a straight-running surface ship at 2,000 yards (most known types of Soviet antiship torpedoes lack a homing capability). This level of proficiency would drop quickly against a fast-moving, maneuvering target. Because of these considerations, we estimate the Soviet hit rate in wartime at no better than about 25 percent for each torpedo fired (.85 technical reliability multiplied by an optimistic .3 probability of hitting the target). Should the Soviets deploy an effective homing torpedo for use against surface ships, their accuracy might improve.

The Soviets might be diverted into firing some torpedoes against escorts—fast, highly maneuverable, shallow-draft ships that are difficult targets. They probably respect Western ASW ships. On occasions when their submarines have been detected by such ships they have found it difficult to escape.

The difficulty of determining whether a merchant ship is carrying important military equipment or routine commercial cargoes would also reduce effectiveness. Soviet writings stress the importance of target selectivity, without indicating how it is to be accomplished. Reconnaissance is difficult from a submarine; the major sea lanes are crowded with ships; and NATO could complicate target discrimination further by such measures as flying neutral-country flags.

Submarines Committed to Interdiction. Despite the high priority and heavy requirements of strategic defense and the difficulties inherent in a large-scale interdiction campaign, the Soviets probably would assign some submarines to attack shipping from the outset of hostilities. They apparently believe that a commitment of relatively few submarines against shipping could tie down a disproportionate number of enemy naval forces, keeping them from combat with important Soviet fleet components, particularly SSBNs. Moreover, they expect that the threat of attack will force NATO to adopt convoying, a practice that alone, in Soviet estimates, could reduce the effectiveness of shipping by some 20 percent.[17]

The number of submarines earmarked for interdiction missions is unknown. In the initial stages of a war, however, we believe that the total would be not more than about 10 percent of those operationally available, because of other force commitments. Many cruise missile equipped submarines evidently would be positioned away from the major sea lanes and in the principal avenues of approach to the USSR to defend against raids by carrier strike forces; those deployed near the sea lanes might be prohibited from attacking targets other than carriers. The more capable ASW submarines (the V-class) probably would be seeking enemy SSBNs and protecting their own; and some of the rest would be conducting barrier operations. If so, relatively few submarines—mostly N-class SSNs and long-range diesels—would be in the major sea lanes, assigned to engage merchant ships.

Torpedo Launch Capacity in the Sea Lanes. If the Soviets gave at-sea interdiction about the same priority as ASW and anticarrier warfare, they could assign 21 long-range torpedo attack submarines against shipping in the Northern Atlantic. (This is 33 percent of the inventory of general purpose submarines in the Northern Fleet, at 60 percent availability.) Over a 120-day period, these submarines under favorable operating conditions could sink or disable some 100 merchant ships, or about 1 percent of NATO-flag shipping.[18] Additional merchant ships flying Pan-

[17] Both Admiral Doenitz and Winston Churchill estimated that the effectiveness of British merchant shipping was reduced by 33 percent during World War II because of defensive measures made necessary by the U-boat threat.

[18] These numbers were derived using a set of assumptions generally favorable to the Soviets. The attrition of forces per submarine patrol was .2; each submarine withheld two torpedoes for self-protection and expended all others against merchant ships; on-station time was 15 days; the technical reliability for Soviet torpedoes was .85; the probability of a hit per single firing was .3, and one hit was sufficient to disable a target. (See annex E.)

amanian and Liberian flags of convenience probably also would be available to the West for sealift if necessary.

After the first interdiction patrol, the capabilities of the attack submarines could be expected to decline. To replenish their torpedo loads, they would have to pass through the G-I-UK gap, where they probably would be especially vulnerable, and once rearmed they would have to return through the gap. The older submarines are the ones likely to be used in an interdiction campaign, and the increased demands on them, combined with minimal time in port for replenishment and maintenance, would probably cause significant materiel failures—which would seriously reduce their combat effectiveness and/or lengthen time between patrols.

The number of submarines the Soviets believe they could maintain on station is unknown. In World War II the Germans, operating new submarines from forward bases in France and Norway, were unable to keep more than 30 percent (and frequently far less) of their U-boats in the sea lanes. The Soviet Northern Fleet, operating from the Kola Gulf, would be unable to keep even 30 percent of its submarines in productive waters.

Deploying out of Northern Fleet bases at the high average speed of 12 knots, Soviet nuclear-powered submarines would spend 22 days in a round trip to and from the sea lanes, while diesels averaging five knots would spend 54 days.[19] The Soviets probably would be more limited by the number of torpedoes they carry than by the endurance of their submarines. Without help in finding targets, however—particularly if they intend to be as selective as their writings imply—patrols by diesel submarines also might be limited by the endurance of ship and crew.

Our estimate of the turnaround time for Soviet submarines is also based on the German experience. German U-boats averaged 25 days in port between patrols. If we assume that the Soviets spend 25 days between patrols and 15 days on station, in a 120-day war their nuclear submarines could operate on the sea lanes 25 percent of the time and their diesels 12.5 percent. In a long campaign, extra time would be required for major repairs or overhaul—an area characterized by poor Soviet performance in peacetime. (The Germans—using simpler submarines, recently built—had to make extensive repairs after seven or eight patrols.) To guard against underestimating Soviet capabilities, we credit the Soviets with the same level of efficiency in turning their submarines around as that achieved in World War II by the Germans and, generally, by the US in the Pacific.

Alternative interdiction scenarios, analyzed with the help of a model, are discussed in more detail in annex E.

[19] This calculation assumes that convoys are routed southward to avoid Soviet aircraft and that Soviet submarines must travel 3,200 nm from their Kola Gulf bases.

Capability of ASM-Equipped Aircraft

Naval Aviation. Soviet Naval Aviation—the primary Soviet air force that would be involved in antiship attacks—is not well suited for interdicting most of the Western sea lines of communication. Soviet naval ASM-equipped aircraft have relatively short combat radii, which rule out their use over most of the major sea lanes in the North Atlantic (see table 3 and map, figure 3). They do have some capability near the United Kingdom, but ground-based air defenses would make strikes there particularly hazardous.

Naval Aviation has some 310 ASM-equipped aircraft assigned to the four Soviet fleets (see table 4). Most of these aircraft are aging medium-range TU-16 Badgers, which are especially vulnerable to modern air defenses. About 67 Badger tanker aircraft are assigned to Badger strike regiments for refueling support. The supersonic Backfire bomber was first introduced into Naval Aviation in late 1974, and about 35 of these aircraft are now operational in the Baltic and Black Sea Fleets.

Some 200 ASM-equipped Backfire aircraft probably will be in naval service in the mid- to late 1980s. The Backfire can fly farther than the Badger, and its high speed and ability to fly at

low altitudes make it better able to penetrate air defenses.

The map, figure 3, shows the practical limits for antiship attacks by naval aircraft in a NATO - Warsaw Pact war, at least in its early stages. These practical limits are shorter than the maximum combat radii shown in table 3 because the conditions would not be optimum—the aircraft would have to penetrate Western land-based and fleet air defenses. Unless Western air defenses were eliminated, Soviet mission planners would have to allow fuel for combat maneuvering, for high-speed flight, and for indirect routing and low-altitude flight to avoid detection of the aircraft. These factors would reduce their range considerably.

The limits shown on figure 3 are keyed to the capabilities of the Backfire, but Badgers—with aerial refueling—could also make some attacks at those ranges. Long-range Badger strikes would be limited by the tanker aircraft, which are few and have only a small fuel-transfer capacity. Only

Table 3

Maximum Combat Radii of Naval ASM-Equipped Aircraft Under Optimum Conditions

	Weapon Load	Unrefueled Radius	Radius With One Prestrike Refueling
Badger C	1 AS-2	1,450 nm	2,050 nm
Modified Badger C	2 AS-6	1,050 nm	1,600 nm
Badger G	2 AS-5	1,150 nm	1,850 nm
Backfire	1 AS-4 [1]	1,750-2,075 nm [2]	2,700-3,100 nm [3]

Note: These radii should be considered upper bounds. They assume flight profiles optimized for maximum range, carrying only a minimum fuel reserve, and they do not allow for loitering, low-altitude flight, high speed, or combat maneuvering.

[1] The Backfire aircraft can carry two, or possibly three ASMs, but only with significant reduction in combat radius.

[2] Intelligence estimates of the Backfire performance characteristics differ. The Defense Intelligence Agency and the Assistant Chief of Staff, Intelligence, Department of the Air Force, estimate the unrefueled radius of the Backfire with a single AS-4 to be about 2,850 nm.

[3] Naval Aviation currently has no tanker force to support Backfire operations. However, there is some evidence that the Soviets are developing a tanker aircraft which could support the Backfire. With one prestrike refueling *under optimum conditions*, the Backfire radius could be improved by as much as 50 percent for some missions.

Figure 3. Assumptions

1. Limits are based on the performance of the Backfire bomber—the most capable naval strike aircraft—armed with a single AS-4 ASM. [1]
2. Flights originate from forward naval airfields in the USSR or from airfields in other Warsaw Pact countries.
3. Flight routes are selected to avoid or minimize overflying Western land-based air defenses.
4. Except where the aircraft encounters extensive land-based air defenses for most of the flight, strike missions are based on the following hi-lo-hi-lo-hi flight profile:
   - The aircraft initially flies at its most efficient cruise altitude and speed.
   - As the aircraft approaches its target, it descends to low altitude for 200 nm to avoid detection.
   - The aircraft then climbs to high altitude to launch its AS-4 missile
   - After launch the aircraft reverses course and descends to low altitude to escape.
   - After 200 nm at low altitude, the aircraft climbs to its most efficient cruise altitude and returns to its base.
5. Where it would confront extensive land-based air defenses—such as the Baltic and eastern Mediterranean regions—the aircraft is assumed to fly at low altitude for most or all of its mission.
6. The Backfires will fly at subsonic speeds; ~~these slower~~ speeds ~~will~~ would reduce their radius. Flying at supersonic
7. The Backfire aerodynamic design is assumed to be optimized for subsonic flight. A less efficient design would reduce the combat radius by some 15 percent.
8. The Backfires will not refuel in flight. Naval Aviation currently has no tanker force to support Backfire operations. However, there is some evidence that the Soviets are developing a tanker aircraft which could support the Backfire. With refueling in the Norwegian Sea, the Backfire range could be extended several hundred miles into the North Atlantic, depending on where the aircraft was refueled. Refueling in the Baltic and Mediterranean regions is not considered feasible—except over friendly territory—because of the hostile air defense environment.

[1] Intelligence assessments of the Backfire's performance differ. The performance characteristics used here are based on the CIA appraisal of the Backfire If the DIA and US Air Force higher estimates of the Backfire radius were used, the limits in the North Atlantic for aircraft flying from the Northern Fleet would extend from northern France to just south of Greenland, and they would encompass some of the northernmost shipping lanes. However, the Backfire still would be unable to attack ships in the central North Atlantic.

Practical Limits for Initial Antiship Attacks by Soviet Naval Aircraft in a NATO-Warsaw Pact War

Figure 3.

Table 4

Soviet Order of Battle of Naval ASM-Equipped Aircraft, January 1978

	Northern Fleet	Baltic Fleet	Black Sea Fleet	Pacific Fleet	Total
Backfire	...	14	20	...	34
Badger C [1]	33	21	22	23	99
Modified Badger C [1]	33	21	23	23	100
Badger G	...	22	10	45	77
Total	66	78	75	91	310

... Signifies zero.

[1] The size of the Badger C modification program is unknown. We assume arbitrarily that half the Badger C aircraft have been modified.

about six tanker aircraft are attached to each strike regiment to refuel some 25 strike and electronic countermeasure support aircraft. The Soviets thus far have not pooled naval tankers from several regiments to support large strike formations. [20]

Long Range Aviation. For the LRA, antiship attack is a secondary mission. Some LRA aircraft usually participate in major naval exercises, and they practice reconnaissance and antiship strikes. The intermediate-range bombers, similar in type to those of Soviet Naval Aviation, could perform antiship strikes in the nearer reaches of those areas shown in figure 3. The LRA has only about 10 tankers for refueling the intermediate-range bombers. Of its 190-odd heavy bombers, 70 TU-95 Bears are equipped with ASMs. Attacks by the TU-95s would be limited to nuclear strikes, since they carry only nuclear AS-3 missiles. (These were designed for use against large-area targets rather than for direct hits on ships.) [21]

Capability of Surface Ships

The ability of Soviet surface combatants to cut sea lines of communication is restricted not only by the priority of other missions but also by the risks inherent in any wartime attempt to operate in open-ocean areas. Of particular importance is the surface ships' vulnerability to NATO air power, both carrier- and land-based, when they are operating beyond the range of Soviet air support. The Soviets are well aware of that vulnerability—senior military officers have cautioned naval planners that they could not count on using their surface ships against Western carriers in the Mediterranean after the second day of hostilities.

Another drawback in the use of surface combatants for interdiction would be the Soviet inability to provide adequate logistic support. Soviet combatants in the Atlantic would have to either return to Northern Fleet bases for replenishment or rely on logistic support ships deploying from those bases. Ships of one type or the other would have to leave the Norwegian Sea through the G-I-UK gap, where they would be highly vulnerable to attack from Western aircraft and attack submarines. Soviet support ships, which are poorly armed and too slow to keep up with warships, would be subject to very heavy attrition. Moreover, they are adapted to operations in harbors and have little capability for providing warships with underway replenishment of munitions. [22]

Over half of the Soviet major surface combatants are equipped with missiles designed for

[21] There is some evidence that the Soviets are modifying some of their ASM-carrying heavy bombers to carry the AS-6 ASM, which has an antiship capability using either conventional or nuclear warheads. They also may be improving the accuracy of the nuclear-armed AS-3 ASMs. Either of these modifications would give the LRA's ASM-carrying heavy bombers a capability for conventional attacks on ships.

ASW and air defense rather than for use against other surface vessels. In any case, Soviet writers do not regard surface ships as important platforms for strikes against merchant ships, except in coastal waters. They regard surface ships as important for safeguarding the sea approaches to the USSR, their own shipping, and the passage of their submarines to and from operational waters.

Other writers have said that surface ships could be used to keep slowmoving convoys continuously under observation. We doubt that such a use could be effective after the outbreak of hostilities, however, except in areas where the Soviets had air superiority.

NATO Capabilities

NATO Sealift Resources

A major Soviet interdiction campaign at sea probably would founder on one of the same problems that plagued the German U-boats: the large number of merchant ships available to the West. Western commerce rides on the keels of thousands of ships.[23] Moreover, the construction of merchant ships—and the potential replenishment of the inventory—is high: *Lloyd's Register of Shipping* reported that in 1976 over 1,000 merchant ships were constructed in the Free World, totaling nearly 30 million tons. This was down four million tons from the peak 1975 level, and further reductions are expected, as a result of overbuilding in the early 1970s, economic recession, and decreasing demand for new tankers.[24] Nonetheless, these figures indicate considerable capacity to replace losses in shipping even early in a war.

[23] According to Lloyd's, in 1977 there were over 9,600 NATO-flag merchant ships of more than 1,000 gross register tons. A recent study by Headquarters, US Command in Europe, concluded that over 5,000 of these would be suitable for sealift of supplies and materiel to Europe. There are shortages of specialized merchant ships, however, such as those having a roll-on/roll-off capability. Additional Western-owned merchant ships flying Panamanian and Liberian flags of convenience also would be available for sealift if necessary. An older study estimated that about 11,500 merchant ships could be used for the resupply of NATO. The number we used in this study—5,832—comes from Lloyd's but excludes ships of less than 6,000 gross register tons.

[24] See *World Shipbuilding: Facing Up to Overcapacity*, ER 77-1068, November 1977, for details.

The Soviet emphasis on target selectivity probably reflects an awareness that random sinkings would achieve little among thousands of ships. In practice, however, distinguishing ships carrying military cargoes bound for NATO forces in Western Europe from the large number of ships loaded commercially would be difficult—some 3,200 Free World merchant ships are estimated to ply the sea lanes of the North Atlantic on a typical day. Time consumed in selecting the target could itself reduce the effectiveness of Soviet at-sea interdiction.

US Plans for the Resupply of NATO

The size of a likely US resupply effort, while providing numerous targets for Soviet submarines, would work against a Soviet interdiction campaign. US plans for resupplying NATO in a conventional war assume a large scale of support shipping that would increase steadily during the war.

Convoys totaling approximately 350 ships could be en route during the first 30 days of hostilities, and during the next 30 days more than 500 additional ships probably would depart for Europe. US projections for later phases of a war assume that over 1,000 more would sail, making a total of 2,000 ships with military cargoes in the first 90 to 120 days of war.

The European NATO countries have agreed to allocate more ships to resupply in wartime, and by the end of 1978 the pool of shipping resources committed to this task should have increased substantially. The earmarked NATO ships, identified by name, would be among the best available, and their status would be continuously monitored. To reduce this pool appreciably (by, say, 25 percent) among the thousands of ships loaded commercially, the Soviets would have to maintain large, continuously deployed strike forces in the sea lanes. We believe that present Soviet forces are inadequate for this task.

Because of the number of ships available, losses in military cargo could be more significant than losses in ships—if irreplaceable equipment is concentrated in a few hulls that are identified, attacked, and sunk.

Outlook

Contemporary Soviet documentation, exercises, and naval force trends indicate that for the next decade or so there is unlikely to be any militarily significant increase either in Soviet willingness to allocate forces to interdiction or in the interdiction capabilities of the forces themselves. This judgment is based on:

- The maintenance of strong Western SSBN and carrier strike forces capable of attacking targets in the USSR with nuclear weapons; this threat requires the Soviets to commit strong forces in counteraction.
- The maintenance of strong NATO air defenses; these could and probably would deny Soviet aircraft free access to the sea lanes in wartime.

A key element in deterring the Soviets from fully exploiting Western dependence on long sea lines of communication in wartime is the credibility of the carrier and SSBN threats to the USSR. The specter of US carrier task groups in areas such as the Norwegian Sea and the eastern Mediterranean would almost certainly hold large Soviet forces in those areas—well away from the major sea lanes. If, on the other hand, the West stationed high-value targets like carriers on the major shipping routes, Soviet naval strike forces would tend to be attracted to those targets and thus be in a position to threaten Western convoys as well.

Soviet ASW forces are ineffective against US SSBNs. To improve their ASW defenses, the Soviets would have to enlarge their forces and solve the difficult problems of detecting and classifying contacts. Confronted with persistent failure, they could conceivably reallocate their submarine forces to take advantage of easier targets, including merchant ships. That change is unlikely, however; all the available evidence suggests that, rather than adapting their strategies to their deficiencies in ASW, the Soviets are working to correct the deficiencies. Because of the design and construction leadtimes required and because of their considerable investment in present forces, they could not easily change this established course.

To some extent, Soviet naval mission priorities are scenario-driven. Thus, any reallocation of naval forces would depend on the outcome of the initial battles, at sea and on land. If NATO checked the Pact advance in Central Europe and if the war were prolonged, Soviet interest in interdiction probably would increase, because cutting the sea lanes—particularly in waters adjacent to a theater of military operations—could then affect the outcome of the war. This would be particularly true if attrition or Western strategy reduced the threat from aircraft carriers, thereby freeing more forces to attack merchant ships.

If a war in Europe were stalemated and Western strike forces remained largely intact, however, the Soviets would face a hard choice: to interrupt the US resupply of Europe or to concentrate their remaining naval forces against SSBNs and carriers. The Soviet tendency to assign higher priority to military targets suggests that under these circumstances the Soviets would choose continued concentration against NATO's offensive naval forces. Should they elect to send most of their surviving attack submarines and ASM-equipped aircraft against merchant ships, they would leave highly mobile Western attack carrier forces free to strike important Pact ground and naval targets.

The Soviets evidently would avoid the dilemma by directing other forces against what they regard as shipping's most vulnerable point—ports of embarkation and destination. They would mine harbor entrances and systematically attack the ports with bombs and missiles. Soviet capabilities against US ports, however, probably would be limited in the conventional phase of war.

ANNEX A

THE ROLE OF INTERDICTION IN NUCLEAR WAR: SOVIET MILITARY VIEWPOINT

In the late 1960s a number of classified articles were written by senior officers of the Soviet Navy and of the General Staff [25] who would be closely involved in planning, coordinating, and executing military operations in wartime. Those articles laid down the basic principles of how the Soviets expected to fight a modern war. The authors regarded interdiction as secondary to the performance of strategic missions, except possibly in the final stage of a nuclear war. They believed that from the outset of hostilities, however, some attacks on merchant shipping should be made, concurrently with strategic missions.

The officers' purpose in writing apparently was to promulgate changes in Soviet strategy that developed when the range of conflict possibilities was broadened (after Khrushchev's ouster in 1964) to include wars fought partly or entirely with conventional weapons. They wrote that by the mid-1960s the US and USSR each had a variety of forces that could be applied in various sequences and combinations, depending on the military situation. This statement acknowledged the need for a "flexible response" doctrine. Their view of flexible response, however, differed from the US view in several important ways: they held that the conventional phase of a war would be brief (lasting from hours to a few days if war began in Europe, and not much longer if it began in a secondary theater) and that the possible period of limited nuclear warfare would be brief (if it occurred at all), as would the decisive nuclear period.

The authors indicated that while wars might be fought with only conventional or tactical nuclear weapons, they doubted that a war with NATO could be limited for long. The losing side, they said, would escalate to restore the situation.

According to these articles, in the conventional and limited nuclear phases of war the main Soviet effort would be against the enemy's nuclear strike forces. The Navy, with help from Long Range Aviation, would concentrate its efforts against enemy submarines and aircraft carriers. The brief opening phase would be important because it would help "set the stage" for the use of strategic nuclear weapons later in the war.

These authors believed that the concluding period of warfare after a nuclear exchange could be protracted, unlike the earlier, decisive stages; that military operations during this mopping-up period would be conducted mainly by surviving general purpose forces; that naval forces, because they can be dispersed, would survive in signifi-

[25] The General Staff, referred to in the USSR as the "military brain" of the state, is the most important military agency in peacetime. In war it would be the executive agency for the *Stavka* (the General Headquarters of the Supreme Command). Statements by leading General Staff officials probably reflect actual Soviet policy.

Note: The conclusions in this annex are based on a much larger volume of material than the articles referred to herein. We quote these articles because, although dated, they are the most authoritative and detailed available discussions of interdiction within the phased development of a general war (beginning with conventional hostilities and progressing through a limited nuclear period to full nuclear war). The more recent relevant writings available to us are few but are consistent with the principles expressed earlier.

cant numbers; and that they would therefore play an important role in this period.

According to more recent information on Soviet strategy for war in Europe, residual naval forces in the final stage of war would:

- Deliver strikes against coastal and theater targets.
- Complete the destruction of enemy fleet strike forces.
- Interdict enemy sea communications.
- Render aid to ground forces by conducting amphibious landings, seizing straits, and protecting their own shipping.

Other classified Warsaw Pact and Soviet writings have provided varying views on how a NATO-Pact war might develop. They differ mainly over whether a limited nuclear phase would occur at all and—less frequently—over whether a conventional phase can be lengthy. The authors assume that war could begin either with a surprise attack, using nuclear or conventional weapons, or after a period of rising tension.

All of the writings emphasize that the major objective of the conventional phase would be to destroy the enemy's nuclear-capable forces—SSBNs, carriers, forward-deployed tactical nuclear weapons and storage areas, and shore-based facilities which support enemy SSBN and ASW operations.

In a limited nuclear phase (should it occur), the tactical forces should immediately launch all of their nuclear weapons—including SLBMs with yields of less than one megaton—against high-priority enemy naval targets and some land targets. Among land targets the naval authors include airfields, tactical nuclear weapons sites, storage facilties, naval bases, and harbors; they exclude population centers and strategic shore installations.

Clearly believing that the first strategic nuclear strike would be the decisive act of the war, the Soviets indicate that during any conventional or limited nuclear phases they would conduct operations as if the transition to all-out nuclear war could occur at any time. They acknowledge that preparation for both kinds of war involves compromises that reduce the effectiveness of general purpose naval forces for either kind of war.

Internal Debate on Interdiction

Since the early 1960s, the naval command has been accused by some Soviet writers of paying too little attention to interdiction—and by others, too much. Briefly, writers who believe that open-ocean interdiction is not important have stressed that:

- *Shipping can be disrupted by attacks on land targets.* Admiral Gorshkov has reaffirmed this view, asserting in his book *Sea Power of the State* (1976) that the character of interdiction operations has changed and that interdiction is now subsumed in the "overall system of naval operations against the shore."
- *The Navy should concentrate on strategic missions.* Most Soviet writers appear to believe that in a general war oceans should be viewed not as an arena of action against shipping but as a vast battlefield for sea-based nuclear strike forces.
- *The power of nuclear strikes and the fast pace of modern war reduce NATO's need for large-scale shipments of materiel.*
- *NATO's military strength does not depend on the sea lanes.* Some of the authors argue that NATO stockpiling of supplies and equipment in Europe and the ability to airlift "minimum consumables" have reduced the value of interdiction at sea.
- *The sheer devastation of nuclear war would make interdiction irrelevant.* In this view, millions of people and thousands of industrial enterprises as well as military forces—all consumers of finished products and raw materials—would disappear, and so would any reason for resupply.
- *Modern submarines are capable of performing more important missions.* In the past,

their slowness and limited endurance made them comparatively ineffective against warships, according to some writers, who argue that today's submarines are "totally adequate" for attacking the main battle forces of enemy navies.

- *Interdiction is indecisive.* Almost all naval officers who have written about interdiction, including Gorshkov, consider that it alone could not determine the outcome of a war.

Other authors have stressed the importance of interdiction—which they do not limit (as our definition of the word does) to at-sea operations. They use the more general Soviet concept, which would include blockade by mining and destruction of ports and could include damage to land transportation, storage facilities, and defense industries. Briefly, these arguments emphasize that:

- *The logistic requirements of fighting a modern war with conventional arms are enormous.*
- *Interdiction can facilitate the attainment of other war objectives.* Several authors write that interdiction, although not "decisive" in itself, contributes to victory by "undermining a country's military-economic potential . . . [by] depriving the enemy of freedom of operation in specific areas of the ocean," and by forcing a diversion of enemy naval resources.
- *Soviet ability to disrupt Western shipping has improved.* Technical improvements to submarines, submarine armament, and ocean surveillance systems would make interdiction more effective now than in the past. Convoying would no longer protect merchant ships, according to some naval officers, because modern submarine-launched torpedoes and cruise missiles can be fired from outside a convoy's defense perimeter.
- *A conventional war could be protracted.* One writer has observed that a conventional NATO - Warsaw Pact war might not necessarily become nuclear, inasmuch as chemical and biological weapons were available in World War II, but neither side used them on a mass scale.
- *Even a nuclear war could be protracted;* and if it were, it would require additional merchant shipping to offset large-scale losses in Europe.

We believe that the authoritative writings summarized here show that interdiction is a mission of the Soviet Navy—but that it is less critical than defeat of enemy nuclear strike forces, particularly in the opening phases of war.

ANNEX B

INTERPRETATIONS OF SOVIET NAVAL EXERCISES

Soviet naval exercises involving merchant ships and convoy types of activity have been rare, but some recent occurrences have evoked considerable interest and debate among intelligence analysts. Interest focused especially on the activity in Okean-75, a major exercise in April 1975 that involved air, submarine, surface, and reconnaissance forces of all four Soviet fleets. Annual exercises involving amphibious forces have also provided information.

Okean-75

Okean-75 was the first major Soviet naval exercise that involved merchant ships, and some analysts in both the United States and Western Europe have seen it as a demonstration of Soviet intent to interdict Western maritime communications in wartime; others disagree. This annex summarizes the arguments of both groups.

Some 200 surface ships, divided into 11 task forces, took part in the exercise. The activity of four of the task forces was sufficiently ambiguous to raise concern that some or all of them represented targets for other forces practicing attacks against merchant shipping. Two of the task forces—one in the North Pacific and one in the Barents Sea—included merchant ships, a factor that reinforced that point of view.

Merchant Ship Participation. The task force in the North Pacific consisted of four naval ships and four cargo ships. An intelligence ship, the Izmeritel', trailed the group as it moved from an area east of Japan northward toward Kamchatka. Some observers have assessed this formation as a simulated Western carrier task force, others as a merchant ship convoy. The formation was supported by ASW aircraft and was stalked by a submarine, which was not precisely identified. If it was a C-class nuclear-powered cruise missile unit, its presence would tend to support the carrier task force hypothesis. If it was a V-class submarine, its presence continues to be ambiguous; this modern torpedo attack class is thought to be primarily assigned ASW missions but could also be used against carriers or merchant convoys.

The second task force operated primarily in the Barents Sea and was composed of seven merchant ships and four naval ships. One of the latter was a tank landing ship, suggesting that the 11 ships represented a hostile amphibious task force. This role would be consistent with past exercise activity in this area, and the steaming formation—with the combatants traveling in a forward screen, and the LST given special protection—supports this conclusion. Moreover, the ships in this group were attacked repeatedly by waves of aircraft equipped with air-to-surface missiles but apparently attracted little attention from submarines.

The actual role played by the merchant ships is unclear. Table 5 lists the arguments that can be made for and against the thesis that the involvement of merchant ships in Okean-75 demonstrated that Moscow gives high priority to the interdiction of Western shipping.

Operations Off Africa. During Okean-75, the Soviets also operated in the merchant shipping lanes between the Indian Ocean and Western Europe. At least two submarines were deployed from the Mediterranean to an area west of Africa near the Canary Islands, where they may have

Table 5

Merchant Ship Participation in Okean-75: Two Views

Interdiction Was Given High Priority	Interdiction Was Given Little Priority
Merchant ships participated in convoy exercises.	Merchant ships may have represented warships or troop ships.
The intelligence collection ship Izmeritel' may have been a member of the convoy in the Northern Pacific for at least part of the exercise.[1]	In trailing the Northern Pacific group, the Izmeritel' was probably acting as a "tattletale"; in this common Soviet tactic a ship shadows a carrier task force and provides targeting information for strike aircraft and cruise missile submarines and surface ships.[1]
Convoys moved at slow speeds more typical of merchant ships than of naval task forces.	The Barents Sea group apparently simulated passage through a minefield, which would have slowed its progress.
Convoy maneuvers were more typical of merchant ships seeking to evade attack by submarines than of a naval task force.	
	The exercises both in the Barents Sea and in the North Pacific took place relatively close to the USSR rather than in major sea lanes between the US and its NATO allies and Japan.
Since only a few (for example, 12 percent in the Northern Fleet) of the available naval surface ships participated in Okean-75, it seems unlikely that the Soviets would have had to divert cargo ships, as they did, simply to provide additonal targets for surveillance systems and aircraft.	
	Both groups were subjected to repeated simulated attacks by ASM-equipped aircraft, primarily TU-16 Badgers. With one refueling, these aircraft would barely have the range to reach the sea lanes between the US and Europe. The intensity of the ASM attacks exceeded what probably would be necessary to interdict merchant ships. The ASM strikes against the North Pacific group took place at the same time as strikes against other groups that were more obviously simulating carrier task forces.
	No attempt was made to protect the merchant ships by placing them in the center of the convoys, as would have been expected if the ships were simulating wartime convoys to provide realistic targets for interdiction.

[1] Alternatively, the Izmeritel' may have functioned as an exercise referee.

established a barrier patrol. At about the same time a destroyer and an oceanographic ship, which had been located west of Africa, began moving northward. The roles played by these ships are unclear. One interpretation is that they simulated oil tankers en route to Western Europe, and another is that they joined a tank landing ship operating in the same area and simulated an amphibious task force. The ships eventually reached the area where the submarines were located, but we do not know whether the submarines simulated attacks against them. Soviet

reconnaissance aircraft using Guinean airfields frequently flew over the ships and could have updated their positions for the submarines

Also unclear was the role of a group of surface ships consisting of about four major combatants and seven hydrographic ships, which operated together northeast of the Azores. The presence of Soviet submarines nearby and the group's steaming formation—in four rows, with the hydrographic ships in the center two—suggest that the group may have portrayed a US convoy or amphibious task group en route to Europe. This group probably was subjected to regular reconnaissance by Soviet aircraft and satellites and to simulated air and submarine attacks. The lack of positive movement toward Western Europe could argue against the group's simulating a convoy.

This example is the least ambiguous, and the ships may indeed have reflected Soviet practice of anticonvoy tactics. However, the group could also have represented a troop transfer movement—a target which the Soviets have clearly indicated has high priority for interdiction and which probably falls within the category "some attacks on shipping" that Soviet authors list among Navy duties.

Interpretation of Okean

On balance, we believe that the two formations involving merchant ships probably simulated naval task forces. In the early stages of the exercise, the merchant ships in the Barents group most likely represented coastal shipping or their own amphibious task groups, to give the Soviet Navy practice in protecting them. In the later stages they probably represented a Western amphibious landing force attacking the homeland. The group in the North Pacific probably simulated an attacking Western force of naval combatants.

The activity west of Africa and north of the Azores is more difficult to interpret. Either group, or both, could have served as a merchant convoy as well as a target for ocean surveillance. Whatever they were, the submarines apparently targeted against them—at least four diesels—were about 10 percent of all the attack submarines deployed for Okean.

Most of the events in Okean-75 could have been a simple exercise of fundamental naval skills: reconnaissance, intercept and attack by the offensive forces, and escort and evasion tactics by the defenders. On the offensive side, interdiction of the sea lanes is a mission of the Soviet Navy, and we would expect to see some antishipping activity in such a large-scale multifleet exercise. Indeed, if interdiction were a major mission, we would expect to see considerably more evidence of it in exercises than we have, since Soviet officers have written that it is a complex and difficult task—the kind that needs practice.

On the defensive side, as their merchant fleet expands its operations, the Soviets have an increasing need to defend it. Shipping is extensive between Soviet ports (78 million tons of cargo in 1975) and with East European ports, and in wartime it would require naval escort. The Soviets routinely co-opt merchant ships for naval operations and would certainly do so in a war. Together with amphibious ships, merchant ships also are used often to carry equipment for the ground forces. The Soviets consider it important to protect their own sea lines of communication, particularly in the northern and far eastern areas of the USSR, where roads are bad or nonexistent. In the Far East, where their military operations would depend heavily on easily interdicted rail lines, the Soviets could believe that moving military supplies by ship would be important for supporting sustained combat against the Chinese.

Thus, the participation of merchant ships in Okean-75 need not indicate a change in the priority of Soviet naval missions. Protection of the USSR's coastal sea lanes is a mission of the Soviet

Navy (although of lower priority than ASW and anticarrier warfare), and it would be normal to see some evidence in exercises of this mission.

Amphibious Landing Exercises

Since 1965, the Soviets have conducted amphibious landing exercises in the Northern Fleet area every year. The groups involved meet some of the US criteria for a convoy: a number of merchant ships or naval auxiliaries, or both, usually escorted by warships and/or aircraft or a single merchant ship or naval auxiliary under surface escort, assembled and organized for purpose of passage together.[26] The main body of the task forces in the exercises usually has consisted of relatively defenseless ships, often including merchant ships and (about half of the time) a major surface combatant that probably simulates an aircraft carrier. They are defended by a screen of warships and are subjected to simulated missile and torpedo attack.

These amphibious landing exercises provide a limited opportunity for practicing convoy techniques and anticonvoy tactics; but since they usually take place in local Soviet waters, they would be of limited value as training for interdiction in the open ocean. The composition of the screening forces would further reduce the realism of the exercises as training for interdiction. They are mostly coastal patrol and destroyer escorts, minesweepers, old destroyers, and small frigates—ships that would have virtually no ASW capability until after enemy submarines disclosed their locations by attacking the convoy.

The tactics employed in these near-shore exercises may show how the Soviets would plan to attack convoys anywhere. As the amphibious groups move toward shore to land their naval infantry (and sometimes troops from the ground forces), they typically are subjected to prestrike surveillance and then to simulated ASM, torpedo, and occasionally submarine-launched cruise missile attacks. Air defense interceptors sometimes oppose the attacking strike aircraft. Surface combatants rarely play any role in the attacks except in coastal areas.

Large numbers of TU-16 Badgers armed with ASMs typically simulate strikes against the invading group. They usually are accompanied for part of the flight by tanker aircraft for aerial refueling and are preceded by other aircraft which drop chaff and conduct electronic jamming to confuse the groups' defenses.

Information on the submarines' activity in these exercises, though sparse, supports several generalizations. The number and types of participating submarines have varied widely, but the exercises have often included nearly as many submarines as there were surface ships under attack—indicating a preference for group submarine operations against amphibious task forces. In an exercise [redacted] for example, the task force may have been opposed by as many as 18 submarines. Eleven carried cruise missiles as their primary armament, but most of them used only torpedoes during the exercise. A Y-class SSBN also took part, probably to update its crew's torpedo training.

On the whole, it appears that the classes most likely to be given interdiction assignments—such as the F-class—do not participate more than other classes in practicing torpedo attacks against surface ships. In landing exercises held during the period 1967-76, missile-armed submarines—primarily the J- and C-classes—conducted more antiship attacks than did submarines that had torpedoes as their primary armament.

Another interesting feature of these exercises is that attack submarines have operated in direct support of the amphibious task forces. This may represent Soviet policy—a policy that could further decrease the number of submarines available for interdiction. On the other hand, the Soviets may occasionally assign submarines to their "US task forces" for realism, because they know that the US Navy sometimes uses attack submarines in a direct support role.

[26] Joint Chiefs of Staff, *Dictionary of US Military Terms for Joint Usage*, 1974.

Other Convoy Types of Operations

In Soviet naval exercises, the total amount of effort devoted to anticonvoy training is small. Much of it appears to be peripheral to other training goals, but exercises involving convoys occasionally occur apart from landing operations or the simulation of anticarrier warfare. In April 1977, as part of the spring exercise held annually by the Northern Fleet, a convoy consisting of three merchant ships, an oiler, and two warships operated off North Cape. Its purpose is unknown but possibly was to provide targets for ASM aircraft.

More is known about Val-74, a Warsaw Pact command staff exercise enacted with skeleton naval forces from East Germany, Poland, and the USSR. This exercise reflected the Soviet Baltic Fleet preoccupation with close-in sea lanes and indicated that the Pact would probably try to control the Baltic and North Seas in wartime. According to the exercise scenario, the Pact first "seized" the Danish Straits and then conducted a variety of naval operations, including convoying their own merchant ships and interdicting Western support shipping in both seas. They also operated in the North Sea against "Western" amphibious forces and performed tactical ASW. These actions were intended to control the approaches to the Baltic, to assist Pact ground forces advancing along the coast of the Baltic and North Seas, and to protect the Pact's coastal shipping. Some of the strikes in the North Sea were made against "troop convoys."

Studied in conjunction with recent classified writings, Val-74 indicates that:

- The Soviets regard interdiction in selected offshore waters as fairly important when it is tied to other objectives like supporting ground troops operating on a coastal front.
- Some Soviet references to "attacking convoys" and some appearance of convoys in exercises probably have to do with countering landing ships rather than interdicting merchant ships.
- Some activity of the convoy type seen in Soviet exercises probably is training to protect Soviet shipping.

Soviet writings indicate an intent to secure Pact shipping—particularly in coastal waters—through a combination of sea control measures and convoying. According to classified writings, the Pact nations plan to establish a centralized board to coordinate convoy operations and expect that the convoys will need 25 to 30 percent more escorts than there are noncombatant ships. In Soviet exercises, however, the escorts have usually been fewer—only about 75 percent as many as the noncombatants.

In addition to convoying its merchant ships, the Pact would seek to control its local waters and the especially important sectors of sea lanes. It also would conduct "special operations"—which include preemptive strikes against enemy airfields and naval bases—as a means of protecting its own shipping.

Thus, what appears to be a growing involvement of commercial ships in Soviet naval operations may reflect concern for naval protection of these assets rather than increased attention to interdiction of Western sea lines of communications.

ANNEX C

WEAPONS CARRIED BY SOVIET ATTACK SUBMARINES

[redacted]

evidence generally is consistent with recommendations for weapon loads contained in the classified writings of the middle to late 1960s, when the Soviets began to grapple with problems raised by the modification of their strategic doctrine to include the possibility that war with the West might be fought (in all or in part) without the use of nuclear weapons. In their military literature

[redacted]

they note the difficulty of being prepared for both nuclear and nonnuclear contingencies, and they emphasize the importance of keeping their operational submarines in sea-ready condition and loaded with authorized levels of both nuclear and conventional armaments.

Doctrine

The need to prepare simultaneously for both conventional and nuclear war—after it was officially acknowledged in the Soviet Union in the mid-1960s—prompted several articles in classified Soviet journals on how the naval forces should respond. These articles made the following recommendations on submarine armament:

- At least half of all the cruise missiles carried by Soviet submarines should be nuclear.
- If a cruise missile submarine has a limited number of launchers and has an assignment in which group operations are impossible, all the missiles should be nuclear.
- ASW submarines should carry rocket-boosted antisubmarine weapons and two to four nuclear torpedoes. All these weapons should be launched against Western SSBNs as soon as nuclear war begins.
- For self-defense, submarines need only conventional torpedoes.
- On torpedo attack submarines assigned to anticarrier operations, as many as one-third of the torpedoes should be nuclear. This would permit them to launch against an aircraft carrier two salvos with conventional torpedoes and one with nuclear torpedoes. (We do not know how many weapons would constitute a salvo.)

Implications of the Cruise Missile Loads

The high ratio of nuclear to conventional warheads on cruise missiles carried by the submarines confirms other evidence that the Soviets believe that war at sea would not remain conventional for long. After expending their few nonnuclear missiles in a conventional conflict, the cruise missile submarines could be relegated to the sidelines as a contingency force in case of escalation or could brave the Western antisubmarine barriers to replenish their supply.

To compensate for the small number of conventional weapons carried by each unit, the Soviets probably would try to concentrate their forces against major targets. Group operations would offset weapons limitations but would require large forces and would decrease the number of units available for other tasks.

The weapon loads reflected in doctrinal writings indicate a strong Soviet commitment to the use of tactical nuclear weapons in naval engagements. In a nuclear environment, fewer weapons are required—a single nuclear hit probably would sink any target at sea.

Implications of the Torpedo Loads

There seems to be a requirement that frontline Soviet submarines, regardless of class, be armed with at least two nuclear torpedoes—a small fraction of nuclear to conventional weapons compared to the cruise missile loads. One reason for this dissimilarity may be that all of the cruise missiles are offensive weapons intended for striking high-value surface ships, while some of the torpedoes are earmarked for defense against Western ASW ships and submarines. In self-defense, and in close engagements generally, the Soviets probably would use conventional weapons to avoid damage to the firing submarine.

ANNEX D

HOW THE SOVIETS WOULD CARRY OUT INTERDICTION OPERATIONS

The Soviets write that in wartime they would attempt to cut Western sea lines of communication by conducting missile and airstrikes against ports, by sinking merchant and troop transport ships on the high seas, and by sowing mines in heavily traveled waters.

Soviet emphasis on all three of these fundamental methods is based, in part, on a critical study of interdiction campaigns in recent history. Soviet authors, for example, have stressed that a major flaw in German planning during World War II was the failure to mount "massed and systematic" attacks on cargo ports. The tone of Soviet discussion of German mistakes suggests that during a war NATO should expect attacks on European ports with conventional weapons if the fighting had not yet escalated into a nuclear conflict. Soviet theorists note that once that threshold is crossed, nuclear strikes against land targets are the most efficient means of disrupting ocean shipping.

Similarly, the Soviets have stated that mining has been underestimated as a means of disrupting shipping. They consider mine warfare useful because it strains enemy naval resources and extends the amount of time that merchant ships must remain at sea, increasing their vulnerability to other forms of attack.

Focusing on the military aspects of interdiction, Warsaw Pact authors distinguish between "ocean" communications and "close sea lines of communication." Disruption of the latter can become an "urgent task," the outcome of which can impact directly on the land campaign. This emphasis is consistent with Soviet planning guidance for use of submarines, aircraft, and surface ships in interdiction operations. Experience indicates, according to a classified Pact document, that shipping in offshore waters is most effectively destroyed by a combination of aircraft and surface ships.

In open-ocean interdiction, submarines would be the primary strike force. Aviation would locate targets and also take part in antishipping strikes. Surface ships, in the Soviet view, would be needed to support the submarines and protect them during their transits to and from the sea lanes. The Soviets probably would deploy their surface ships only within effective range of their land-based aircraft. The Soviet emphasis on coordinated operations, coupled with the lack of air cover, might dictate the concentration of forces within a few hundred miles of Europe, with only a few submarines operating alone in distant waters.

If enough forces were available, the Soviets probably would seek to create a submarine threat within an entire naval theater because they also view interdiction as a useful diversionary tactic. They know that it is much easier to attack a merchant ship than to defend it and that, consequently, a few submarines can tie up a disproportionate number of enemy forces. In 1972 and again in 1976, Adm. Gorshkov wrote that, for each German U-boat in World War II, the Allies were obliged to deploy 25 ASW ships and 100 aircraft.

In a long war, moreover, attacks against sea communications are useful because they impose "great stress" on defending naval forces. One

Soviet officer argued that scattered attacks worldwide could force the enemy to monitor the entire ocean. If these views were implemented, the Soviets might try to conduct strikes in unexpected areas—as well as against the main North Atlantic shipping lanes—in order to force as large a dispersion of Western naval resources as possible.

Other Soviets argue, however, that antishipping forces should be concentrated on "decisive axes"—probably close to shore—where they could produce quick results. There is no evidence to suggest which course the Soviets might take, but it seems most likely that they would hedge their bets and use both diversionary and concentration operations.

General Staff Planning

Classified Soviet documents, written in the mid-1960s but apparently still in use by the General Staff for planning all types of naval operations, describe in some detail the factors in Soviet planning for interdiction. These documents do not indicate how the Soviets would divide their forces between interdiction and other missions in wartime, but they describe the way an interdiction campaign should be conducted.

The Soviets believe they would need:

- To collect advance intelligence on the nature, the importance, and the defenses of enemy shipments.
- To reconnoiter the entirety of the enemy's sea communications.
- To relieve submarines that have expended their weapons or to resupply them at sea.
- To deploy interdiction forces covertly along the expected routes of enemy convoys.
- To be able to shift forces promptly to new areas if the enemy engages in evasive convoy routing.
- To solve the problem of hydrometeorological forecasting in distant areas.

These documents state that interdiction forces should be divided into three groups, consisting of:

- Strike forces, primarily submarines, allocated to sinking convoys and disrupting port operations.
- Surface ships, to safeguard the submarines as they deploy to and from their patrol areas.
- A reserve of naval aircraft.[27]

The Soviets expect to begin an interdiction campaign by striking ports while ships are being loaded and convoys formed.[28] Later, submarines and aircraft would strike convoys en route. If a diesel submarine detected a convoy, the submarine would trail it and report to the "fleet command post," which would order faster nuclear-powered submarines to join and then remain in contact with the convoy, presumably until enough forces were available for a coordinated attack. As they approached their destination, surviving merchant ships would encounter successive minefields, which would be systematically replenished. Finally, as they came within range, the remaining merchant ships would be attacked by the aircraft and missile troops of coastal forces.

Weapons Employed

The Soviets have the option of employing a variety of weapons against merchant ships at sea—torpedoes, air- and submarine-launched cruise missiles, and mines laid by aircraft and submarines. Because of range constraints on Soviet naval aircraft and their heavy commitment early in war against carrier task forces, we believe it unlikely that many aircraft would be used against merchant shipping. The Soviets could have difficulty laying and replenishing mines in areas of Western air superiority.

With regard to submarine-launched cruise missiles, Soviet opinion has probably not changed

[27] In a more recent Warsaw Pact discussion of the three groups necessary to conduct interdiction operations, an air group dedicated to "reconnaissance" was substituted for the "reserve" of naval aircraft.

[28] The Soviets have indicated that they believe it would take the United States between two and three weeks to organize convoys and that they would attempt to deliver strikes (presumably with nuclear weapons) against the ports toward the end of this period, when the concentration of ships would be highest.

since the early 1960s, when one admiral wrote that "there is no need to expend [cruise] missiles against transports, since one or two torpedoes are sufficient to sink a merchant vessel." If the convoys are well protected and are of high value, however, or if success against aircraft carriers permits the reassignment of cruise missile submarines, the Soviets probably would allocate some of them against convoys.

Whether the Soviets would use submarine-launched cruise missiles or torpedoes with nuclear warheads against merchant convoys probably would depend on the status of NATO carriers, on how well convoys were escorted, and on the importance of the convoys. Soviet sources, in general, indicate that they expect a shortage of tactical nuclear weapons to develop as the war progresses and, consequently, that these weapons would be reserved for use against capital ships.

ANNEX E

METHODOLOGY FOR ESTIMATING SOVIET INTERDICTION CAPABILITIES

This annex describes an analysis of the ability of Soviet submarines to deliver torpedoes against US convoys in the North Atlantic. A model employing several sets of assumptions provided a range of outcomes.[29] The analysis focuses on three scenarios, which represent commitments of attack submarines to interdiction at three different levels. The assumptions built into the model deliberately tend to "worst case" the situation for NATO and result in optimistic exchange ratios for the USSR.

Key assumptions used in the model were:

- Submarines spend 15 days on station.
- Each submarine withholds two torpedoes for self-defense and fires all its other torpedoes against merchant ships in a target-rich environment.
- Most merchant ships are using the southern shipping lanes of the North Atlantic in order to stay beyond range of Soviet ASM aircraft for most of the voyage; this also extends transit times for Soviet submarines.
- Turnaround time between patrols is 25 days.
- Submarines suffer 20 percent attrition—10 percent each time they pass through the G-I-UK gap; no attrition on station was included.
- No torpedoes with nuclear warheads and no cruise missiles are expended against merchant ships.
- Nuclear submarines transit at 12 knots, diesels at 5; this is consistent with Soviet practice. (Higher speeds of 15 knots for nuclear submarines and 8 for diesels would not cause a militarily significant change in the results.)
- The Soviets maintain a continuous submarine presence in the shipping lanes.
- Northern Fleet bases are undamaged and continue to support submarine operations.
- Submarines must return to those bases for replenishment. (NATO air superiority prevents the Soviets from replenishing submarines from captured territory.)
- The Soviets achieve a hit rate of about .25 for each torpedo fired (.85 technical reliability multiplied by a deliberately optimistic probability of .3 for accuracy).
- A single hit disables or sinks a merchant ship.

In all three scenarios, Soviet submarines fail to sink ships at a level that would seriously affect the resupply of Europe. The results of the model are summarized in table 7.

Scenario 1 (Secondary-Priority Level of Effort)

This scenario assumes that the Soviets are interested in attacking merchant ships in the open ocean mainly in order to create a diversion—to force NATO to disperse its forces over the sea lanes. It represents the level of effort likely in the early phases of war while Western aircraft carriers and SSBNs still pose a threat to the Soviet Union.

In 120 days the submarines in this scenario could, under favorable operating conditions, sink

[29] The model, which is called Firearm and is unclassified, was developed by Science Applications Incorporated of Englewood, Colorado. It is described in a draft *User's Manual*, SAI-77-143-DEN, 26 August 1977. Copies of the manual can be obtained from SAI.

Table 7

Western Merchant Ship Losses to Soviet Submarines in a 120-Day Open-Ocean Interdiction Campaign in the North Atlantic

Scenarios	Level of Effort	Participating Submarines	Ships Sunk or Disabled [1]	Percentage of NATO-Flag Ships [2]
1	~~30%~~ 20% of available long-range torpedo attack submarines	5 F-class SS [3] 2 N-class SSN	36	.6
2	All available long-range torpedo attack submarines except V-class	12 F-class SS [3] 2 T-class SS 5 N-class SSN 2 Z-class SS	107	1.8
3	Maximum: All available torpedo and cruise missile attack submarines [4]	6 C-class SSGN 8 E-II-class SSGN 7 J-class SSG 5 N-class SSN 12 V-class SSN 22 F-class SS 2 T-class SS 2 Z-class SS	274	4.7

[1] These numbers assume a Soviet hit probability of about 25 percent and that a single hit disables a target.

[2] Our calculations included NATO-flag ships of 6,000 gross register tons or more. They excluded more than 3,000 Liberian- and Panamanian-flag ships, some of which probably also would be used for sealift if needed.

[3] F-class submarines deployed to the Mediterranean are excluded from the strike forces in Scenarios 1 and 2.

[4] The Northern Fleet normally supplies about 10 attack submarines for the Soviet Mediterranean Squadron. Scenario 3 assumes that these forces would be available for operations in the North Atlantic, although it is unlikely.

or disable some 36 ships—or less than 1 percent of the sealift resources available to NATO in that period.[30]

Scenario 2 (All Available Long-Range Torpedo Attack Submarines Except V-Class)

This scenario assumes that NATO armies have fought Pact forces to a standstill on the Rhine; that the Soviets have preempted at sea, using conventional weapons to destroy some Western SSBNs at their bases and some carriers; and that this partial success, plus a continuation of the conventional phase, has persuaded Soviet leaders to risk sending all available long-range torpedo attack submarines in the Northern Fleet, except the V-class, against merchant ships. This level of effort by Northern Fleet submarines against shipping would be approximately the same as that expended against Western SSBNs and carriers.

Under favorable operating circumstances these submarines could destroy or disable 107 merchant ships, constituting 1.8 percent of the NATO-flag ships of over 6,000 gross register tons.

Scenario 3 (Maximum Effort)

All available long-range general purpose submarines in the Northern Fleet and Mediterranean Squadron are sent against merchant ships in the North Atlantic. This force could sink some 274 merchant ships—a level of attrition that would represent about 5 percent of the inventory of NATO-flag ships of 6,000 gross register tons or greater. Even if all of the sinkings in Scenario 3

[30] Figure 4 shows the effect on ship losses of varying the number of submarines committed to interdiction.

Figure 4.

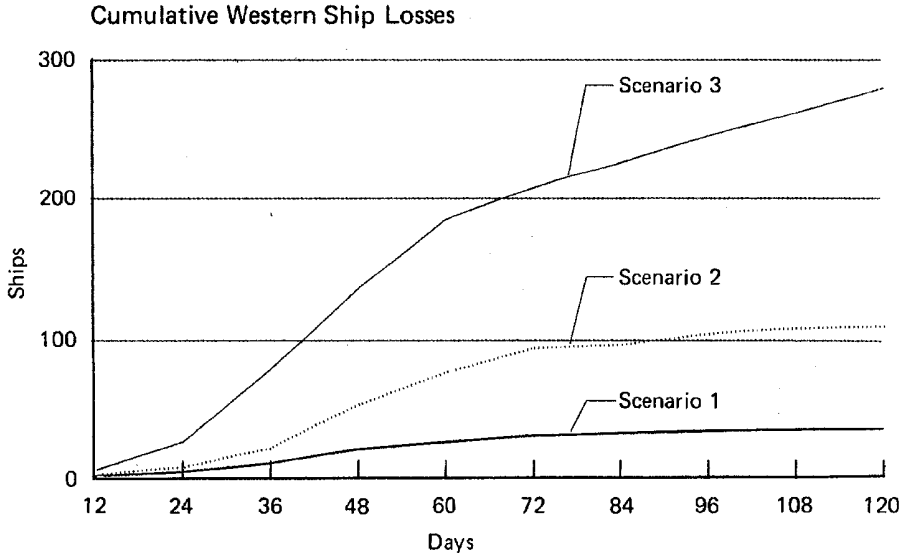
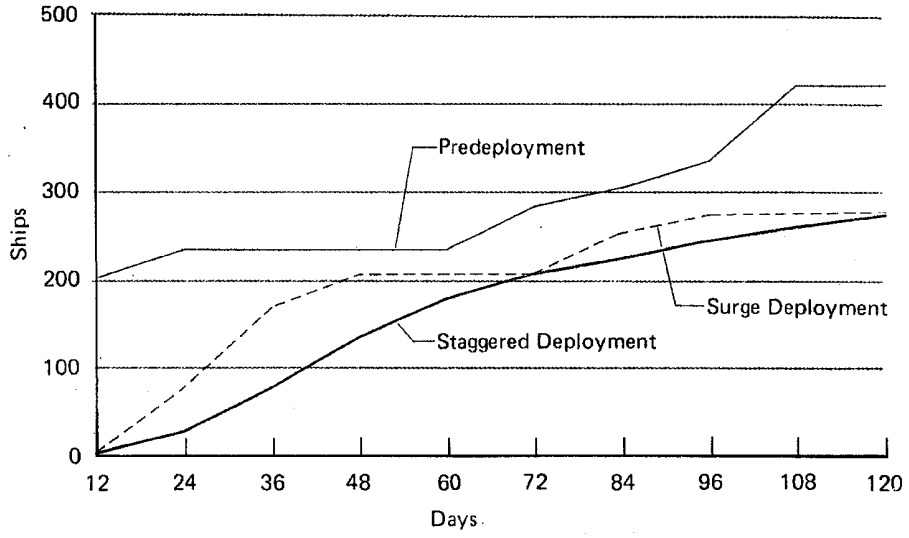


Figure 5



were of ships carrying military cargoes, they would represent less than 15 percent of those programed to carry military loads in the first 120 days of war.

The Soviets could achieve this latter level of success only if they had perfect intelligence on those particular ships from the time they sailed until the time of attack. It is likely that some ships carrying military cargoes would be sunk, of course; however, we do not believe that the Soviets could generally convert dockside intelligence into locating information suitable for attacks against specific ships by submarines at sea.

Identifying high-value ships in convoys containing many ships of low value would be difficult for the attacking submarine. Given convoy defenses and tactics and normal visibility problems in the North Atlantic, successful identification and attack are likely to be the exception rather than the rule. The model, in assuming randomness, may tend to understate the likely success of Soviet submarines against high-value merchant ships, but it almost certainly compensates for the effects of that assumption by not including any adverse effects as functions of attacking defended convoys or selecting and chasing fast ships. These adverse effects would almost certainly include additional attrition of submarines as they attacked convoys, the expenditure of more torpedoes per kill, and a loss of time in target selection. The net result of changing the randomness assumption would likely be that the submarines would have to spend more than 15 days on station to expend all their torpedoes and that there would be fewer submarines making subsequent patrols—because of the higher attrition—and fewer kills per patrol.

This analysis assumes that the Soviets would stagger their submarine departures in order to maintain an approximately continuous presence in the sea lanes.[31]

In an alternative deployment within Scenario 3, before war begins the Soviets could send all their available submarines to positions in the sea lanes so as to interdict shipping at the outset of hostilities. Predeploying would eliminate wartime attrition on the submarines' first outbound trip, increase the total amount of time on station, and increase Western losses by about 50 percent in the first 120 days. It would have little impact over the longer term, however, and the extra NATO losses early in the war would include relatively few ships carrying military cargo (because of the time required to prepare the military shipments). Moreover, Soviet capabilities would drop rapidly; they could not maintain so large a presence in the sea lanes for long.

In any case, we believe that the Soviets would not predeploy large numbers of attack submarines in a period of rising tension because such an action, in their view, could trigger an unacceptable NATO response.

A third Scenario 3 alternative would be to deploy all of the available submarines promptly when war begins. Over time, this "surge" deployment would yield about the same attrition of Western shipping as would staggered deployments. Such a "surge" strategy, however, would leave periods when virtually all the submarines were in transit or undergoing replenishment, leaving the sea lanes safe for shipping, as shown in figure 5.

To some extent, the Firearm model is sensitive to changes in transit speeds of the submarines. Increasing transit speeds to 15 knots for nuclear submarines and 8 for diesels would increase losses to shipping by some 25 percent, but would make the submarines more subject to detection. In Scenario 3, increasing the transit speeds would result in 70 more ships lost in a 120-day campaign—a total of 344, which would still be less than 6 percent of NATO-flag shipping.

In this scenario, the submarines could sink additional ships if they used conventionally armed cruise missiles as well as torpedoes. If half the missiles carried by C-, E-II-, and J-class submarines had high-explosive warheads, this would provide about 100 more weapons for use against merchant shipping in Scenario 3.

[31] Figure 5 shows the effect of varying the mode of deployment on ship losses.

We do not assume the above use of cruise missiles in our calculation of losses in Scenario 3; on the other hand, we do assume that the submarines have more effective antiship torpedo loadings than the evidence would indicate. There is good evidence that "alert" submarines in peacetime carry mixed weapons loads, including ASW and nuclear torpedoes. If this practice were carried over into wartime—as seems likely—fewer torpedoes could be expended against merchant ships, and fewer ships would be lost than the 274 postulated.

Other, more realistic, operating conditions likely to prevail in wartime probably would make ship losses lower than those attained in this analysis. If the Soviets persisted, for example, in their peacetime practice of firing at long range from outside escort screens, their accuracy probably would be less than that we have assumed. In actual warfare, moreover, a single hit might not disable or sink a ship.

Realistically, submarines would be subject to attrition during their entire patrols, not merely during transits. If submarine attrition were .3 to .5 per patrol (instead of .2, as assumed in this analysis), the Soviets, after 120 days of war, could sink 200 to 250 merchant ships in Scenario 3 (instead of 274), and their ability to continue an at-sea interdiction campaign would be sharply reduced.

If the higher attrition rates were used in Scenario 3, submarine losses in 120 days would rise to 35 or even 50 percent of all long-range general purpose submarines maintained in the Northern Fleet (as opposed to 25 percent at .2).

Given the basic assumptions of this model, we can find no reasonable scenario that would appreciably increase the number of merchant ships sunk in any of the variations examined. All three scenarios were constructed to the Soviets' advantage. Even if we were to further increase that advantage by assuming that the convoys were undefended—thus allowing about a .43 hit rate (.5 accuracy times .85 technical reliability)—in Scenario 3, the Soviets could still sink only about 8 percent of NATO-flag shipping in a 120-day interdiction campaign.

Top Secret

Top Secret