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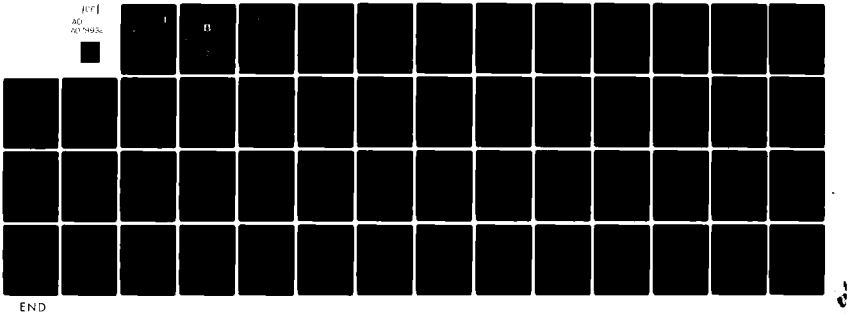

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SUBMARINES AGAINST SUBMARINES
(SELECTED ARTICLES)

By

N. I. Suzdalev

EDITED TRANSLATION

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
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К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*Ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yë or ë.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	arcsinh
cos	cos	ch	cosh	arc ch	arccosh
tan	tan	th	tanh	arc th	arctanh
cot	cot	cth	coth	arc cth	arccoth
sec	sec	sch	sech	arc sch	arcsech
cosec	csc	csch	csch	arc csch	arccsch

Russian	English
rot	curl
lg	log

SUBMARINES AGAINST SUBMARINES

N. I. Suzdalev

FOREWORD

The experience of two world wars has shown that submarines are a menacing weapon on the sea lanes and ocean lanes, and that their role among the other branches of the navy is steadily growing. At the same time, they have proved to be a rather effective means of conducting combat operations against submarines themselves.

The postwar introduction of nuclear power in submarines represented a true revolution in submarine construction. Thanks to this fundamentally new form of power, submarines were transformed from conventional "diving ships" into true underwater vessels with virtually unlimited underwater cruising ranges and high speeds.

Along with nuclear technology, submarines also began to receive the most sophisticated electronic gear and nuclear missiles, which led to a drastic increase in their combat power.

These achievements in submarine construction have been exploited

by the leaders of the capitalist sea powers for their aggressive purposes of creating a powerful offensive weapon. Construction of a nuclear submarine fleet is accelerating at the present time in the USA. Construction of nuclear-powered submarines has been undertaken by Britain and France, and creation of such vessels is being planned in the Netherlands, the FRG, and Italy.

Since the USA is economically and militarily the most powerful country in the capitalist camp, it has a commanding position in all aggressive blocs and forces its partners in politico-military alliances to develop their armed forces in a way which corresponds to the interests of the American imperialists, who dream of achieving world domination.

The deepening of the general crisis of capitalism and the intensification of its antagonisms have strengthened the aggressiveness and adventurism of imperialism. In fear of the growing forces of socialism, peace, and democracy, imperialism has with increasing frequency looked for a way out in military provocations, conspiracies, and direct military interventions. The barbarous war in Vietnam, the bandit attack on the Arab states by the Israeli aggressors, who are supported by elements of reaction around the world and especially by the American imperialists, the fascist military coup in Greece, and many other aggressive acts of imperialism are evidence of its general course in the direction of promoting aggressive activities.

Particular danger for the cause of peace in Europe is constituted by the politico-military alliance of the ruling circles in the USA and the FRG, who are promoting a revival of neonazism and revanchism

in West Germany. All of this is leading to aggravation of international tension.

Present-day American imperialism has the most reactionary and aggressive character and is making feverish preparation for war. In the fiscal years from 1946 through 1968 the US has spent about 1,050 billion dollars on the arms race, twice as much as it spent in its entire history up to 1945, including the First and Second World Wars. The arms race has been especially intensified in connection with the escalation of the war of aggression in Vietnam. According to the US defense budget for fiscal year 1968/69, the Pentagon is allotted 71.9 billion dollars, i. e., more than 3/4 of the federal budget. And the preliminary US defense budget for the fiscal year starting 1 July 1969 projects the astronomical sum of 102 billion dollars for the Pentagon.

The political leadership and the military command in the US do not hide their intentions of launching a surprise nuclear-missile attack on the most important centers of the Soviet Union in order to solve a number of strategic problems in a war against countries of the socialist camp. Subject to these plans the US has adopted a system of continuous flights by aircraft with nuclear bombs on board, and patrolling by a large number of submarine missile launchers with Polaris missiles.

With this purpose the ruling circles in the US have initiated feverish efforts to consolidate and expand aggressive blocs and alliances and have created more than 2200 army, air force, and naval bases, strong points, and other military installations along the borders of the socialist countries.

The aggressive circles in the US are seeking to entrust their navy with the role of one the principal strategic instruments in a future war. Concentrated in the US nuclear-submarine and carrier fleet at the present time is more than one-third of the entire nuclear-missile potential of the American armed forces, and it is supposed that by 1970 this share will be increased to one-half.

As of 1 August 1968 the US Navy possessed 76 nuclear-powered submarines, including 41 missile-carrying subs.

Military specialists in the West believe that modern missile-carrying submarines are capable of delivering powerful strikes from the underwater depths against the most important targets on enemy territory, and with these strikes they expect to achieve strategic results which can decisively affect the course and outcome of a war. If the goal of antisubmarine warfare in the recent past consisted in providing security for shipping and removing the threat to the movement of ships, then the main goal of such warfare today — for all the importance of the earlier tasks — is the prevention of strikes against the vitally important centers of the state. This means that under present-day conditions antisubmarine warfare has taken on strategic significance.

In their strategic military plans the US and NATO commands attach the greatest importance to building up the forces and means for combatting modern submarines, and to organizing antisubmarine warfare as a whole.

In the opinion of foreign specialists, searching for reliable ways to defeat submarines is the number-one mission of the US Navy, and antisubmarine defense is seen as one of the most important

directions in the activities of the US Navy in the immediate future.

The present book summarizes the essential results of the combat utilization of submarines by the capitalist countries in antisubmarine warfare, based on the experience of the First and Second World Wars, and sets forth the views of military leaders in the countries of the imperialist camp on the role, the objectives, and the methods of employing submarines in solving the most important collective problem for the US and NATO navies — the struggle with an underwater enemy.

The state of the art and the prospects of torpedo submarine development are examined, and the quantitative and qualitative characteristics of the submarine forces belonging to the principal capitalist states are discussed; also described are the control systems, weapons, and radioelectronics of multipurpose and, for the most part, nuclear submarines.

In recent years the pages of military journals in the member countries of NATO have carried many articles devoted to propaganda about the "technical perfection" of the US Navy's equipment, particularly that of the submarines. It should be noted that the Western press's unrestrained praise of American technology employed on submarines has an obvious public-relations and propagandistic orientation. For this reason all statements in the foreign press about high tactical and technical qualities of military equipment must be treated critically.

Foreign specialists have been forced to admit that many types of military equipment, including that on submarines, have serious defects. These defects are a cause of the unending accidents involv-

ing weapons and hardware on American submarines which are afloat.

Thus, according to official figures for 1960–68, which are far from complete, 54 accidents and disasters occurred in the submarine fleets of the major capitalist states. According to the gloomy statistics, 35 such cases occurred on US submarines during the period indicated. Two of them led to the loss of the nuclear submarines Thresher and Scorpion. Materials from the investigations of the reasons for the loss of the Thresher, which had been touted in its day as a masterpiece of submarine-building, and the Scorpion, give evidence that the leadership of the US Navy, in the heat of the arms race, has allowed the commissioning of submarines with major structural errors.

While making preparations for a third world war, foreign apologists for military adventures cannot help reckoning with the fact that the armed forces of the Soviet Union, including the Soviet Navy, have effective means of fighting any aggressor. The basis of our navy has now become nuclear-powered submarines, armed with powerful nuclear missiles. As the Commander-in-Chief of the Navy of the USSR, Admiral of the Fleet of the Soviet Union S. G. Gorshkov, has stated, they are fast, capable of diving to great depths, and able to operate in any area of the ocean, even the most remote. Because of sophisticated energy generation and powerful armament, our nuclear vessels can accomplish all kinds of crucial combat missions, including successful warfare against the surface and submarine forces of any aggressor. The might of the Soviet Socialist state has been and continues to be the main bulwark of world peace, the chief barrier in the path of the imperialist warmongers.

Under present-day conditions the strengthening of the Soviet Union's defensive might is an unceasing concern of our party, and this was clearly expressed in the Summary Report of the Central Committee to the XXIII Congress of the CPSU. The party and the Soviet people expect their fighting men to work persistently to master new equipment and weapons and increase in every way possible their combat readiness to repel any aggressive acts by enemies against our homeland.

By studying the combat resources in the navies of the imperialist powers, especially the combat potential of modern submarines and views on their employment, Soviet navy men will greatly assist in preparing our forces to fight an aggressor.

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Chapter V

COMBAT EMPLOYMENT OF SUBMARINES IN ANTISUBMARINE WARFARE IN THE VIEWS OF THE US AND NATO NAVAL COMMAND

Organization of ASW forces

The equipping of modern navies with nuclear missiles, atomic energy, electronics, and other sophisticated technology has radically altered the conditions and character of armed conflict at sea and has led to a reappraisal of the significance of the branches of navies and the methods of their employment.

It is increasingly apparent that submarines, which in fact define the striking power of the navies of the major sea powers, are becoming their main branch.

Modern missile submarines are capable of delivering powerful blows from the underwater depths against the most important objects on the territory of an enemy, thereby achieving strategic results which can decisively affect the course and outcome of a war.

If antisubmarine warfare in previous world wars was considered

one of the important missions of the navies of the main capitalist powers, under present-day conditions, especially with the appearance of nuclear-powered strategic missile submarines, antisubmarine warfare has acquired particularly important significance and is becoming one of the most important forms of combat action at sea.

The imperialist states in military blocs, and the US above all, are engaged in an unrestricted arms race and are openly making intensive preparations for war against the Soviet Union and the countries in the socialist camp.

Soviet submarines armed with powerful nuclear missiles are seen by militant circles in the US and NATO as one of the serious obstacles in the realization of their adventurist plans.

In their efforts to neutralize these forces the ruling circles in the capitalist countries have devoted considerable attention to problems of antisubmarine warfare. For example, a report by the US Secretary of Defense on the military budget for 1965–69 indicated that efforts to create antisubmarine weapons are growing from year to year, reflecting the extreme complexity of the problem of antisubmarine warfare.

In their strategic military plans the US and NATO commands attach great significance to building up forces and means for combatting modern-day submarines and to the organization of antisubmarine warfare as a whole.

In the opinion of foreign specialists, the search for reliable ways to defeat submarines is the most important task of the US Navy, and antisubmarine warfare is looked upon as one of the most important directions of US Navy activity in the immediate future.

In this connection the US Navy has taken a number of important measures aimed at increasing the effectiveness of employment and development of ASW forces and weapons. These measures include: improving the organization of ASW; providing ASW equipment for sea and ocean theaters; finding better means of hunting, investigating, and identifying submarines; developing new ASW weapons; modernizing existing ASW weapons carriers and creating new ones; speeding up combat training of ASW forces; finding new tactical procedures for employing ASW forces and facilities, etc.

As is commonly known, there are two forms of organization in the US Navy: administrative, in which the navy is structured into homogeneous forces for the primary purpose of administrative supervision and combat training at the force level; operational, in which elements are structured into heterogeneous forces and fleets for combat employment and operational training.

All multipurpose submarines in the Atlantic Fleet are administratively organized into three flotillas: the 2nd, 4th, and 6th; in the Pacific Fleet, also into three: the 1st, 5th, and 7th (forces and units of the Atlantic Fleet are given even numbers, while those of the Pacific Fleet are given odd numbers). Each flotilla consists of three to five squadrons,with 5-10 submarines per squadron.

Operationally the vessels and units of the Atlantic and Pacific Fleets are organized into heterogeneous operational formations and forces: the 6th Fleet, the 2nd Fleet, and ASW Forces (Atlantic Theater) and the 7th Fleet, the 1st Fleet, and ASW Forces (Pacific Theater). In their operational organization the ASW forces of these fleets include multipurpose submarines as well as surface vessels and

aircraft. There are over 40 multipurpose submarines in the ASW forces of the Pacific Theater.

Among the surface vessels prepared for antisubmarine warfare, the most attention is given to the antisubmarine carriers, the destroyers, and the escort ships.

The antisubmarine forces in the US Atlantic and Pacific Fleets are equated to operational fleets. The entire complex of combat activities by the various types of antisubmarine forces in the US Navy and NATO has been united in the concept of "antisubmarine warfare".

General control of antisubmarine forces in the Atlantic and Pacific theaters is exercised by the commanders-in-chief of the fleets, but since 1957 (the year ASW commands in the theaters began) direct control has belonged to the commanders of the ASW forces, whose headquarters are located in Hawaii (Pacific theater) and Norfolk (Atlantic theater).

In their own theaters these headquarters have control over all antisubmarine forces in their fleets and directly supervise the activity of forces engaged in antisubmarine patrolling. Control of the forces and means of antisubmarine warfare in the Atlantic theater is centralized and permits their transfer to any zone in the theater.

The participation of the Canadian Navy is envisioned for resolution of ASW problems in the theater. The commander of the Canadian Navy, located in Halifax, can assume command of US Navy ASW forces pursuing a submarine, and vice versa.

The US naval leadership attaches the greatest importance in overall ASW organization to the development of measures aimed at cen-

tralizing the control and coordination of all Navy activity in the development and refinement of antisubmarine defense. With this aim two important new central organs have been created in the US Navy: a directorate of ASW programs and a directorate of antisubmarine systems development. The directorate of ASW programs is tasked with the study of enemy submarine forces and the development of methods for combat utilization of antisubmarine forces and means. The directorate of antisubmarine systems development supervises the introduction of antisubmarine weapons and also basic scientific-research work in the field of antisubmarine weapons development.

The recent creation of two new US Navy test areas should also be noted: the Atlantic underwater weapons testing center in the region of the Bahamas and the Pacific tactical range in the area of the Hawaiian Islands. The first is intended primarily for the testing and evaluation of new means of detecting and hitting underwater targets (fig. 24); the second is for determining the effectiveness and combat potentials of antisubmarine forces and weapons in the course of tactical exercises.

The US antisubmarine forces are being developed with consideration of the main requirement — to disrupt or significantly weaken strikes by missile submarines against the most important land targets. This mission is of national significance, and it is among the foremost ones assigned to the US Navy. About 60% of the time devoted by the US and Nato navies to combat training is already being spent on antisubmarine missions.

The majority of foreign specialists believe that the most difficult problem in present-day conditions is the creation of effective

means of combatting nuclear submarines. In the opinion of the commander of US Pacific Fleet antisubmarine forces, warfare against nuclear-powered submarines is far more complicated than that against diesel-powered submarines.

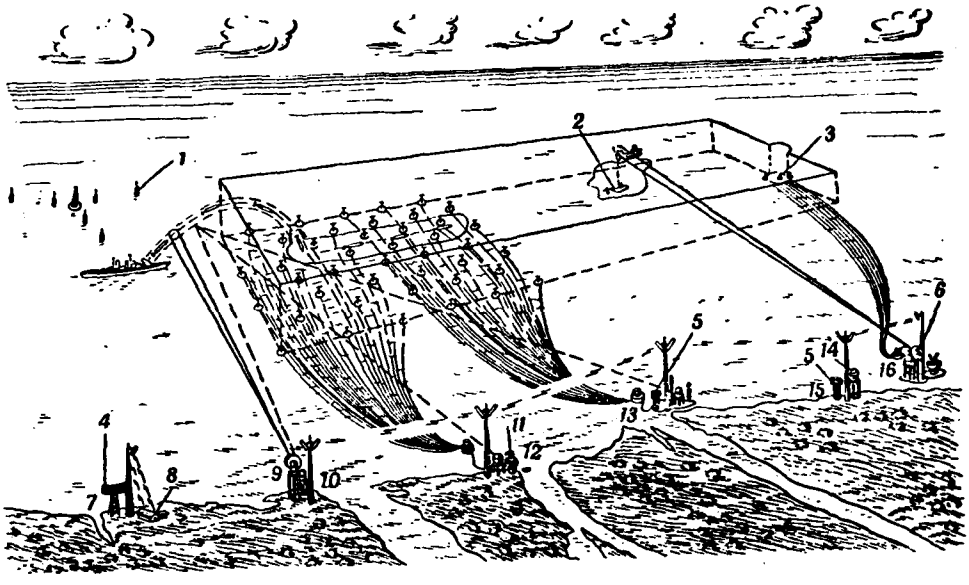

Fig. 24. Range of the Atlantic underwater weapons testing center

1 — anchor buoys in deep-water anchorage area; 2 — underwater target; 3 — underwater sonar tracking antenna; 4 — aerial observation radar station; 5 — surface observation radar station; 6 — tracking station No. 2; 7 — site No. 1; 8 — command and control center; 9 — tracking station No. 1; 10 — site No. 2; 11 — telemetry post; 12 — site No. 3; 13 — site No. 4; 14 — theodolite post; 15 — site No. 6; 16 — site No. 7

At the basis of the organization of antisubmarine force command and control is the zone principle, whereby a certain grouping of antisubmarine forces is to operate in each zone.

US Navy and NATO admirals believe that antisubmarine warfare must be accomplished with those forces which the command has available at the start of the war. Hence, the US devotes great attention

to the creation of special antisubmarine forces even in peacetime.

Submarines in the overall system of antisubmarine forces

The antisubmarine forces of the US Navy consist of surface vessels, aviation, and submarines.

As platforms for powerful antisubmarine equipment, surface vessels represent, in the view of the American command, the basic force in the US Navy for antisubmarine defense of sea lanes and fast-moving strike forces. They are capable of spending prolonged periods at sea, and they have good potential for organizing the control of operations by heterogeneous antisubmarine forces and for providing various types of defense.

Surface vessels have large capacity, which is important in view of the current trend of increased weight and size for antisubmarine equipment. Surface ASW vessels have recently received low-frequency sonar stations with high emission power (AN/SQS-26), which in some cases, with the use of convergent zones, are capable of detecting submarines at a distance of 30–45 miles.

Such a range of detection is achieved by repeated reflection of sound waves off the boundaries of a sound channel and can occur when the upper and lower boundaries of the sound channel (the surface of the sea and a temperature-discontinuity layer,or a discontinuity layer and the bottom) are separated by a favorable distance, commensurate with the frequency of the acoustic signal emitted.

The zone of the direct range of underwater target detection with these stations is 8–14 miles. Between the zone of coherence and the

zone of direct action, however, is a rather wide zone of acoustic shadow, in which the vessel cannot track an acquired underwater target and is therefore deprived of the opportunity to employ ASROC antisubmarine rockets and the DASH drone helicopter system.

In the opinion of foreign specialists, the basic shortcomings of surface vessels include their vulnerability to submarine attack, since their operational concealment is excessively low, and they do not have the submarine's advantage in detection range. The operational effectiveness of antisubmarine ships is adversely affected by bad weather, which hampers the detection and pursuit of modern submarines.

Nevertheless, in spite of the fact that the role of antisubmarine surface ships in the system of ASW is not what it was during the Second World War, they are considered a rather effective means of combatting submarines, if their interaction with planes, helicopters, and submarines is taken into account.

The high speed and long range of aircraft permit them to investigate enormous areas above the ocean.

With existing search and detection apparatus, ASW airplanes are capable of forcing diesel submarines to stay under water and thereby substantially reducing their combat activity, since diesel submarines have a limited supply of electrical power and require periodic surfacing to recharge batteries. The proportion of diesel subs in the submarine forces of the leading capitalist powers continues to be high, which, in the opinion of foreign specialists, makes antisubmarine airplanes a valuable ASW component for the immediate future.

The foreign press admits that ASW aircraft at the present time do not have effective enough means of searching for and detecting submerged submarines. For the present they can only provide a degree of support, reestablishment of temporarily lost contact with a submarine detected earlier by other means, or detection of a submarine on the surface or using its periscope or snorkel.

However, because periscopes and snorkels do not project far above the surface, their range of detection by airborne radar varies between 5 and 30 miles, depending on aircraft altitude and the condition of the sea. At the same time, the aircraft radar emissions may be strong enough for a submarine to detect the aircraft at a distance of 50 to 100 miles and reach a safe depth in time.

Visual means of detecting surfaced submarines have not lost their significance and are used by ASW aviation, but,according to statistics and foreign specialists,the probability of detecting a submarine first by this method is higher on a submarine than on an aircraft.

To search for and detect submerged vessels with aircraft, use is often made of radio sonobuoys and magnetic detectors. The range of measurement of magnetometric devices here does not exceed 200–300 m, while radio sonobuoys operating in the direct listening mode provide submarine detection at a distance of 3–5 miles and depend upon the noise level, as well as upon the hydrologic conditions of the area.

Sonobuoys of the Julie system register low-frequency acoustic waves which are reflected off the hull of a vessel after being generated by the explosion of small charges dropped from an aircraft; under favorable conditions these sonobuoys can provide an underwater

target detection range of up to 6 miles. However, reflections of acoustic signals off the sea bottom greatly limit the range of submarine detection, which, according to foreign data, is no more than 3.5 miles in the Atlantic Ocean and 1.5 – 2 miles in the western Mediterranean.

Therefore, radio sonobuoys and magnetometers give aircraft some search potential, but they are still devices for pinpointing target location, in spite of the increased reliability of radio sonobuoys in recent years (in the mid-fifties their reliability averaged less than 73%, and today it exceeds 95%). As before, an ASW airplane has to receive at least approximate information about the presumed location of an enemy vessel in order to detect it. In addition to the means listed, US Navy ASW aircraft use "Sniffer" equipment to search for diesel submarines; it is designed to detect engine exhaust gases in the atmosphere.

The future of ASW aircraft depends upon increases in the detection range of existing instruments and upon the creation of devices which are capable of detecting continuously submerged submarines at great distances.

The ASW helicopter's principal means of searching is sonar and the magnetic detector. Dipping sonar and variable-depth sonar can penetrate below the surface layer, but the helicopter itself is a noisy and vibrating platform. The detection radius of dipping sonar is still inadequate at the present time. Nevertheless, the helicopter is helping to solve a number of problems even now, and in the future it may prove to be a rather effective antisubmarine weapon.

Judging from the experience of antisubmarine training in the

navies of the principal capitalist powers, the drastic improvement in the fighting qualities of submarines has created great difficulties in their detection, tracking, and destruction by surface vessels, airplanes, and helicopters. ASW has been complicated especially by the considerable increase in underwater stay time and underwater speed.

At the present time, in the opinion of foreign specialists, one of the most promising means of fighting an underwater opponent is the submarine itself, especially the nuclear-powered sub. This stems from the fact that, unlike surface vessels and aviation, it possesses unlimited cruising ranges, it is independent of sea turbulence and weather conditions, it has the best conditions for operating sonars, it is capable of fighting submarines in enemy waters, from which other antisubmarine forces are excluded, and it also has the potential of attacking enemy submarines from concealment, by exploiting its own quietness and its direct-listening systems.

Nuclear submarines are preferred here. A great submergence depth, the latest underwater search sonars, and up-to-date antisubmarine armament allow these vessels to fight enemy submarines effectively.

The outlook is for nuclear submarines armed with torpedos and antisubmarine guided missiles (PLUR) to become the main antisubmarine forces, so great attention is being given to their development, especially in the US.

This conclusion has been reached by military specialists in the West's leading sea powers after comparative evaluation of the combat potential in various antisubmarine weapons platforms.

It is assumed that a submarine engaged in ASW in its assigned patrol area and concentrating entirely on the search mission has obvious advantages over a submarine which is passing through the area or which is occupied with other tasks.

The negative aspects of submarines as antisubmarine forces, according to the foreign press, include the fact that subs are less capable of cooperation within tactical ASW groups than are surface vessels and aviation, and that nuclear-powered torpedo submarines cost about twice as much to build as conventionally-powered ASW surface vessels.

Under modern-day conditions, say foreign specialists, homogeneous ASW forces such as submarines alone, or aviation or surface vessels, cannot be expected to deal successfully with the submarine threat. None of these ASW platforms has all of the qualities necessary for conducting antisubmarine operations. Therefore the struggle with submarines can only be successfully decided through the efforts of all antisubmarine forces and means, combining the best features of each of the platforms.

According to material in the foreign press, the military leadership in the imperialist states is preparing its naval forces to conduct the following types of combat operations against submarines:

- nuclear strikes against enemy bases and submarine-building centers;

- hunting and destruction of submarines on their routes of travel, at antisubmarine barriers, and in their areas of combat operations.

These tasks are expected to be worked out through the implemen-

tation of special measures, as well as in the course of day-to-day combat activity, with the extensive participation of submarines from the NATO military alliance. The principal zones of ASW activity by submarines are considered by foreign specialists to be:

— areas immediately adjacent to enemy submarine bases;

— areas of the most probable routes of travel by enemy submarines on the way to areas of combat operations;

— patrol areas of enemy missile submarines;

— areas of combat deployment of friendly formations.

The American aggressors attach great importance to nuclear surprise attacks against submarine bases and construction centers. US Navy missile submarines are to participate extensively in these strikes.

Until the mid-fifties the US and NATO navies were given the task of completely denying ocean access to the submarines of a probable enemy by destroying them at bases and at the beginning of deployment.

In the subsequent years this requirement was acknowledged to be unrealistic. While not completely abandoning the mission of destroying submarines at bases, the NATO military leadership considers one of the critical stages in ASW to be the organization of powerful counteraction on submarine routes to areas of combat operations.

Such a counteraction against the deployment of enemy submarines is to be effected first of all by submarines located in the immediate vicinity of the enemy coast. Evaluation of the combat potentials of ASW platforms suggests that submarines can operate most successfully in areas adjacent to enemy submarine bases and along

their coastal routes.

Therefore, in a future "big" war, militarist circles in the West contemplate using part of their submarines primarily near hostile submarine bases, where other ASW forces (surface vessels and aviation) can be detected and attacked by the enemy.

An object of special concern for the US and its allies in aggressive blocs is the organization of antisubmarine barriers in the Atlantic and Pacific theaters, and also at the straits of the Baltic, the Black Sea, and other seas.

The creation of similar barriers on the main routes of enemy submarine deployment from base areas to areas of combat operations was widely practiced in the First and Second World Wars. Geographic bottlenecks and confined combat-theater areas are considered the most suitable places for organizing such barriers.

Modern-day antisubmarine barriers, as envisioned by Pentagon naval specialists, should be an interconnected complex of systems for detection, investigation, identification, and destruction of submarines, and should include stationary sonar systems as well as heterogeneous antisubmarine forces.

The barriers are planned to make wide use of minefields, automatic sonar stations, and sonar signal bouys.

Within the defended zone the forces and facilities must provide the opportunity to detect an underwater target, investigate the contact with it, and destroy it.

The plans of the American command give special attention to the creation of antisubmarine barriers in the Atlantic (fig. 25), which are of great importance for defense of the American continent

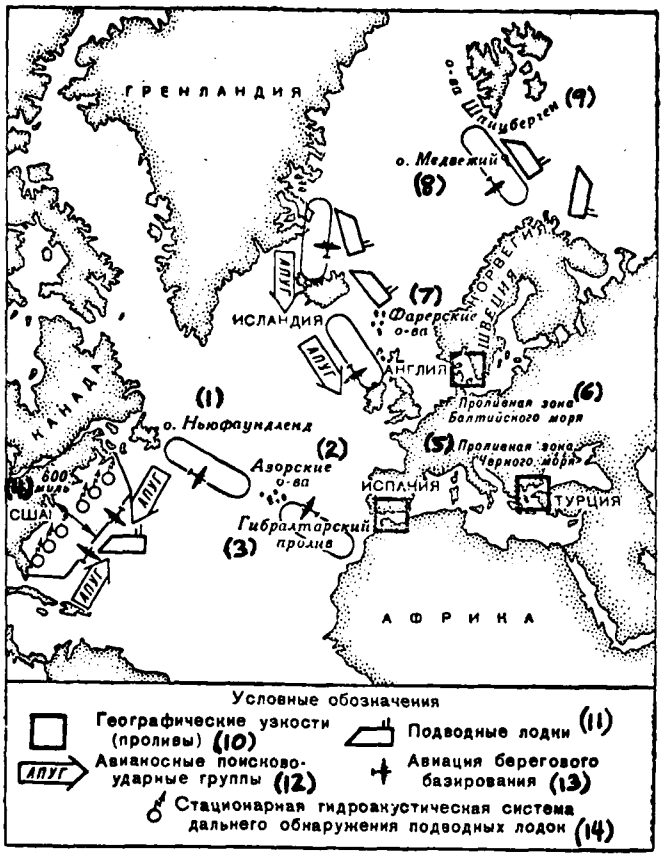

Fig. 25. Antisubmarine barriers in the Atlantic

1 – Newfoundland; 2 – Azores; 3 – Straits of Gibraltar; 4 – 600 miles; 5 – Black Sea straits zone; 6 – Baltic straits zone; 7 – Faeroe Islands; 8 – Bear Island; 9 – Spitsbergen; 10 – geographic bottlenecks (straits); 11 – submarines; 12 – carrier hunter-killer groups; 13 – shore-based aviation; 14 – stationary sonar system for remote detection of submarines

against attacks from the sea, and also for the central European theater. According to data in the foreign press, organization of such barriers is envisioned in the areas between northern Norway and Spitsbergen and between Greenland, Iceland, the Faeroe and Shetland Islands, and the southwest coast of Norway.

In the Pacific theater, as in the Atlantic, the US Navy is creating an in-depth system of countermeasures against an underwater

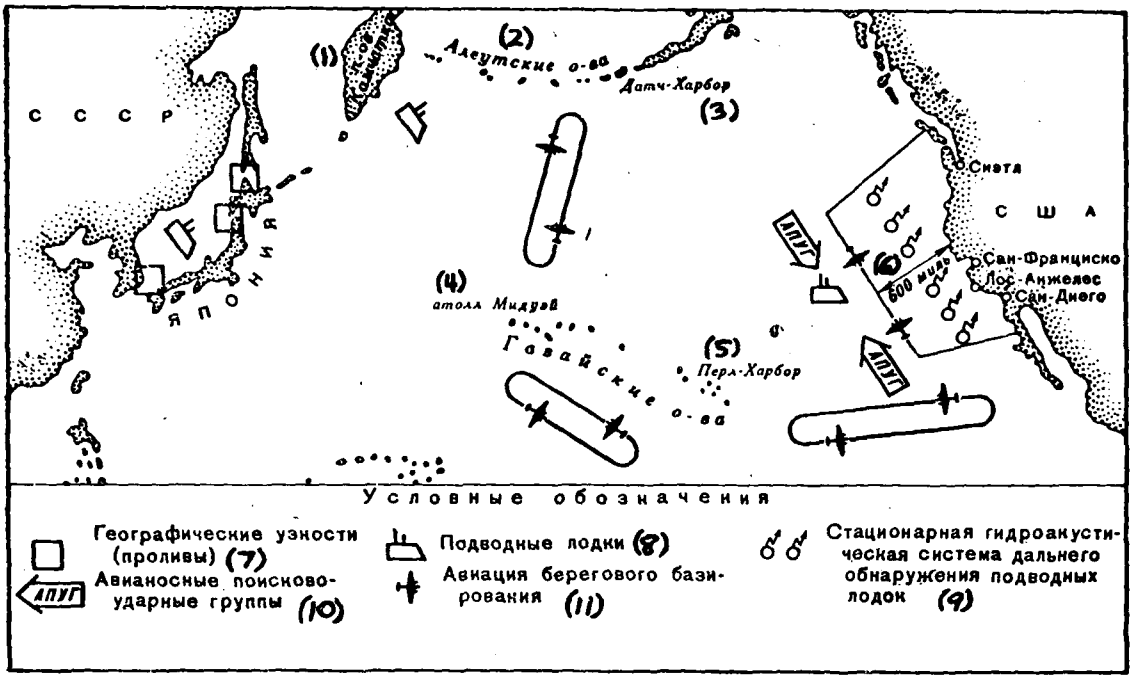

Fig. 26. Antisubmarine barriers in the Pacific

1 — Kamchatka Peninsula; 2 — Aleutian Islands; 3 — Dutch Harbor; 4 — Midway atoll; 5 — Pearl Harbor; 6 — 600 miles; 7 — geographic bottlenecks (straits); 8 — submarines; 9 — stationary sonar system for remote detection of submarines; 10 — carrier hunter-killer groups; 11 — shore-based aviation

enemy (fig. 26).

The barrier between the Aleutian and Hawaiian Islands must become the main obstacle for submarines trying to break through in this theater. The unfavorable climatic and natural conditions limit the use of positional ASW facilities in this barrier, and therefore, according to foreign military specialists, the barrier will consist by and large of maneuverable forces.

The primary barriers are already organized and operating, but with limited ASW forces, which can, however, be quickly increased as the situation dictates.

The American command has recently been giving much attention to problems associated with the organization and improvement of methods of fighting enemy missile submarines directly at the approaches to the US coast.

Coastal antisubmarine zones 300 to 600 miles in depth are being created here. They include stationary active and passive sonar systems and ASW forces.

Deep-water stationary systems of remote submarine detection are a basic and integral part of the antisubmarine defense of the American continent.

These systems, designated Atlantic, Trident, Caesar, Colossus, and Artemis, have been intensively developed in the last ten years by the US Navy.

The systems use active and passive sonar in combination with stationary data and anchor listening devices (buoys).

Work on the Atlantic program was completed in 1959. The Trident program represents a continuation of the Atlantic program and contains three major sub-programs - Artemis, Caesar, and Colossus. The Artemis program is considered an experimental scientific research program of active sonar systems for remote detection of submarines. It is claimed that the powerful ultra-low-frequency transducer in this system, placed on a specially-equipped vessel, makes it possible to detect an object moving under water at a distance of 500 miles. This system is undergoing further refinement for purposes of installing it on the US coast.

The Caesar and Colossus programs are dedicated to research on remote passive sonar systems, the Colossus program being a variant

of the Caesar system, but with greater detecting range. This system is to be set up along the west coast of the USA.

The US Navy attaches great significance to stationary sound-locating systems, which are being installed at strategically important points to provide ASW forces with information on the location of the submarines of a probable enemy even in peacetime.

In addition to ship formations (frigates, destroyers, escort vessels), land-based patrol aviation (Orions, Neptunes, etc.), and special carrier hunter-killer groups, the forces of antisubmarine zones (barriers) will include a considerable number of submarines.

Foreign specialists assert that antisubmarine operations constitute a war of attrition, whose outcome depends on the cumulative effect of a number of limited-scale clashes, in which the role of antisubmarine barriers will be rather significant.

For advance preparation of ASW forces and facilities in the US and NATO navies, systematic integrated exercises of ASW forces are held to practice hunter-killer missions.

Thus in September-October 1963 there were seven such exercises involving practice in ASW missions. The primary object of one of the stages in such an integrated exercise was combat with "enemy" submarine forces. Taking part in the exercise were 18 submarines and seven ASW air squadrons from the navies of the US, Great Britain, Canada, and the Netherlands. The exercise area was along the Iceland-Shetland Islands line; the exercise involved practice in coordinating the ASW forces of the barrier in the event of "enemy" submarine penetration into the Atlantic from the north.

The antisubmarine barrier forces included 11 subs and all of the

aircraft taking part in the exercise. The remaining submarines were the "enemy".

From 21 September to 2 October 1964 the NATO navies held large-scale joint antisubmarine exercises in the Atlantic under the code name "Team Work". The site of these exercises was the area of the main antisubmarine barrier in the North Atlantic (between Iceland, the Faeroes and the Shetlands), and also the English Channel and the Bay of Biscay.

The maneuverable forces of the barrier consisted of antisubmarine carrier hunter-killer groups, torpedo submarines, patrol aircraft, and surface ASW vessels. The British nuclear submarine Dreadnought first took part in this exercise. The most important phase of exercise "Team Work" was the breaching of the antisubmarine barrier by submarines (the "orange" forces) and the organizing of the search for and destruction of the underwater enemy by heterogeneous forces of the barrier (the "blue" forces).

In the succeeding years ASW practice by maneuverable forces of the antisubmarine barriers has continued to intensify. In 1966 alone seven major exercises were held to practice various ASW missions along the barriers. Taking part in one of them, code-named "Silent Rain", were submarines, aviation, and surface vessels from the navies of Great Britain, Canada, France, the FRG, the Netherlands, Norway, and Portugal. The exercise area was north of Ireland.

In the period from 19 September through 30 September personnel of ships and units involved in the exercise received theoretical and practical training in weapons employment methods at the NATO joint ASW center in Londonderry, and from 1 October through 7 Octo-

ber the participants in the exercise practiced searching out and destroying "enemy" submarines which were breaking through the barrier into the Atlantic from the north. Attention here was devoted mainly to practice in coordinating heterogeneous antisubmarine forces (including submarines) at the antisubmarine barriers.

Great importance has recently been attached to practicing joint operations by submarines and antisubmarine aviation to repel "enemy" submarines.

For example, this was the purpose of the 1967 joint summer exercise of the NATO navies code-named "Quick Pursuit", which was held in the area between Norway and Iceland north of the Faeroe Islands. Submarines and patrol aircraft from the navies of the US, Great Britain, France, Canada, Norway, and the Netherlands took part in the exercise.

The most important stage in exercise "Quick Pursuit" was practice in organizing coordinated operations to search out and destroy "enemy" submarines.

The ninth annual joint ASW exercise of the US Navy and Latin American navies, code-named "Unidas-IX", was held in 1968. Representing the US Navy were the antisubmarine carrier Randolph, five destroyers, and the nuclear submarine Chopper. The primary purpose of all these exercises is to practice coordinating antisubmarine forces and facilities in searching out and destroying "enemy" missile submarines in coastal antisubmarine zones at the immediate approaches to the American continent. These exercises make extensive use not only of US Navy submarines, but also those of Latin American navies.

Major exercises to practice tactics of submarine cooperation with other ASW forces and to assess the general effectiveness of antisubmarine barriers have also been held in other areas of the seas and oceans.

The employment of submarines for ASW purposes in exercises basically consisted in the following: The areas for submarine operations were divided into the most promising routes of "enemy" submarines. The dimensions of these areas were selected according to the width of the hypothetical zone of movement of the underwater "enemy" and according to the number of friendly submarines taking part in the exercise. The areas determined in this way were in turn broken down into patrol positions and zones, and each sub searched in its assigned zone, usually at the very lowest speed, which allowed it to have a low level of inherent noise and favorable conditions for sound location.

In order to conceal their own operations in trying to detect a penetrating "enemy", the submarines chiefly employed passive sonars.

The most successful participants in these exercises were nuclear submarines provided with AN/BQQ-2 sonar, which were said to have a rather high probability of detecting an underwater "enemy" in the 60-mile search zone of the antisubmarine barrier.

To avoid attacks by mistake on friendly submarines, each submarine taking part in an exercise could only maneuver inside the zone assigned to it. Since the effective range and reliability of equipment for mutual recognition of submerged submarines are inadequate at the present time, foreign specialists consider this a necessary condition of ASW employment of submarines. Hence,

the commander of an attack submarine assumes that only his vessel can be located at the position assigned to him, and that any other underwater target appearing at that position is an enemy sub.

Individual phases of the exercises involved practice with variations on the theme of submarines passing through positions of friendly submarines, such as the passage of a missile submarine into or out of the patrol area assigned to it. In this case the commander of the missile submarine had to receive permission to enter the zone from the commander of antisubmarine forces in the area, who notified the attack submarine located on the route of passage.

For reasons of safety the commander of antisubmarine forces in the area ordered the submarine maneuvering at the position and the submarine passing through the position not to use torpedoes against submarines for the required period of time, and he established a certain range of depths for each of them, which they were not to leave.

In antisubmarine employment of submarines, foreign specialists consider it advisable for the most part to use the positional method. In their opinion this method of submarine employment is the most effective at exits from enemy submarine bases, in places of the greatest submarine activity, in areas of antisubmarine barriers, and in areas from which submarines can launch missiles against targets on land.

The submarine positions must be chosen with consideration of the geographic features of the area and the specific conditions.

The foreign press has also stated that the increased combat potential of nuclear submarines in solving ASW problems makes it

possible to use them not only in the positional method, but also as part of the antisubmarine defense of maneuverable formations of large surface vessels. However, the foreign press also notes that although this idea is tempting, the state of the art of communications and identification equipment is such that employment of nuclear submarines in this way is unlikely at the present time.

One possible combat application of nuclear attack submarines is in preliminary sweeps of the areas of deployment of carrier strike forces to prevent attacks by hostile submarines.

Of considerable importance in ASW, in the opinion of the naval leaders of the principal capitalist nations, are offensive minelaying operations; evidence of this is the creation in the West of a number of sophisticated types of mines specially designed to be laid by submarines. Foreign specialists feel that attack submarines, carrying up to 30 mines, are the most suitable means of concealed minelaying.

It has recently been suggested that in special circumstances it might be advisable to convert part of the missile submarine fleet into minelaying submarines. The large displacement and sophisticated navigational gear of these subs satisfy two basic requirements for minelaying submarines — large mine-carrying capacity and the ability to lay mines secretly and with great accuracy.

US Navy specialists have calculated that each of the 16 missile tubes can hold 16 mines, i. e., one nuclear missile submarine can carry 256 mines. This would be enough for a minefield up to 16 square miles in area.

In view of the great secrecy of submarine operations, it has

been recognized that mines would be advisable at exits from enemy submarine bases and in narrow areas through which submarine deployment routes pass.

The fact must not be overlooked that some authorities in the West do not share the opinion of the submarine's extreme supporters who claim that submarines are the most effective branch of forces for ASW; these authorities point out that submarines in a military engagement operate in the same environment, and the odds are almost even.

For example, the commanders of the Canadian Navy are opposed to ASW employment of submarines without an extreme need for it, considering it an unwarranted expenditure of forces. They believe that the losses of friendly submarines in this case will equal the number of enemy submarines destroyed. On the basis of experience in NATO hunter-killer exercises in the northern waters of Europe with the participation of a large number of Canadian surface vessels, the Canadian naval command has concluded that antisubmarine forces should consist of surface vessels, long-range patrol planes, and high-speed jet aircraft and helicopters.

However, such views on the composition of antisubmarine forces are not the prevailing ones, and they do not reflect the viewpoint of the political leadership and the naval commands in the leading capitalist powers. The current trend of multipurpose-submarine construction by the principal capitalist states, and the direction of their combat training, are evidence that these vessels are primarily intended for ASW, while nuclear multipurpose submarines are looked upon as the most promising ASW forces. This may be seen, for

example in the nature of the combat-training missions practiced by American submarines in peacetime,and the time spent for these purposes.

The foreign press has stated that the submarines (including nuclear submarines) belonging to the 1st flotilla of the Pacific Fleet spend 70% of their sea time practicing antisubmarine missions. Moreover, they take part annually in four fleet exercises and nine amphibious exercises, which also involve a certain amount of ASW practice. It should be borne in mind here that the US plays the leading role in all aggressive blocs, and its views on naval employment, particularly the employment of multipurpose submarines, are the prevailing ones, as a rule, for the naval leadership of the nations belonging to these blocs.

Cooperation of submarines with other antisubmarine forces

Under modern-day conditions, foreign specialists maintain, the greatest effectiveness in antisubmarine warfare is achieved during close cooperation of heterogeneous ASW forces and facilities; this cooperation makes it possible to use diverse methods of detecting and destroying underwater targets, without completely ruling out the possibility of independent operations by these forces, as the situation dictates, of course. The US and NATO navies give special attention to practice in submarine cooperation with shore-based patrol aviation and carrier ASW hunter-killer groups (APUG).

Foreign specialists acknowledge that joint operations of aircraft and ASW submarines are a complicated form of cooperation and

can only be successful under certain conditions: assured two-way communication between submarine and aircraft; availability of reliable and rapid means of mutual recognition; a high level of training in cooperation; precise knowledge by the submarine and the aircraft of their own location and their orientation to each other.

The absence or violation of these conditions can lead to mistaken attacks on friendly submarines.

It has been pointed out, however, that these conditions cannot yet be fully met, because of the low range and insufficient reliability of communications with submerged submarines, which has been a fundamental problem in using submarines in close cooperation with surface vessels and aircraft. Nevertheless, the organization of joint operations by submarines and other ASW forces is even at the present time considered one of the best ways of achieving success in antisubmarine warfare.

Such joint operations have become necessary because modern submarines possess greater underwater target-detection range than the other antisubmarine forces. Foreign specialists are trying to exploit this most important tactical advantage of submarines in joint ASW measures. The role of submarines in such measures, and the methods of their employment, depend on many factors, above all the composition of the cooperating forces and the specific situation in the area.

In the overall system of countermeasures against enemy submarines at the antisubmarine barriers an important role belongs to ASW carrier hunter-killer groups (APUG), which are a rather sophisticated form of organization of heterogeneous antisubmarine forces

with a relatively high level of practice in cooperating to perform ASW tasks.

According to the foreign press, a HUK group usually comprises one antisubmarine carrier and as many as nine destroyers and escort ships.

Attack submarines, including nuclear-powered subs, have recently come to be included in carrier hunter-killer groups of the US Navy for joint accomplishment of ASW missions and for refining tactical methods of cooperation.

Three special operational groups — Alpha, Bravo, and Charlie — were formed by the US Navy in 1958 to practice various methods of joint operations by all the heterogeneous forces of a HUK group, and to check out new ASW tactics. Alpha Group made a very intensive survey of forms and methods of tactical cooperation by heterogeneous antisubmarine forces with submarines.

The main purpose of these studies was to increase the overall ASW effectiveness of the carrier hunter-killer group as a whole by exploiting the advantages of submarines in warfare against enemy submarines.

HUK operations to accomplish antisubmarine missions are usually divided into three stages: search of the ocean and establishment of primary contact with a submarine; secondary search and establishment of sonar contact with the submarine; pursuit and destruction of the enemy submarine.

The first stage is decisive for the activity of the whole HUK group. The principal means of searching out and establishing primary contact with a submarine in this stage is the carrier-based

airplane; with existing radio equipment it is capable of detecting enemy submarines which are snorkeling or are on the surface; it can scan rather large areas of the ocean in a short time. But these aircraft, as was noted earlier, are not effective for primary detection of submerged submarines.

This significantly affects the overall success of ASW activity by a HUK group, so the Americans are trying to use submarines, with their advantage in detection range, as a source of information for a carrier hunter-killer group trying to establish primary contact with an underwater enemy.

In practicing such measures, submarines are most often located a considerable distance ahead of the HUK group and at a favorable depth for sonar operation.

If contact with an underwater target is established during this coordinated activity, the commander of the multipurpose submarine acts on the basis of the specific situation at hand. Under favorable circumstances he attacks the target and then reports to the commander of the HUK group. Otherwise he must first issue an immediate report about detection of the enemy.

When the report is received from the submarine, carrier-based planes are sent to the area first; these begin the search with the aid of sonobuoys. When the carrier approaches the area of primary detection, helicopters join the search, using dipping sonars. Most of the destroyers and frigates in the group also proceed to the area of detection; two or three ships stay back to give protection to the carrier and to provide takeoff and landing security for the aircraft. As they approach the detection area, the ships disperse

and, cooperating with antisubmarine planes and helicopters, conduct a joint sonar search.

In the period of the secondary search and establishment of sonar contact with the enemy submarine by the HUK forces the multipurpose submarine operates according to the orders of the HUK group commander.

If the secondary search is successful, the Americans believe that several attacks in succession are generally required for destruction of the submarine in the concluding phase of HUK operations.

The success of a carrier HUK group in cooperating with submarines depends especially upon coordination of the operations of all forces belonging to the group. The main requirement in such cooperation is that each combat unit in the group must precisely know its own position and the positions of the other units, especially the coordinates of friendly submarines.

It is apparent from exercises held by the US and NATO navies in recent years, and from statements by foreign specialists, that in practicing coordinated operations by heterogeneous ASW forces these countries are giving the greatest attention to joint operations not only between HUK groups and multipurpose submarines, but also between multipurpose subs and shore-based patrol aviation. Close cooperation between the latter is necessary because of the submarine's ability to detect underwater targets at long distances, and shore-based patrol aviation's ability to reach an area quickly, reestablish contact, and attack the targets.

Shore-based planes involved in ASW missions are located near the submarine positions. So as not to alert an enemy sub, they do not use their active search devices.

At the most favorable depths and with the aid of sonar, the submarine maintains surveillance of the waters in its area.

In the event of contact with an underwater target, the subsequent actions of the submarine will depend upon the situation at hand. In favorable circumstances the sub will approach the enemy and attack him. But if the submarine commander decides that it is advisable to call in antisubmarine aircraft in order to confirm sonar contact and attack the enemy, the sub rises to periscope depth, radios a plane, and transmits data on the enemy. After receiving the message, the plane heads for the area indicated to conduct the necessary ASW operations.

When a submarine establishes remote sonar contact with an enemy sub, it can guide aircraft to attack the enemy or it can use long-range antisubmarine weapons.

The US and NATO navies also envisage individual operations by submarines and aviation at separate barriers. In this case submarines and antisubmarine aviation independently search out and destroy enemy submarines in areas assigned to them. This method is used in order to force conventional enemy submarines, which have a limited electric power supply, to pass submerged through the patrol areas of antisubmarine aviation and to either snorkel or surface when passing through ASW submarine positions; this causes them to make a good deal of noise, which aids in their detection by sound-locating gear on ASW submarines a considerable distance away. This method is not a new one; it was used by the British and American navies even during the Second World War.

The foreign press admits, however, that at the present time such

a method cannot be expected to have a significant effect against nuclear submarines.

The foreign press acknowledges that, in spite of the admitted advantages of cooperation by heterogeneous ASW forces, the tactics of joint operations by submarines with other ASW forces have not been sufficiently worked out in foreign navies, and most importantly, the US Navy; this is due to many unresolved problems, above all the problem of communications with submerged submarines.

Special aspects of ASW employment of nuclear submarines

The US and NATO naval commands look upon nuclear-powered submarines as one of the most effective types of ASW forces. A former Chief of Naval Operations of the US Navy, Admiral Burke, has written: "These [i. e., nuclear-powered] submarines are the best weapons system in our arsenal of antisubmarine forces".

As their number grows, nuclear attack submarines are occupying an increasingly more important place in the overall system of antisubmarine forces. Pentagon naval specialists believe that it is advisable to use nuclear submarines in ASW operations in enemy waters, in antisubmarine zones protecting the immediate approaches to the American coast from attacks by missile submarines, and at antisubmarine barriers.

It should be noted that, for security of operations by missile submarines, the Americans propose to use nuclear-powered multipurpose submarines for searching out and destroying enemy subs in the zone of movement belonging to the missile submarines. Moreover, when missile and attack submarines are used together in this way,

it is difficult for the enemy to determine what kind of submarine he has established contact with.

Missile submarines are provided with antisubmarine weapons, such as torpedo launchers adapted to fire Subroc missiles. The US Navy command believes that such armament increases the defensive capability of nuclear missile submarines and, in certain conditions, will allow these vessels to be used as multipurpose attack submarines after their primary missions have been accomplished.

Looking at antisubmarine warfare as a number of successive and interconnected stages (phases), American specialists feel that the nuclear submarine is most effective in the search and detection stage. But it is admitted that this task is more fully accomplished during cooperation of all antisubmarine forces and facilities.

The nuclear submarine also has greater potential than other antisubmarine forces in investigating an underwater contact, since it uses passive sonars, whose operation cannot be detected by a target submarine under water.

A nuclear submarine carrying modern sonars interfaced with automatic torpedo launchers can determine the position of the target discreetly and with the accuracy required to use the weapons.

It is felt that if the first three phases are accomplished in secret, the success of the concluding phase is assured.

Only in the first two phases (detection and investigation of contact) do underwater communications and identification devices give a measure of support for cooperation by nuclear submarines with other forces. In the future the nuclear submarine must operate independently, so as not to be attacked by friendly ASW forces.

When underwater communications become more sophisticated, the nuclear submarine will be able to operate jointly with other forces in the target-location and destruction phases as well.

Nuclear submarines have an undeniable advantage in fighting diesel submarines, especially in tracking diesels which are using snorkels; the running diesels are sources of considerable noise, which gives away the conventional submarine and causes problems for its own sonar. But US Navy exercises have shown that, when a diesel submarine was able to switch from snorkeling to running on electric motors, it was difficult for the nuclear submarine to detect the diesel sub, and the nuclear submarine was by no means always superior in detection.

In such cases the nuclear submarine will try to choose an optimum course in the hope that it will prove to be parallel to the course of the submarine being pursued, and the nuclear sub will then follow the enemy sub until the latter begins snorkeling to replenish or conserve electric power. Under favorable circumstances a nuclear submarine can pursue a conventional one and attack repeatedly until the enemy has used up his electric power supply and is destroyed.

A nuclear-powered submarine is therefore capable of independently conducting a number of operations against a conventional sub, i. e., detection, pursuit, and destruction. After comparing the fighting qualities of nuclear and diesel attack submarines, naval specialists in the West concluded that the combat effectiveness of nuclear subs is at least four times greater.

Equipping nuclear submarines with up-to-date sonar and special antisubmarine weapons makes it possible for them to fight enemy

submarines successfully. In underwater combat between two nuclear submarines with equivalent sonars the advantage will lie with the quieter, more vigilant submarine.

US and British specialists believe that one of the conditions for success in antisubmarine operations by nuclear-powered submarines is technological superiority over the underwater enemy. For this reason they are making considerable efforts to build muclear multi-purpose submarines (primarily for ASW purposes) with higher tactical and technical performance characteristics.

With the appearance of submarines equipped with nuclear power plants,the leaders in the Pentagon began to see the area beneath the Arctic icecap, considered inaccessible until recently, as one of the potential regions of naval operations, and great attention has been given to opening it up with nuclear submarines.

According to information in the foreign press, nuclear submarines of the US Navy have regularly made voyages under the ice in the Arctic basin since 1957.

In the period from 1957 through 1962 the American submarines Nautilus, Skate, Sargo, and Seadragon made nine such cruises, during which techniques for cruising underwater and surfacing in ice-free areas were practiced, navigational and hydrographic conditions were studied, operational reliability of equipment was tested extensively, and the effectiveness of submarine operations in the Arctic was evaluated.

During one of these cruises the nuclear submarine Sargo surfaced twenty time in ice, and it was found that the conning tower fairwater, reinforced with additional stiffeners, could penetrate ice

up to 122 cm thick.

In August 1960 the nuclear attack submarine Seadragon took a new route under the Arctic ice through the straits of the Canadian Arctic archipelago; the route was Portsmouth (US east coast) – Davis Strait – Baffin Bay – Lancaster, Barrow, and M'Clure Straits – Central Arctic Basin – Bering Strait – Pearl Harbor.

The American command believes that the route under the ice taken by Seadragon can now be used by all nuclear-powered submarines of the US Navy as a passage into the Arctic Ocean

In the summer of 1962 Skate and Seadragon made the first joint Arctic cruise. After meeting under the pack ice about 100 miles north of the island of Severnaya Zemlya, they cruised to the North Pole together. With great difficulty they managed to avoid a collision while surfacing at the Pole. After this they submerged and proceeded to the Beaufort Sea, where they parted: Seadragon turned west to the Bering Strait, and Skate headed east.

During their joint cruise the subs practiced antisubmarine tactics under the ice and conducted several mutual torpedo attack exercises, some of them with launches of practice torpedos. In the Beaufort Sea the submarines held a joint exercise with antisubmarine aviation. Furthermore, during the joint cruise they tested underwater sound communications equipment and other sonar apparatus.

Communication with all nuclear-powered submarines operating in Arctic waters was achieved with the aid of a VLF transmitter (2000 kW power) at Cape Cutler, Maine.

The voyages confirmed the nuclear-powered submarine's capability of cruising under the Arctic ice, communicating there by radio, and

finding places to surface in summer and winter.

The US has undertaken a great deal of work to study the water area of the Arctic Ocean and the adjacent seas and to determine the effectiveness of operations by various antisubmarine forces beyond the Arctic Circle.

In the opinion of Western military specialists, the ice conditions, the severe Arctic climate, the long polar nights, and the frequent summer fogs pose formidable obstacles to surface vessels and aviation, and they are not likely to be able to perform antisubmarine missions effectively in the polar basin. It is assumed that submarines capable of cruising under the ice must become the primary ASW force in the Arctic regions. Nuclear-powered submarines are acknowledged as the best vessels for this purpose.

In order to test the Arctic equipment of submarines, the US has built a special tank where the specific conditions of the Arctic are simulated. The tank makes it possible to test, in a situation close to actual, a number of devices for submarines, such as periscopes, extendable antennas, etc.

The leaders of the submarine forces in the British Navy, following the example of the American admirals, also give a great deal of attention to the study and use of the Arctic regions for submarine operations.

For these purposes Great Britain has used conventionally-powered vessels, which made several cruises into the Arctic in the period from 1948 through 1966.

Of course, the underwater endurance of diesel-powered subs is limited by the need for periodic surfacing to charge batteries.

In Arctic regions this can be accomplished at places where the ice has parted or has not formed. It is felt that modern diesel-powered submarines with high-capacity storage batteries and a sophisticated system of regeneration and air conditioning can operate in Arctic conditions more freely and successfully than their forerunners.

For practical confirmation of this thesis the Royal Navy's modern diesel submarines Narwhal and Otter cruised for a month in the area under the edge of the ice. The cruise area extended 100 miles north from the edge.

Unlike nuclear-powered submarines, which can turn 180° after discovering a suitable unfrozen spot, the British diesel subs would stop and back up to the hole, in order to conserve power. This maneuver always required precise differentiation.

Surfacing and submersion in unfrozen spots were accomplished solely by changing bouyancy. Surfacing speed was maintained at 1.5 – 3 m/min. At these speeds it was possible to observe the movement of ice near the open area through the periscope and, if necessary, to suspend or stop the maneuver quickly.

Starting in 1965, France sent conventionally-powered submarines into the waters of the Arctic.

The diesel submarine Narval took part in the third such cruise in 1967. Its mission included mastering underwater cruising techniques and studying aspects of navigation in the presence of ice. Narval cruised under the ice, surfaced in open areas, and reached 80° North latitude, which is about 1000 km from the North Pole.

Militarist circles in the FRG also began to show interest

recently in studying the possibilities of using the Arctic Ocean for military operations by submarines.

In 1966 the diesel submarine U-5 made a twenty-day submerged cruise using snorkels and electric power in the region of the Arctic.

The principal handicap of submarines operating in the Arctic with a conventional electric power plant is the limited power supply, which prevents them from going more than 250–300 miles without surfacing.

With this underwater cruising range there is no assurance that the submarine will find an ice-free surface of water which can be used for surfacing and charging the batteries.

The commander of a conventional submarine is considered to be acting imprudently if he gets away from open water by more than half the distance which the submarine can cover with the electric motors without recharging batteries.

The whole enormous program which has been organized by the Pentagon and the NATO naval leadership to study and open up the Arctic and adjoining seas has been aimed not only at preparing this region militarily for a surprise attack on the socialist countries, but also at turning it into one of the primary zones of ASW activity by submarines.

The assimilation of postwar scientific and technological achievements into submarine construction has greatly enlarged the role and significance of submarines in conducting armed struggle at sea and has made it possible to entrust them with missions of strategic scale. The latter circumstance has forced the naval leaders of the

imperialist states to look upon antisubmarine warfare as one of the most important forms of combat operations at sea. Nuclear energy, modern antisubmarine weapons, and sophisticated sonar equipment have, in the opinion of foreign specialists, made submarines the most effective and promising means of antisubmarine warfare.

The aggressive policies of the imperialist states oblige Soviet navy men not to let their vigilance slacken, to study the modern naval technology of the capitalist states and their views on its use, and always to increase the combat readiness of our Soviet Navy.

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