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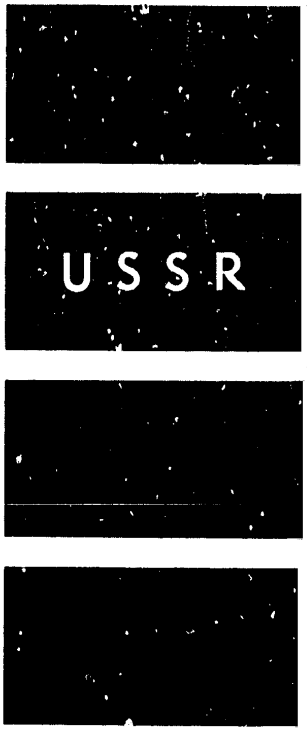


# TRANSLATIONS ON USSR MILITARY AFFAIRS
(FOUO 15/79)

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COMMENTS ON U.S. CPX 'NIFTY NUGGET'

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 pp 8-9

[Article by Lt Col V. Georgiyev: "Exercise "Nifty Nugget"]

[Text] Along with the implementation of numerous and expensive programs for equipping the armed forces with the latest weapons, the Pentagon and the bosses of the U.S. military-industrial complex are devoting great attention to increasing mobilization readiness and the gaming of individual stages in the conduct of war. In justifying their militaristic preparations, they intensely intimidate the peoples of the western countries with the myth of a "Soviet threat."

This is indicated by a strategic command-post exercise (CPX) which was conducted in the period from 10 October through 8 November 1978 under the code name "Nifty Nugget."

The basic goal of the regular demonstration of imperialism's might was the check of existing mobilization plans and the refinement and elaboration of basic measures to convert the armed forces and some branches of the U.S. economy from a peactime to a wartime status.

According to a report in the foreign press, the following took part in the exercise: directorates and divisions of the Department of Defense which are directly responsible for the planning, preparation, and conduct of mobilization deployment; headquarters of joint and special commands located in the continental United States; and representatives of a number of federal departments and agencies including the Departments of Energy, Transportation, Commerce, Labor, Interior, the Treasury, and Justice. Headquarters and, in a number of cases, also individual subunits of regular troops and their reserve components (the National Guard and reserve branches of the armed forces) were included in the exercise on a selective basis.

The exercise was gamed in accordance with plans of the Joint Chiefs of Staff of the U.S. Armed Forces and was directly worked out and prepared in 11 months by two of its directorates (operations and rear services). The armed forces of the socialist countries were openly considered as the specific enemy.

A special operations group was created to direct the exercise. In addition to highly placed military figures, it included representatives of civilian departments which participated in a given measure. The course of the CPX play was monitored by the Secretary of Defense, H. Brown.

The operational-strategic background of the exercise was a "war in Europe" which arose between the countries of the North Atlantic bloc and the Warsaw Pact. "Combat operations" were initiated after some period of aggravation of the international situation. In the opinion of the Pentagon leadership, it is this type of war in Europe which will require the United States to implement a broad mobilization deployment in compressed times and on large scales.

As foreign military specialists believe, the lifting of the main portion of the strategic reserve, including Ground Force and Air Force large units and units during the first month of combat operations to the European theater of war is envisioned to assist America's NATO allies. Along with this, it is also planned to send reserve subunits (so-called early deployment) to this region of the world.

According to the concept of the exercise, the NATO command had preliminary information of an attack that allegedly was being prepared and had a certain amount of time available to expand the NATO armed forces and the economies of the NATO countries for war. In accordance with this, mobilization of large units and units of the National Guard and reserve branches of the U.S. Armed Forces was begun ahead of time, prior to the initiation of the conflict in Europe and could be accomplished by stages and covertly.

Essentially, in the course of the exercise many measures on the mobilization expansion of the armed forces and the country's economy were conducted hypothetically; however, automatic control systems and computers were widely employed. They were used to check calculations which were conducted and, in some measure, problems in the call-up and notification of reservists were worked out in a practical manner and the call-up of a small contingent of this category of reservists was actually accomplished on limited scales. This was done under the guise of conducting annual summer camps.

In addition to the measures which have been considered, a military draft system was introduced hypothetically and problems in the call-up of recruits were worked out. For this purpose, a so-called Selective Service System was set up which, in peacetime, functions at reduced strength and is occupied primarily with questions of estimating the U.S. draftee contingent and planning mobilization expansion.

Foreign specialists believe that in case of war the United States will be required to call up 100,000 recruits in the first two months after the declaration of mobilization and 650,000 men in the first half year. With today's reduced staff (98 people) the Selective Service System does not ensure mobilization of the necessary contingent in the indicated times.

As reported in the foreign press, on the exercise special attention was allotted to questions of converting the country's economy to a war status. First, integrated measures were worked out on mobilizing industry and resources of strategic raw materials and expanding military production in reduced times.

According to the appraisal by Pentagon specialists, exercise "Nifty Nugget" disclosed a number of substantial shortcomings in the plans for the mobilization expansion of the armed forces and the transfer of the U.S. economy to military rails: the absence of the required number of trained reservists intended to bring the regular large units and units up to full strength and to make up losses suffered in the initial period of the war; a delay in replenishing the armed forces with personnel (it is believed that the Selective Service System can ensure the arrival of recruits in the combat subunits no earlier than 110 days after the announcement of mobilization); difficulties in the preparation and timely transfer of means of transportation to be at the disposal of the military authorities, in particular the required number of commercial airplanes which it is intended to use actively to lift troops and combat equipment to Europe; the slow expansion of a number of branches of industry, including those which provide the production of armored equipment, vehicles, ammunition, and equipment. However, it is noted that many of the indicated shortcomings were presented to substantiate the necessity for a further increase in militaristic preparations.

It is stressed in the foreign press that the CPX "Nifty Nugget" was the biggest in a series of such exercises conducted in the United States after World War II. In the opinion of the Chairman of the Joint Chiefs of Staff, General D. Jones, "strong and weak aspects of the mechanism for implementing mobilization on a national scale" were disclosed "and now the Department of Defense has a clear view of ways for its further improvement."

These words of a high-ranking Pentagon figure confirm once again the true intentions of the United States military-industrial complex--to continue to intensify militaristic preparations.



6367
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COMMENTS ON INTERNATIONAL CENTERS OF 'IDEOLOGICAL DIVERSION'

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 pp 14-19

[Article by Col G. Arzumanov: "International Centers of Ideological Diversion"]

[Text] Ideological diversion is a specific form of subversive activity by the reactionary forces of imperialism against the main revolutionary detachments of contemporary times which is widely employed both under conditions of peace and in time of war. Serving the class interests of the monopolistic bourgeoisie, it combines within itself propaganda and secret actions of intelligence organs, diplomacy and economic blackmail, and the direct and indirect use of armed forces. Ideological diversion always accompanies the foreign-policy actions which are most important for imperialism and frequently anticipates them in order to introduce discord and dissension in the camp of the opposing side. Because of this, the activity of ideological saboteurs which differs in forms and methods used is distinguished by strict organization and centralization of control at the highest level, primarily in the United States and NATO.

In the United States, anticommunism was elevated to the rank of state policy immediately after World War II, and questions of ideological diversions occupy a prominent place in the work of the National Security Council (NSC) which is headed by the President. The NSC accomplishes overall supervision of the activity of all government institutions which are involved in foreign policy propaganda. The directors of the Central Intelligence Agency (CIA) and the International Communications Agency (ICA) and representatives of military intelligence and counterintelligence as well as of other departments which are engaged in subversive actions and anticommunist propaganda abroad are systematically called on for participation in its work.

In 1948, that is, less than a year after the start of its activity, the NSC recommended, in particular, the undertaking of "tremendous propaganda efforts" which are called upon to supplement and justify the arms race which had been initiated by the United States, organize a "psychological offensive against the Soviet Union," and to consider propaganda "the fourth weapon of foreign policy" which follows directly behind military, diplomatic, and economic measures.

In the spirit of these recommendations, state appropriations for subversive propaganda began to increase steadily beginning in 1949, and by 1951 the Congress adopted an unprecedented law which openly provided for the allocation of 100 million dollars for diversionary work against the socialist countries. The next year, the Interdepartmental Bureau for National Psychological Strategy was created and, in 1953, the U.S. Information Agency which has now been reorganized as the Joint Agency for International Communications--the main executive organ for the conduct of American propaganda abroad.

According to its official status, the agency is a governmental department which is directly accountable to the U.S. Secretary of State and the President of the country. It possesses considerable independence: it has its own budget and its own system for the training and assignment of personnel, and it has 10 separate institutions in Washington and 189 sections in 120 countries of the world. But it by no means operates on its own fear and risk. Its activity is regulated by the U.S. ruling circles' "interests of strategic policy." And it is not by chance that the official U.S. diplomatic representatives abroad in those countries where ICA sections are located have been directed to consider the agency's activity as one of the important elements of U.S. representation abroad.

The technical base which the ICA inherited in 1978 from its predecessor, the USIA, consists of more than 115 radio transmitters, high-volume publishing and printing facilities capable of providing the weekly publication of several dozen journals with a circulation of 1.3 million copies, motion picture studios which produce up to 50 films per year, and so forth. The framework for the agency's activity is provided by tremendous appropriations to propagandize the "American way of life" and to implement a policy of licentious anti-Sovietism and anticommunism. They increased from 31 million dollars in 1949 to almost 400 million at the present time.

The CIA, Bureau of Intelligence and Research of the State Department, the Defense Intelligence Agency, the National Security Agency, and the Federal Bureau of Investigation (FBI) are working in the field of ideological diversion hand in hand with the ICA and its peripheral centers, although on independent budgets. The offspring of the CIA is a complex of subversive radio stations, the biggest of which are "Radio Freedom" and "Radio Free Europe." Organizing and conducting secret operations and implementing espionage-diversionary activity against the USSR and other socialist states, the departments which have been named come forth as the most important suppliers of misinformation which is directed toward the deception of public opinion. Fake documents and fabrications are sent by means of a large number of recruited journalists by the CIA alone to dozens of information agencies, radio and television stations, and big publishing houses in a number of countries as well as to hundreds of newspapers.

Many emigre organizations and anticommunist centers are supported by the CIA--the White Guardist "Popular-Labor Alliance" (NTS) as well as all kinds of "unions," "organizations," and "assemblies" of former Vlasovites, Banderists, and rabble like them. The emigre rabble from these "organizations" are

attracted to the conduct of anti-Soviet actions against the crews of our vessels which call at foreign ports, attempt to provoke Soviet citizens and citizens of other socialist countries who are on official business trips and tourist trips abroad, initiate purposeful talks, pump them for information, and try to establish contacts, sometimes even complaining about their own fate to cause pity and compassion.

But the interest in the life of the Soviet people which is displayed by the hirelings of the CIA serves as camouflage to cover the main mission of the provocateurs--intelligence which is conducted to facilitate the activity of the ideological saboteurs. This subject was discussed frankly in the book, "Fourth Weapon," which was recently published in London. Its author, a certain Charles Cruikshank, who claims to be an all-around specialist in the field of "psychological operations, propaganda, and subversive operations" without false modesty, writes: "There can be no propaganda, at least effective propaganda, without carefully provided intelligence. The propagandist must study the country and the people to whom he is appealing in the most detailed manner. He must know them so that not one false note creeps in in his radio appeal or leaflet. He must know what the housewife is saying when she is standing in line at the food store, what questions interest the plant workers, and the peasants' attitude toward the government.... The living conditions and attitudes of the people should be known in detail primarily in order to determine more precisely where and when to attack in propaganda and what ammunition to use."

If the National Security Council steps forth in the United States as the organ for strategic planning, and the ICA and intelligence agencies as the immediate organizers of ideological diversions, the brains of their centers are about 200 specialized scientific-research institutions which are engaged in the "ideological" servicing of anticommunist and anti-Soviet campaigns. Among them are the Hoover Institute on War, Revolution, and Peace, the Russian Institute and Research Center on Problems of Communism at Columbia University, the Russian Research Center at Harvard University, the Institute for the Study of Communist Strategy at the University of South Carolina, and others. The activity of these formally private and independent institutions in the field of ideological diversion is closely coordinated by government institutions, in particular by the Federal Consultative Commission on Information Questions.

A number of other capitalist countries also have their own national centers for the conduct of ideological diversion on an international scale. In the FRG, for example, propaganda campaigns abroad are organized by the Federal Department of the Press and Information which is directly subordinate to the chancellor and has an annual budget of up to 120 million marks.

In Great Britain, the role of chief coordinator in the conduct of a policy and propaganda of anti-Sovietism is played by the Joint Intelligence Committee and the Interdepartmental Committee on Information. A mighty state institution with an annual budget of about 60 million pounds sterling, the so-called. British Council comes forth as the main organizer of British propaganda

abroad. The hardened spy-diplomat, R. B. Lockhart, acted in the role of one of this organ's leaders for long years.

Lockhart died eight years ago. But the traditions which he founded in the organization of secret operations against socialism are being preserved and are being developed by British ideological saboteurs. Well known, in particular, is the plan "Liotey" [as transliterated] which was worked out in the depths of Great Britain's intelligence organs "for the entire period of peaceful coexistence." The plan envisages causing "friction in the highest spheres of the Warsaw Pact countries," rewarding so-called dissidents--renegades of socialist society, shattering the fraternal collaboration of the peoples in the socialist countries, and attaining the breaking away of individual states from the socialist family.

Increasing activity in the field of ideological diversion is being shown in recent years by Israel which is using the propaganda of Zionism to camouflage its aggressive policy and to set the Jews against the non-Jewish population of any country. The Zionists are sparing no resources for subversive activity against the world socialist system.

The general council and executive committee of the World Zionist Organization with headquarters in New York and Jerusalem and the so-called Jewish Agency which controls the radio station "Voice of Zion" and which is conducting considerable printed propaganda, has a network of branches in more than 40 countries, and has "its own people" in many organs of mass information and in public and religious circles including Catholics and Protestants step forth as the main organizers of Zionist ideological diversion. The Zionist-fighters who are used for terrorist acts and for sabotage, diversion, and espionage are united in the ranks of an organization with a fascist trend called the "Jewish Defense League."

The Beijing Maoists, who are attaining hegemonistic goals in the international arena, are also stepping forth as assistants to the ideological saboteurs from the camp of imperialism. A specially authorized member of the Politburo and corresponding departments of the Central Committee, Communist Party of China, are directing and coordinating subversive actions within the communist and workers' movement, the creation of Maoist groups in individual countries, and the activity of emigre associations of fellow-countrymen and press organs with a pro-Beijing orientation. The Ministry of Foreign Affairs, the New China News Agency, the Administration for Matters in the Publication and Dissemination of Literature in Foreign Languages, the Administration for Tourism, and the Main Administration for Radio and Television with the State Council of the People's Republic of China are stepping forth as the administrative headquarters for ideological diversion.

Joining the anticommunist camp, the Beijing ideological saboteurs are playing into the hands of the most extreme forces of world reaction. Abusing the authority of the CCP and the Chinese revolution which was won earlier, gambling on socialist ideals, and taking refuge behind revolutionary slogans, they

in essence opened a new front in the ideological-political struggle against socialism, are falsifying and distorting scientific communism, spreading bourgeois-nationalistic ideology and anti-Sovietism, and trying to lull the vigilance of the peoples in regard to imperialism.

The important leading centers of ideological diversion on an international scale are concentrated, finally, in NATO. The NATO Council and the three permanent committees which function in it--on political questions, on questions of information and cultural ties, and on problems of contemporary society--form a sort of main staff which defines the general strategic line for subversive propaganda against the socialist countries. Executive organ of this headquarters is the NATO Information Directorate which works out the basic propaganda theses in the interests of the organization's members, publishes official materials, and coordinates the activity of the ideological saboteurs from various bloc countries. Maintaining close ties with the information agencies of the capitalist world, the NATO Information Directorate has the opportunity to use more than 5,200 newspapers and radio stations to spread anti-Soviet and antisocialist frauds.

Coordination of the activity of ideological saboteurs in preparing to wage "psychological war" under combat conditions is also accomplished primarily within the framework of NATO. In particular, a conference of 120 representatives of intelligence and propaganda services of NATO countries as well as psychologists, physicians, and other specialists took place from 1 through 10 August 1978 in Khania on the island of Crete. The participants in the conference heard and discussed almost 20 reports on the social trend, content, forms, methods, and planning the activity of information resources as a weapon of "psychological war."

In the opinion of NATO specialists, "psychological weapons," that is, refined, purposeful propaganda in combination with blackmail and various types of diversion can have a significant influence on the opinions, feelings, attitudes, and behavior of enemy servicemen as well as the civilian population. It is called upon to cause fear and panic, undermine the resolve and will of people, thrust capitulatory convictions upon enemy troop personnel, mislead them, and reduce the combat capabilities of large units and units. In one of the plans for unleashing aggressive NATO actions against the Soviet Union which was prepared in deep secrecy under the code name "Dropshot" but recently became public property, it was indicated in this regard: "'Psychological war' can serve as an extremely important weapon to introduce dissidence and disorder among the peoples of the USSR, to undermine their morale, and to introduce disturbances and disorganization in the life of the country. A special effect should be expected from subversive operations conducted among individual ethnic groups with the use of nationalistic arguments and slogans of liberation...."

In general form, the regulation documents of the NATO countries' armies point out that the main goal of "psychological war" is to undermine the resolve and will of the enemy for victory and lower the combat morale qualities of his troops. To weaken the combat effectiveness of the troops, it is recommended that "surprise and disquieting actions, flexibility of maneuver, propaganda,

misinformation, provocations and intimidation, sabotage, and terror" be employed and that "the enemy must be given no respite and the opportunity to restore the troops physically and with regard to morale."

Within the framework of the NATO military structure, responsibility for the planning, preparation, and conduct of "psychological warfare" against the enemy troops and population is assigned to the commanders of armed forces formations in theaters of military operations. The directorates for civil affairs as well as operations directorates and intelligence directorates and sections of the appropriate headquarters are the working apparatus of the commander. In the headquarters of the supreme commander of the NATO combined armed forces in Europe, a "special warfare" section is part of the civil affairs directorate.

The direct leadership of the "psychological warfare" units and subunits is assigned to the commands of each individual NATO country and their staffs. The men and equipment for "psychological warfare" include special battalions and companies which are called upon to accomplish both large-scale ideological operations against the armed forces and population of one or another country as a whole and small diversions whose mission is to contribute to the combat success of friendly troops on individual sectors of the front.

The training of personnel for the accomplishment of ideological diversion by the NATO countries is conducted in the United States at the "Special Warfare Center" (Fort Bragg) and in three schools for the conduct of "psychological warfare" which are functioning in Great Britain, the FRG, and France.

Under contemporary conditions, the activity of international centers for ideological diversion is wholly and completely subordinate to attempts of the most wicked reactionary forces to slow down the process of detente. They are sowing dissension between peoples, organizing anti-Soviet and anticommunist ballyhoo, and camouflaging the imperialist policy of aggression and interference in the internal affairs of other states. The present activity of the ideological saboteurs is one more illustration of the sagacity of the Lenin indications of the imperialists' perfidy: "...if now they cannot come against us with weapons in hand, they come with weapons of the lie and slander..." (V. I. Lenin, "Polnoye sobraniye sochineniy" [Complete Works], Vol 42, p 366).



6367
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COMMENTS ON AIR DEFENSE OF NATO GROUND TROOPS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 pp 29-33

[Article by Maj Gen Arty A. Sherstyuk, candidate of military sciences, docent: "Air Defense of NATO Ground Troops in a Theater of Operations"]

[Text] The military leadership of the aggressive NATO bloc is devoting great attention to air defense in a theater of operations, stressing that under contemporary conditions the ground forces cannot count on success in an operation if their basic groupings are not covered reliably from enemy air strikes and reconnaissance.

The predominant views on the role, place, and principles for organizing air defense [AD] of the ground forces in a theater of operations, it is noted in the foreign press, are the views of the American command. Moreover, the armies of the majority of NATO countries are armed with air defense complexes and fighter aircraft which are primarily of American production.

Despite certain differences in AD weapons, the organizational and manning structure for air defense, and in existing views on individual questions in its organization and conduct which have existed up to now in the armies of the NATO countries and exist at the present time, as evidenced by the foreign press work is continuing on improving the air defense system of the NATO ground troops.

The air defense system of the ground forces in a theater of operations functions within the limits of a zone of combat operations which has a depth of up to 200 km (depending on the operational deployment of the troops) and is the first operational echelon of the entire NATO air defense in Europe. It consists of a basic number of weapons to combat the aerial enemy, especially low-flying targets.

The commander of the armed forces in a theater of operations is responsible for air defense as a whole. He distributes the air defense means which he has available between the communication zones and zones of combat operations and between his subordinate troops. As a rule, the Air Force commander is

designated air defense commander in a theater of operations. In addition to fighter aviation, the ground air defense weapons in the communication zone are operationally subordinate to him.

The commander of a formation (large unit) is responsible for the organization and conduct of air defense of a ground force formation (large unit). Its immediate organization is accomplished by the senior commanders of organic or attached air defense units and the control elements of combined-arms headquarters tactical operations centers (TOC) which they deploy in wartime: in the army group--by the AD section of the army group headquarters; in the field army (if present)--the commander of the air defense artillery large unit and the AD section of the TOC; in the corps--the commander of the air defense artillery large unit (unit) and AD section of the corps TOC; in the division--by the commander of the air defense unit and the AD section of the division TOC.

The American press points out that the fighting strength of the air defense forces in a theater of operations which are intended for covering the ground forces is not constant and depends on the importance of the theater of operations, the number and national affiliation of the troops which comprise it, the grouping and possible scale of operations of the aerial enemy, and other elements of the situation. Thus, according to their views, about 70 percent of the air defense missile complexes and 40 percent of the air defense fighters from the combined NATO air defense system in Europe is concentrated on the main, Central European Theater of Operations while about 25 percent of the air defense missile complexes [ZRK] and 45 percent of the AD fighters are in the Southern European Theater and only 5 percent of the ZRK and 15 percent of the AD fighters are in the Northern European Theater.

According to reports in the foreign press, the fighting strength of the AD men and equipment in this theater of operations numbers 13 "Nike-Hercules" battalions, 20 "Hawk" battalions, a squadron of "Bloodhound" antiaircraft guided missiles [AAGM], a squadron of "Rapier" AAGM's, and 10 squadrons of air defense fighter aircraft. Together with the air defense weapons of the ground forces, this comprises approximately 2,000 ZRK's, of them about 200 "Chaparral" ZRK's, 850 antiaircraft guns, and 150 AD fighters.

The foreign press points out that the major portion of the air defense weapons which are at the disposal of the commander in the theater of operations are used in the disposition area of the ground force large units (formations) and their basic rear area installations.

The air defense of the ground forces in a theater of operations consists of air defense men and equipment of the forward area, corps rear area, army group rear area, or rear area of another ground force operational formation which cooperate with each other in a coordinated manner and is supplemented by a system of fighter cover which is organized on a scale of the theater of operations (AD zone).

Antiaircraft weapons which are most adapted for engaging low-flying aerial targets, including helicopters, are located in the area occupied by divisions of the first echelon. In the U.S. division, this is a mixed "Chaparral-Vulcan" air defense battalion (24 "Chaparral" air defense complexes and 24 "Vulcan" 20-mm ZSU [antiaircraft self-propelled artillery mount]) and about 70 portable "Red Eye" ZRK's; the FRG--an air defense battalion (36 40-mm twin ZSU's and 15 40-mm antiaircraft guns) and portable ZRK's of the "Red Eye" type; Great Britain--a subunit of portable "Blowpipe" ZRK's; the Netherlands--an antiaircraft artillery battalion (18 40-mm antiaircraft guns); and in the Belgian division--22 20-mm antiaircraft guns consisting of antiaircraft platoons and brigades.

The regulations of the armies of the United States and the other NATO countries point out that the performance characteristics of the air defense weapons in the inventory do not permit the creation of a continuous zone of cover in the division's entire zone of action. Therefore, it is recommended that organic or attached weapons be used for the close-in cover of the combat units which are operating on the direction of the main effort and division command posts.

In the divisions which are operating in the corps second echelons and in the divisions of second-echelon corps, the regulations recommend that the artillery, control posts, and rear area installations be considered as the main AD objectives.

Destruction of the aerial enemy by the first-echelon division's AD weapons ("Chaparral" and "Red Eye" ZRK's) is accomplished, as a rule, above the combat formations of the troops being covered. In order to destroy the aerial enemy prior to his accomplishment of his combat mission, it is recommended that if possible the air defense weapons be located on the approaches to the troops and objectives being covered. As noted in the foreign press, this requirement can be satisfied only when covering objectives and troops which are at some distance from the line of contact of the troops.

The contemporary air defense weapons of divisions in the ground forces of the United States and other NATO countries are not capable of destroying enemy means of aerial attack at night and in difficult weather conditions. Therefore, the regulations note that under these conditions the missions for covering the divisions are assigned, as a rule, to the corps "Hawk" air defense complexes.

Foreign military specialists believe that in the future the increase in the effectiveness of the AD system will be furthered by including in the tables of organization and equipment of divisions of the United States, the FRG, the Netherlands, Belgium, and other NATO countries the new "Roland" ZRK and the "Gepard" ZSU. The British press expresses the opinion concerning the possibility of adopting in the inventory of the division the "Rapier" ZRK which initially was intended for use only at the corps level.

Corps weapons, according to the views of commands of the United States and other NATO countries, are intended for the creation of an all-weather zonal

AD system, primarily at low and medium altitudes. The U.S. army corps may be reinforced by an air defense artillery group consisting of three or four "Hawk" battalions and one "Chaparral/Vulcan" battalion. The artillery division of the British corps has two "Rapier" air defense missile regiments while the Belgian corps has an air defense artillery group of two "Hawk" battalions and an antiaircraft battalion. As a rule, the army corps of the FRG as well as in some other countries where the "Hawk" and "Nike-Hercules" air defense missile units are part of the Air Force has only an antiaircraft artillery unit. In this case, the covering of the army corps is also accomplished by one or two "Hawk" battalions from the national Air Force.

The "Hawk" air defense battalions which are attached to the corps or support it (from the Air Force) are used to create a continuous zone of cover for the corps troops and objectives. As a rule, one "Hawk" battalion is deployed in the zone of action of each first-echelon division with the mission of reinforcing the division air defense, destroying the aerial enemy on the approaches to the troops being covered at altitudes beyond the reach of division weapons. At night and under difficult weather conditions the "Hawk" battalion actually accomplishes the mission of division air defense independently, without the participation of division antiaircraft weapons.

The second important mission of the "Hawk" air defense battalions is to cover the "Lance" guided missile battalion, large units of the second echelon (reserve), control posts, and other important corps installations.

The air defense of the army corps is organized, as a rule, on the principle of the AD area (zonal system) whose essence is covering the troops and objectives from enemy air strikes from all of his possible directions of operation. This is attained by arranging the batteries of the "Hawk" air defense battalions in several lines at mutual distances which ensure covering their killing zones. The American regulations note that the zonal air defense is not uniform. It must envision the reinforcement of cover on approaches to the most important objectives and on the most probable directions of an enemy air raid.

The first line of "Hawk" batteries is deployed at a distance from the FEBA [forward edge of the battle area] which excludes their destruction by field artillery: up to 15 km for "Hawk" self-propelled ZRK's and up to 30 km for towed "Hawk" ZRK's. A second and, sometimes, even a third line of "Hawk" batteries is deployed at a distance of 15-40 km from the preceding line. The intervals between batteries in the first line fluctuate between 10-30 km, and in the second and subsequent lines--30-40 km.

As reported in the foreign press, "Hawk" air defense battalions which are part of the NATO countries' ground and air forces are deployed on a line which is 30-40 km from the eastern borders of the FRG and other NATO countries. Comprising the first air defense missile position for the combined NATO AD system, at the same time they are the main grouping of corps air defense weapons of the NATO armies with their initiation of aggressive combat operations against the Warsaw Pact countries.

The statements of individual western specialists stress that with an insufficient number of "Hawk" ZRK's (which is typical of the army corps of several NATO countries) the covering of only the most important objectives is organized and only from the main probable directions of enemy operations.

The next important element is the AD system which is created in the operational formation (field army or army group) which is reinforced by an air defense artillery large unit or several units ("Nike-Hercules" and "Hawk" ZRK's), several "Chaparral/Vulcan" mixed battalions, and electronic-countermeasure (ECM) battalions. In the armies of Belgium, the Netherlands, and several other NATO countries missions for covering troops and objectives located in the rear area of the operational formation are assigned to the air defense missile units which are part of the Air Force.

In the rear area of the operational formation, "Nike-Hercules" air defense battalions form a continuous AD zone at medium and high (up to 30 km) altitudes for the entire depth of the zone of combat operations with its extension to the approaches to the troops in the enemy's direction and to the flanks. The amount of extension of the killing zone varies from 30-40 to 80-100 km depending on altitude.

Existing American regulations recommend arranging the "Nike-Hercules" batteries in approximately a checkerboard order at mutual distances of 50-60 km to create a continuous killing zone. The first line of "Nike-Hercules" batteries is deployed 40-60 km from the front line and the next two or three lines, as a rule, at a distance of 40-60 km from each other. The great range of destruction of the "Nike-Hercules" ZRK (up to 160 km) permits concentrating the main efforts on covering both individual objectives as well as directions with the relative uniform distribution of the batteries through the maneuver of fire. Thus, the "Nike-Hercules" air defense battalions supplement the AD systems of divisions and corps, creating a zone for killing the aerial enemy at great ranges and altitudes which are unattainable for division and corps air defense weapons. Furthermore, they create a killing zone above important objectives having operational significance: nuclear-weapons units, large units of the combined-arms reserve (second echelon), and organs for the control and supply of troops. Airfields of a considerable part of tactical and army aviation fall into their zone of cover in addition to the ground troops.

The "Hawk" battalions which are left under the orders of the operational formation are also used to create the zonal air defense of such important objectives as nuclear-weapons units, large units of the combined-arms reserve or the second echelon, and organs for the control and supply of the troops. The deployment density of the "Hawk" air defense batteries in the rear area of the operational formation is considerable less than in the corps rear area. Therefore, some of the objectives are covered by the objective air defense system rather than by the zonal system.

Air defense artillery battalions and mixed "Chaparral/Vulcan" battalions are used for the direct objective covering of nuclear-weapons units and main control posts.

The NATO military leadership attaches great significance to neutralizing the aerial enemy's airborne electronic equipment. The employment of special ECM subunits is envisaged for this purpose. Thus, according to the views of American specialists, an ECM company can be attached to an air defense artillery group.

At present, air defense complexes are considered to be the basic AD means of the ground forces in a theater of operations. AD fighter aviation supplements the operations of the air defense weapons, as a rule covering the ground forces by extending their zones of combat operations beyond the limits of the air defense weapons' killing zones. The main forces of AD fighter aviation in a theater of operations are disposed at airfields 150-200 km from the front line. In the opinion of the NATO countries' military specialists, such deployment ensures covering the AD aircraft from air strikes by the "Nike-Hercules" and "Hawk" air defense complexes, at the same time permitting the extension of the AD fighters' zones of combat operations beyond the limits of air defense weapons' killing zones to the front, to the flanks, and to the rear.

As indicated by the foreign military press, the NATO command is devoting considerable attention to the deployment of effective air defense weapons in theaters of operations. According to the views of western strategists, further improvement of the AD system of NATO ground forces will follow the path of equipping the bloc's armed forces with new ZRK's having long and medium range, all-weather and highly mobile short-range air defense missile and artillery complexes, the adoption of new airplanes of the F-15A and F-16A types in the inventory to accomplish the mission of winning air superiority, the introduction of new automated systems to control AD weapons, and the development of methods for their combat employment under various conditions and situations.



6367
CSO: 1801

COMMENTS ON DEFENSE IN A U.S. MOTORIZED INFANTRY BATTALION

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 pp 38-41

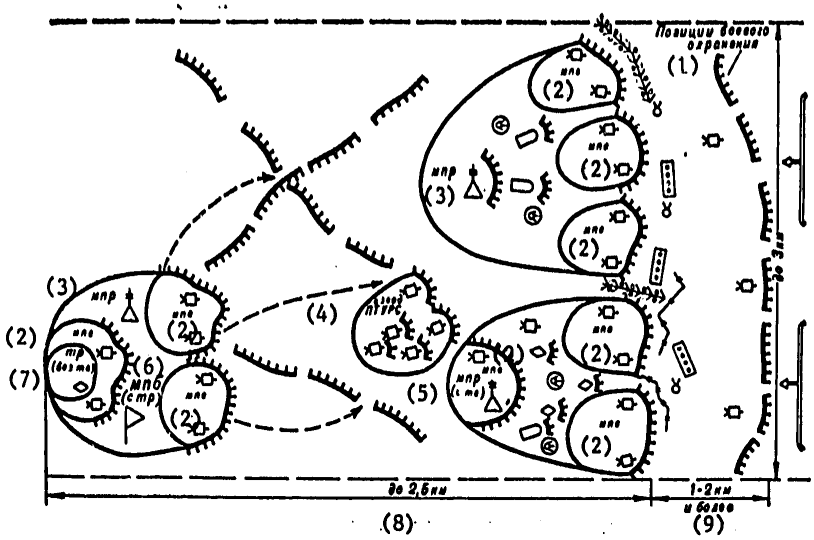
[Article by Col M. Borisov: "U.S. Army Motorized Infantry (Infantry) Battalion in the Defense"]

[Text] Attaching primary significance to the further improvement of tactics in active offensive operations by ground forces in a theater of operations, the military leadership of the United States is also working out problems in the organization of the defense of small units, units, and large units. In particular, U.S. Army regulations note that the success of the defense as a whole is greatly dependent on its correct organization at the lowest element--the battalion.

As stressed by the American military press, the motorized infantry (infantry) battalion conducts defensive operations as part of one of the brigades in a mechanized (infantry, armored) division, being in its first or second echelon. In individual cases, it acts independently, covering the flanks or gaps in the division combat formation and operating as part of the covering and security force in the security zone.

For the accomplishment of specific missions in the defense, the brigade commander may create battalion tactical groups based on the battalion, thanks to which the greatest effectiveness is attained in employing each of the subunit's weapons. In the opinion of the American command, battalion tactical groups should be balanced in their composition so that flexibility in their combat employment on various terrain is ensured. Thus, when conducting defensive operations on terrain which is favorable for tank operations and their conduct of fire at maximum ranges, battalion tactical groups are created with the predominance of tanks in them. And conversely, on difficult terrain with a limited view as well as in populated places, preference is given to the motorized infantry. On the battalion commander's decision, company tactical groups may be created in the battalion tactical group.

The reserve battalion tactical group (brigade second echelon) is usually used to block the enemy who has made a penetration, to reinforce first-echelon battalion tactical groups, for the conduct of special counterattacks, and to cover an open flank.




Combat Formation of a Reinforced Motorized Rifle Battalion in the Defense (Variant)

Key:

1. Combat outpost position
2. Motorized infantry platoon
3. Motorized infantry company
4. Antitank guided missile platoon
5. Motorized infantry company with tank platoon
6. Motorized infantry battalion (with tank company)
7. Tank company (minus tank platoon)
8. Up to 2.5 km
9. 1-2 km or more

In the position defense, the combat formation of the battalion tactical group can be organized in one or two echelons. The company tactical group, which is part of the second echelon (reserve), is disposed on a tactically advantageous position or terrain sector. The battalion mortar subunits are located close to it, as a rule.

The tank subunits which are detailed to the battalion tactical group are usually employed to conduct special counterattacks and to engage enemy tanks which have broken into the depth of the defense. Sometimes, the tanks may operate together with company tactical groups of the first echelon to repel tank attacks in front of the battalion's FEBA [forward edge of the battle area].

The foreign press notes that, being in the brigade first echelon, the battalion defends an area up to 3 km frontally and up to 2.5 km in depth. Company strong points which have received engineer improvements and prepared for the conduct of a perimeter defense comprise the basis of the battalion defense area.

Improvement of the area will depend on the availability of time and engineering equipment. The primary strong points, cover for personnel, and control posts are prepared first. The system of strong points is organized in such a way as to force the enemy to attack in a direction which is advantageous for the defender (see figure).

The main element of the defense is the fire system which is organized so as to create the maximum fire density on probable directions of enemy attack with organic weapons. Envisioned simultaneously is the creation of a zone of continuous, barrage, and concentrated fire as well as the use of the fire of armored personnel carriers (69 vehicles in the motorized infantry battalion) which are under cover or on prepared positions.

One of the basic requirements imposed on the defense is the ability to repel mass enemy tank attacks to prevent their breakthrough into the depth of the company strong points. To accomplish antitank defense missions, the battalion has rather effective organic antitank weapons. They include the "TOW" ATGM [antitank guided missile] (18 launchers) and the "Dragon" ATGM (27 launchers). ATGM subunits are disposed under natural cover or in field fortifications, and their firing positions are improved in such a way as to destroy tanks at the distant approaches. In addition to supporting counterattacks to destroy the enemy who has made a penetration, the tank subunits which are attached to reinforce the battalion are also assigned missions to engage tanks. In addition, all battalion personnel are trained to combat tanks, and it is recommended that well-trained groups armed with various antitank weapons be created in its companies.

The battalion's air defense is organized within the division's overall air defense system, and the close-in cover of the main elements of the battalion's combat formation--by "Red Eye" ZRK [antiaircraft missile complex] sections (five complexes).

American military specialists believe that the survivability of the battalion defense can be attained through the maximum use of advantageous terrain conditions, good engineer improvements of the combat positions, and cover for personnel and armament, and also thanks to careful camouflage.

Primary and alternate positions are prepared for the battalion's weapons, and shelters are prepared to provide cover for the personnel against weapons of mass destruction, air strikes, and artillery fire.

It is believed that the most important means to increase the battalion's combat power in the defense are obstacles which force the attacking enemy to deploy prematurely and reduce the rate of his attack. Engineer obstacles and the fire system of the battalion strong point should supplement one another.

Minefields and wire entanglements are installed in front of the FEBA and in the gaps between strong points, obstructions and antitank ditches are constructed, and bridges and sections of the road are blown. Switch, blocking, and dummy positions are created in the depth of the defense, and minefields on tank

avenues of approach. It is considered expedient to construct obstacles along and across probable enemy directions of attack 200-500 meters from one another and at a distance of 100-200 meters from the limit of the battalion weapons' effective range of fire. As a rule, it is recommended that minefields of the mixed type be laid: antitank mines reinforced with antipersonnel (fragmentation and blast) and sometimes chemical and napalm mines. Such a mixed minefield may number about 1,000 antitank and up to 4,000 special mines.

Concealed routes which should provide the dependable cover of the displacing subunits from enemy observation and fire are selected and prepared ahead of time to execute the maneuver of the battalion's men and equipment in the course of a defensive battle. In addition to the battalion personnel, combat engineer subunits are used to accomplish the most laborious engineer work and build the obstacles.

According to the views of the American command, the conduct of defensive battle is characterized in the following manner. In the absence of direct contact with the enemy, the field artillery in direct support of the battalion forces the enemy to deploy on the distant approaches to the defense by fire. Tactical air launches strikes against the enemy columns which are moving up and helicopter gunships which are operating in the battalion zone of defense destroy his tanks.

As the attacking units and subunits approach, defensive battle is initiated with them by the battalion combat outposts which, with the active support of the artillery and mortars, try to prevent the enemy from conducting reconnaissance, mislead the enemy concerning the outline of the battalion's FEBA and to force him to deploy to organize its breakthrough.

After accomplishment of the assigned mission, the combat outpost withdraws to the dispositions of the battalion combat formation. When the enemy reaches the FEBA, fire is intensified by means of all battalion weapons. Tanks and ATGM's located in the first-echelon company strong points open fire on the enemy tanks which are deploying for the attack.

In case the enemy succeeds in penetrating the defense, he is counterattacked by forces of the battalion second echelon (reserve). With an unsuccessful outcome of the counterattack, the battalion's subunits occupy switch and blocking positions and, holding them firmly, provide conditions for the conduct of a counterattack by forces of the brigade or division second echelon (reserve).

The battalion's defensive battle is supported by field artillery fire as well as by strikes by tactical air and helicopter gunships, for the accomplishment of which representatives from the field artillery group and tactical air control group may be detailed to the battalion.

The motorized infantry (infantry) battalion can also conduct delaying operations. The essence of these operations consists of the successive holding

of intermediate defensive positions to force the attacking enemy to deploy into combat formation repeatedly for the breakthrough of these positions and, thereby, to reduce the rates of his advance. Judging from reports in the foreign press, the battalion will conduct delaying operations most often in the defense of the security zone, as part of the covering force, and in the depth of the defense after losing the main defensive line. As a rule, the battalion will receive a wider zone when conducting delaying actions.



6367
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WESTERN EFFORTS TO IMPROVE TANK MOBILITY DESCRIBED

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 pp 41-48

[Article by Engr-Col Ye. Viktorov: "Ways for Increasing Tank Mobility"]

[Excerpts] High mobility, along with fire power and dependable armor, is presently viewed by foreign military specialists as one of the most important characteristics in the combat effectiveness of a tank. This contributes to a substantial reduction in tank vulnerability and provides an opportunity to impose combat on the enemy in surprise and under conditions disadvantageous for it. Abroad it is felt that tank mobility must be divided into operational and tactical.

By operational mobility one understands the possibility of rapidly concentrating a large number of tanks in a designated area for the purpose of their subsequent use in an operation. It is felt that this depends upon the average speed and range of the tank over roads, the dependability of its motor, transmission and running gear, the convenience of the crew's work, as well as upon the weight and size of the tank which determine its ability to be transported by various types of transport.

Tactical mobility includes the capacity of the tank (under any geographic and weather conditions) to travel rapidly on the battlefield and cross natural and manmade obstacles in the combat area. In addition to mobility during straight-ahead travel over solid ground, great significance is given to maneuverability of the tank in skirting obstacles and avoiding enemy fire, as well as cross-country capacity over swampy, sandy and other terrains with ground having a poor bearing base.

The speed, maneuverability and cross-country capacity, has the basic indicators of operational and tactical tank mobility, depend mainly upon its specific capacity and engine acceleration, the performance of the transmission and control system, the braking qualities, the running gear and the amount of clearance.

In developing the engines for the new tanks of the NATO countries, basic attention has been given to increasing their power-to-size ratio, as this, as has been pointed out by foreign specialists, helps to maintain the combat weight and dimensions of the tank within the established limits, and its mobility is dependent upon this. An increase in the power-to-size ratio of diesel engines is achieved primarily by their supercharging by injecting air under an increased pressure and by increasing the crankshaft speed. These measures shorten the service life of the engine. Nevertheless West German specialists feel that the diesel engines of the MB-873 series which have a power of up to 200 horsepower per cylinder are most suited for the tanks being developed in the FRG.

Testing has also been carried out on another version of a 12-cylinder diesel engine with increased-volume cylinders. This has made it possible to increase the engine power (the rated power equaled 1,800 horsepower and the brief tolerable power reached 2,000 horsepower) and also improve such performance as torque and acceleration. Such an engine has been proposed for use on the West German experimental model of the 38-ton turretless Leopard-3 tank which is being developed, and the power-to-weight ratio should be around 50 horsepower per ton.

Many foreign specialists consider that the power of the diesel engines is already approaching a limit, and on tanks they are endeavoring to use gas turbine engines which are characterized by a high size-to-power ratio. Thus, on the experimental model of the XM1 tank developed by the American Chrysler firm, they have used an AGT-1500 gas turbine engine with a power of 1,500 horsepower.[1] It weighs around 1,000 kg, and in volume is almost 2-fold less than the equal-powered experimental model of the diesel engine which is used on the XM1 tank of General Motors. The AGT-1500 engine is 1,615 mm long, 1,015 mm wide and 710 mm tall. Its compactness is achieved basically by using a new ring heat exchanger which is located around the reduction gear and the exhaust diffuser of the turbine, and because the overall dimensions of the engine were not increased. The presence of an adjustable turbine nozzle ring made it possible to improve its acceleration and economy.

The foreign press has pointed out that recently, in developing the basic combat tanks abroad, particular attention has been given to high acceleration for the possibility of using this to escape from enemy fire. It is felt that the acceleration of the tank will play an even greater role than speed.

The maneuverability and cross-country capability of a tank also depend upon the transmission. In addition to the possibility of transmitting high power, it should also be able through the entire speed range of having good controllability and braking qualities, as well as minimal overall dimensions

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[1]For a drawing see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 11, 1978, p 31. Editors.

and weight. In a majority of foreign tanks the transmission is combined with the engine and its servicing system into a single block which is usually mounted in the rear of the tank on three or four suspension mounts.

Tank transmissions are divided into hydromechanical and mechanical.

The use of a torque converter in tank transmissions combined with a planetary gear box (PGB), has facilitated the development of an automatic transmission system. Such a system in the form of an electrohydraulic device which provides preselection of the required gear, is found on the Leopard-2 tank in which they have employed the HSWL-354/3 hydromechanical reversible transmission produced by the Renk firm[2] with four speeds forward and two reverse. The PGB consists of three planetary sets with disc brakes on the first, second and third speeds and a disc clutch on the fourth speed.

The Allison X-1100-3A automatic transmission for the XM1 tank has a four-speed PGB with an interlockable torque converter. Its PGB consists of five clutches and three planetary sets which provide four speeds forward and two reverse. This transmission operates under automatic conditions in the three higher speeds and the shifting of them is done by the electrohydraulic drive. This is operated by the driver using a T-shaped lever. The electric drive for fuel supply is also operated by this.

However, full automation of the shifting process, in the opinion of Western military specialists, in certain instances is disadvantageous. Thus, in driving over very rugged terrain, the use of only automatic shifting can lead to the frequent use of low gears, as a consequence of which the average speed is reduced. It is felt that the driver should also be able to select the driving conditions (particularly on descents). For this reason in both the West German and American transmissions, in the PGB provision is made for manual shifting but with the automatic interlocking of the torque converter. In this instance the transmission is semiautomatic.

In the opinion of the foreign specialists, the PGB with a torque converter and an automatic shifting system is more complicated, expensive and poorer in terms of its absolute volume and weight indicators than synchronized shaft gear boxes. Moreover, the possibilities of repairing them under field conditions are limited. However it is assumed that the ability to be used on high-powered engines and their advantages in ensuring the mobility performance of the tanks provide grounds to consider such transmissions as the most promising for further developments.

The transmission control system, in the opinion of foreign military specialists, should ensure the smooth starting up of the tank, the shifting of the forward and reverse gears, the control of the turning mechanism and braking

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[2]For the drawing see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 11, 1978, p 32. Editors.

system. The performance of the control systems influences the controllability and traction indicators, while the type of controls and the effort required to operate them influence the degree of driver fatigue. A mechanical transmission control system is employed on the AMX-30 tank, and a mechanical hydraulic one on the M60A1. The most effective is considered to be the mechanical electrohydraulic one which is used on the Leopard-1 and 2, the Chieftain and the XM1 tanks.

The turning mechanisms of foreign tanks usually employ clutch elements (AMX-30, the Chieftain, the M60A1 and the Leopard-1) or with hydraulic transmissions (the Leopard-2, XM1, STRV-103B and Pz68). However, according to statements in the foreign press, the turning mechanisms of the AMX-30, Chieftain and M60A1 tanks do not provide stable straight-ahead movement of the machines with varying resistance on the tracks due to the differential coupling of the drive wheels and the absence of stabilizing clutch elements. As is felt this is their shortcoming which reduces the average speed. This has been eliminated in the turning mechanisms of the remaining basic tanks by using planetary sets and hydraulic transmissions.

In the opinion of foreign military specialists, a common shortcoming of the planetary turning mechanisms (PTM) is the high losses in friction and the impossibility of providing a uniform dependence between the position of the controls and the turning radius. Even when the PTM employs clutches operating in oil and which have a rather stable coefficient of friction, in determining the position of the controls, the turning radius of the vehicle can vary broadly. For this reason the driver is forced to operate the controls periodically, and this leads to an abrupt change in the angular velocity and turning angle of the vehicle. As a consequence of this tank controllability is worsened and speed is lost in passing through curvalinear legs of a route.

The use of a hydraulic transmission which makes it possible to change the turning radius smoothly and to obtain a uniform dependence between the control wheel and the turning radius (as in wheeled vehicles) eliminates the chief shortcoming of turning mechanisms employing clutch elements. It is considered that the use of a hydraulic transmission facilitates tank control, and helps to reduce driver fatigue and speed losses in curvalinear areas. As a result the average speed is increased.

In the views of foreign specialists, the basic evaluation indicators for tank braking qualities are braking distance and deceleration. Until quite recently all the basic tanks of the NATO countries had mechanical had stopping brakes which as a whole provided the required deceleration performance or emergency braking. But the absence of power braking and the difficulties of ensuring the workability of mechanical brakes with frequent or extended braking, for example, with the movement of a tank down slopes, as well as the increase in the power-to-weight ratio and the increase in the average speeds led to an increase in the intensity of brake use. The turbosupercharging also somewhat reduced the braking properties of the engines. For

this reason for improving braking performance, a combined type of brake is used with a hydrodynamic delayer (a hydraulic clutch on the output shaft of the transmission). For the Leopard-2 and M60A1 tanks which are equipped with them, braking distance at a speed of 40 km per hour is 15 and 22 minutes, respectively.

The suspension and running gear abroad are viewed as organs which to a significant degree determine the possibility of using the high power-to-weight ratio with the movement of tanks over rugged terrain. It is felt that the suspension should provide sufficiently high dynamic operation of the road wheels, while the tracks must have high ground-gripping properties and cause minimum power losses in spinning.

Modern foreign tanks employ an individual torsion and hydropneumatic[3] suspensions (the Japanese 74 tank and the Swedish STRV-103B). In selecting the type of suspension for the XM1 American tank being developed, attention was given to their operational performance, weight, cost, ease of maintenance and repair, vulnerability under combat conditions, and other factors. According to statements in the foreign press, a comparison of the weight and cost characteristics affirmed that for these indicators the torsion and hydropheumatic suspensions are approximately equal. However, considering the technological efficiency, the requirements for maintenance and repairs, and low vulnerability in combat, preference was given to the torsion suspension developed by Chrysler. The XM1 tank uses seven doubled road wheels per side with torsion bars from high-grade steel and improved blade-type shock absorbers mounted on the first, second and seventh wheels. American specialists feel that in using seven wheels (instead of six as on the M60A1), the service of the running gear elements will be increased by reducing the load on them. The road wheels of the XM1 tank 635 mm in diameter have been manufactured from an aluminum alloy. The power stroke of the wheel is 380 mm.

The running gear of the Leopard-2 tank also has seven road wheels (700 mm in diameter) and a torsion suspension. Disc friction shock absorbers are mounted on the first, second, third, sixth and seventh wheels, and these provide a rather smooth ride of the tank.

In the opinion of foreign military specialists, the effective use of tanks in operations in theaters of action to a significant degree will depend upon the durability of the tracks and their dynamic characteristics. Here they consider that in terms of cross-country capability the future tanks will obviously not surpass the existing ones (see the table) [not translated]. However, the use of long-life tracks should lead to a significant rise in tank mobility.

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[3]For the drawing see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 11, 1978, p 33. Editors.

For this purpose for the XM-1 tank the United States has developed the T-142 track with a rubber-metal link for a track 635 mm wide. It is designed to operate up to 8,000 km. Its design makes it possible to use removable rubber cushions for pads which prevent wear in traveling over hard surfaced roads (concrete and asphalt). In traveling over snow or loose ground, the pads can be removed, and on the bottom of the tracks there are steel grips which significantly improve the traction qualities of the track.

Testing has been carried out on the Leopard-2 tank for a rubber-metal track made by the Western German Diehl firm and this provides a life up to 6,500 km over roads. A particular feature here is the possibility of installing special snowshoes which are mounted on each eighth link.

Judging from the statements in the foreign press, the NATO countries, and above all the United States and the FRG, without still having completed the development of the future XM1 and Leopard-2 tanks which will be the basic ones in their armed forces until the end of the 1990's, have already begun to develop tanks which have higher speeds, maneuverability and cross-country capacity. These characteristics, in the opinion of foreign military specialists, should in the future help to significantly reduce the vulnerability of tanks in combat.



10272
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COMMENTS ON EFFECTS OF TECHNOLOGY ON FIGHTER-INTERCEPTOR TACTICS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb, No 3, Mar 79 signed to press 5 Feb 79, 7 Mar 79 pp 53-60, 43-49

[Article by Col V. Kirilov, candidate of military science: "The Modern Fighter in Air Combat"]*

[No 2, Feb 79, pp 53-60]

[Text] The United States and the other countries of the aggressive NATO bloc are presently devoting increased attention to studying the future development of fighter aircraft and their capabilities to conduct modern air combat. The current nature of this problem is linked to generalizing the experience of local conflicts and to the delivery of more modern aircraft into the air force inventory.

Scientists, designers and experienced flying personnel are conducting these studies. Moreover, achievements in the field of cybernetics are being used on a widespread basis; they make it possible to program fighter operations during certain phases of combat and to create mathematic models to obtain the required characteristics and to use them as a basis for scientific forecasting. The flight experiment (full-scale modeling) occupies an important place in this; during the experiment, theoretical conclusions are tested and tactics suitable for a given type of aircraft are formulated. Analog-aircraft and specially trained crews--which simulate enemy actions--take part in the experiments.

When modeling modern air combat, foreign military specialists definitely take into account the experience of past combat operations. The evaluation is conducted according to the following basic criteria: speed, altitude, time, range and aspect for employing aircraft weapons systems and also the number of aircraft participating.

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* This article reviews foreign specialists' views on the effect of equipment and weapons on the tactics for waging air combat.

During closure or disengagement, flight speed seldom exceeded Mach 1.5 although this did not approach the capabilities of supersonic aircraft which are able to develop speeds in excess of Mach 2.2. After the adversaries acquired each other, maneuvering began in the Mach 0.9-1.5 range and ended close to the limits for stall speed. While trying to gain an advantageous position relative to the enemy, pilots tried to stay in the high subsonic flight envelope (Mach 0.8 $\pm$ .1) which guaranteed a maximum rate of turn.

During fluid combat, flight altitude was limited to 1,500-7,000 meters. At altitudes above and below these limits, only single attacks were conducted with the fighter immediately escaping from the target. The fighters did not fight in the stratosphere (above 12,000 m); therefore, their high altitude characteristics also were not fully used.

Due to the energy used and not being able to replenish it after accomplishing unexpected (accelerated) turns, an overall trend of reducing speed and altitude was observed during fluid combat.

Considering the possible build up in effort, the time of combat--which broke down into individual fights after initial engagement--was 2-7 minutes. Combat usually ended due to the enemy's defeat, disruption of formation integrity, breaking contact with the target or a shortage of fuel.

The range and aspect for weapons employment were characterized by small values, that is, combat was conducted at short range limited by the visual contact between adversaries and a target kill was only possible during a real hemisphere attack.

AI assisted launch (prior to acquiring the target visually) of medium range missiles (Sparrow) was complicated by the unreliable identification system and the resulting danger of fratricide. Short range missiles (Sidewinder) were greatly limited by G-load (approximately 2.3) which made it almost impossible to employ them during a high-G maneuver. Only weapons which were not effected by large G-loads were effective at short ranges (600-1,100 m), i.e., guns which were installed on American fighters only toward the end of the war in Vietnam.

Based on the experience of local conflicts, foreign specialists concluded that the weapons systems in being were not suited for the nature of current air combat--formation and fluid.

The number of aircraft fluctuated from 1-2 dozen at the beginning of combat down to an element (or individual crews) at the end of combat. A pair of fighters was considered an "element," i.e., an inseparable fire and tactical unit. However, the integrity of

an element was frequently disrupted due to the poor field of view from the aircraft cockpit and due to their low maneuverability.

The foreign press points out that, instead of the intercepts for which the pilots and equipment were prepared, air combat was conducted according to the classical system where adversaries tried to come out on each other's tail in the actual combat situation. Neither the aircraft, the weapons systems nor the crews were prepared for such a turn in events. Partial improvements and modifications did not lead to any significant changes in tactics. Therefore, even during the war in Vietnam, requirements began to be developed in the US for a new generation of air superiority fighters. Later, programs for building specific models of these aircraft were adopted.

As a result of the work conducted, the new F-14 and F-15 entered the US Air Force inventory; the following characteristics were changed for them: maneuverability in the high subsonic flight envelope was significantly improved--in the Mach 0.8 $\pm$ 0.1 range of speeds where the maximum rate of turn and the minimum climb time are attained; enemy acquisition range for internal radars was increased and IFF systems were improved; the capabilities of weapons systems were expanded--systems which ensure an enemy kill both head-on and in dogfighting; aircraft handling was improved at the edges of the flight envelope--this protects aircraft against early departure into a spin during unexpected maneuvers and increases the air combat envelope in altitude and speed.

In the opinion of foreign specialists, all of this places the F-14 and F-15 in the catagory of modern fighters and it should also be reflected in the methods for their combat employment and it should introduce new elements into air combat tactics.

A Formula for Modern Air Combat: Many factors have an unequal effect on the success of air combat. Steadfast attempts have recently been made abroad to determine the most important of these factors and to rank them in the order of their importance. At first, the simplified formula "pilot--aircraft--weapons--electronics" appeared; it reflected the relationship in an overall form and it gave preference to the experience and level of training of flying personnel. Then, a more detailed formula of "aircraft capabilities for air combat" appeared in the West German magazine TRUPPENPRAXIS. It is not a mathematical expression which makes it possible to calculate some sort of quantitative data or numerical ratios. Certain foreign military specialists believe that this formula makes it possible to provide a qualitative evaluation of the effect of individual factors on achieving success in combat by making use of the advantages of equipment and weapons

systems. Each value, taken independently or in combination with another, is related to combat tactics between specific aircraft. The so-called logic of combat is formulated on the basis of a comparison between their characteristics.

The formula looks like this: $L \sim \frac{P \cdot S^3 \cdot SEP \cdot T \cdot M \cdot Bd \cdot Si \cdot N \cdot Wa^3 \cdot B^4}{G^3 \cdot Cr}$

However, to understand the following discussion of it, it can be presented in the following form:

$$L \sim \frac{\left(\frac{P}{G}\right) \cdot SEP \cdot T \cdot M \cdot Bd \cdot Si \cdot N \cdot Wa^3 \cdot B^4}{\left(\frac{G}{S}\right)^3 \cdot Cr}$$

where: L--"aircraft capability for air combat";
P--engine thrust;
G--airborne weight;
S--wing area;
SEP--surplus energy or specific excess power;
T--deceleration;
M--effect of high-lift devices;
Bd--aircraft controllability;
Si--aircraft stability;
N--individual defense (invincibility);
Wa--warning equipment capabilities;
B--weapons systems characteristics;
Cr--aircraft dimensions;
$\frac{P}{G}$--aircraft thrust-to-weight ratio;
$\frac{G}{S}$--wing loading.

The formula can also contain a certain constant value which reflects the effect of factors like weather conditions, the advantage of acquiring the enemy first, over whose territory the fight takes place, etc.

These characteristics are reviewed below in the order of their importance (some of them are combined into overall factors and others are examined independently).

The Weapons Factor: Weapons are raised to the fourth power in the formula; this emphasizes their special importance in modern air combat. Foreign specialists believe that the new weapons with which modern fighters are equipped make it possible for them to conduct combat at long and medium ranges in addition to dogfighting. This leads to a revision of tactical principles and it makes significant changes to the methods for fighters to accomplish their operational missions.

Long range weapons. In studying the characteristics of the Phoenix missile and the AWG-9 weapons control system (maximum target acquisition range of 280 km, automatic target tracking begins at 180-190 km, missiles are launched over 100 km away, six missiles can be launched simultaneously), foreign specialists concluded that the employment of this type of weapons system has actually transformed combat into target detection and missile launch. Combat will consist of two phases--search and attack. The traditional phases like closure, dogfighting and disengagement will disappear.

According to the magazine AVIATION AND MARINE, a fighter equipped with long range missiles is able to achieve an enemy kill before the latter reaches its own weapons employment envelope. In addition, it is possible to oppose a numerically superior enemy by launching several missiles against several targets. However, as a stand-off delivery platform for such weapons, the aircraft "becomes heavier" and is not able to conduct a successful dogfight. American specialists are trying to develop tactics for F-14 fighter units by taking these ideas into account.

Specifically, the foreign press has reported that the F-14 has launched Phoenix missiles at altitudes between 120-16,000 m, speeds between the minimum up to Mach 1.6 and with G-loads of 1-6. In one of these launches, six missiles were almost launched simultaneously; four of them hit the targets at ranges greater than 80 km, the fifth did not reach the impact point due to an equipment malfunction and the sixth missed due to a high-G target maneuver.

Although long range combat is still not being discussed as something which has been developed and tested, there is no doubt among foreign specialists about the long-term prospects for it.

Medium range weapons (like the Sparrow missile) determine the fighter's capability for air combat at medium ranges (5-50 km). This combat is characterized by two basic features: by the ability to achieve an enemy kill during the closure phase, which merges with the attack phase, and also by eliminating the requirement to maneuver to the target's rear hemisphere. These weapons are usually employed against an enemy who is not being visually observed. The pilot takes his bearings in the situation from instrument readings--azimuth, range and rate of closure with the target. When the head-on range to the target is reduced to 15-20 km, there is not enough time to prepare for a missile launch at present closure rates and the pilot is forced to transition to a dogfight.

The foreign press has reported that the following minimums for a head-on attack were recorded during live missile firings of

the AIM-7F Sparrow from the F-15 fighter against remotely controlled targets: an acquisition range of 50 km, a lockon (automatic tracking) range of 37 km and missile launch at 22 km.

In analyzing the results of live missile firings and of mathematical models, American specialists have concluded that air combat using medium and long range missiles is characterized by a narrow range of diversity and a small number of possible alternatives; therefore, it can be programmed to a certain degree. In this case, target acquisition, identification and selection are the most important phases for the pilot. If launch conditions fall within the limits established, the weapons system can be employed automatically against a target in the auto-track mode. An analysis of the instrument readings is the basis for the pilot's decision. In medium and long range combat, maneuvering takes a strictly subordinate position to firing.

Short range weapons (guns and missiles like the latest modifications to the Sidewinder). When missile-armed, supersonic fighters appeared at the end of the fifties and air intercepts occupied the dominant position in tactics, guns were removed from aircraft. They have again taken their place on the new, air superiority fighters and they have given the pilot the capability to fire against maneuvering targets at short range. However, guns have a limited range and a low kill probability.

After the war in Vietnam, new weapons were built for close-in combat--missiles--which do not replace guns but only supplement them since they also have shortcomings. The limitation on minimal launch range is one of the shortcomings. The foreign press points out that it is possible to employ the AIM-9L Sidewinder for dogfighting on the F-15 and F-16 (Figure 1) [figure not reproduced] due to the removal of the limitations which the previous versions of this missile had. Specifically, the minimum launch range was reduced to 300 m (instead of 1,000 m) and the allowable G-load during launch was increased to 6 (instead of 2.3). Other characteristics of the missile were also improved. American specialists believe that all-aspect dogfighting may become a reality after the increase in the missile's operational range. The weapons employment envelopes for a dogfight are shown in Figure 2. The appearance of short-range missiles brought about a requirement to improve siting systems and methods of firing against maneuvering targets. The creation of helmet-mounted sights and the development of procedures for firing by "guestimating" are of greatest interest in this respect.

As pointed out by the foreign press, helmet-mounted sights remove the excessive workload--which appears when sighting--from the pilot and they increase the overall capabilities of the

"pilot-weapon" system. The experience of combat operations in Southeast Asia and the Middle East have shown that the conditions of modern air combat demand swift, precise and effective actions from the aircraft crew. Moreover, the communications system between the firer and the weapons system must ensure the complete utilization of the former's motor skills and his capability to perceive the situation.

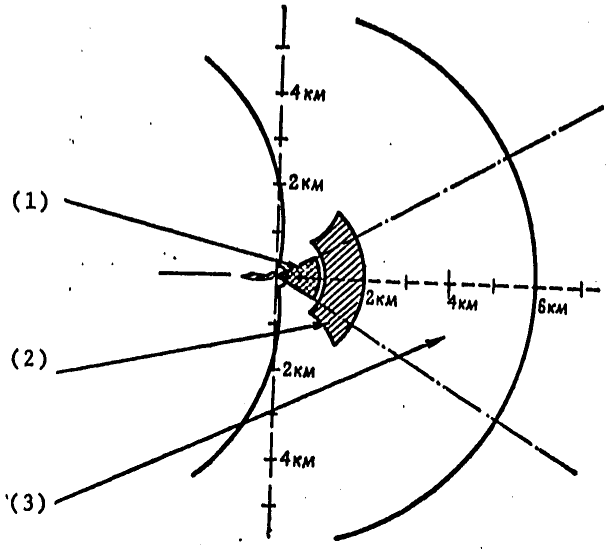


Figure 2. Weapons Employment Envelopes for Fighters During a Dog Fight (from TRUPPENPRAXIS magazine).

Key:

1. Aimed gunfire envelope.
2. Employment envelope for modern, close-in missiles.
3. Employment envelope for future all-aspect, close-in missiles.

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The creation of helmet-mounted sights is one of the promising directions in the modern developmental stage of the "pilot-weapon" system. There operational principles are as follows. Either a visor with a sight pipper or an electro-optical sensor with a crosshair is firmly mounted on the helmet. The pilot keeps the visually acquired target in the crosshair and special mechanical or electrical systems, which transmit guidance commands to the radar, television camera, missile homing head or computer, track the position of the helmet.

In the opinion of foreign specialists, the ideal process of sighting in a dogfight is guiding the weapons system on to target after the pilot has located it visually (eyeballing the target) and launching the missile along the line of sight. In this case, the sight must simultaneously perform two functions: determining the location of the line of sight and controlling the weapon.

The method of sighting by eyeballing the target (determining the position of the eye's line of sight) is attracting a great deal of attention among foreign scientists. As reported by the foreign press, the possibility of using a remote occuometer [okziometr]--which estimates the direction of the line of sight according to the value for the angle of infrared rays reflected from the cornea--is being investigated to implement this method. According to AVIATION WEEK AND SPACE TECHNOLOGY, the requirement to install rather cumbersome sighting equipment on aircraft will disappear when such a method is implemented. In the opinion of foreign specialists, using the eye as a sight will significantly expand the pilot's capability to fire in a dogfight.

Firing by "guestimating" belongs to the new methods for weapons employment. The foreign press points out that the air combat experience acquired during local conflicts has shown that the rate of change in the line of sight during a target attack frequently exceeded 30 degrees per second while the lead angle exceeded the limits of the sight's optical system and it was impossible to fire. In addition, small mistakes in target tracking caused relatively large mistakes in computations. Due to the difficulty in tracking a maneuvering target, some American pilots preferred using the iron sight and aiming by eye.

In the opinion of foreign specialists, the method of firing by "guestimating" is based on a more efficient division of responsibilities between the pilot and the computer. They believe that the pilot has a better ability to predict target movement based on his knowledge of the logic of combat and his analysis of the current situation. Therefore, it is his duty to determine the most probable direction for target movement and the lead angle. The computer calculates the flight trajectory for the round (missile) relative to the attacking aircraft. The estimated "track" is painted on the sight display; by using it, the pilot must carry out a maneuver to place the "track" on target. If there is a range finder, the distance is automatically computed. In principle, nothing new is introduced into the attacker's maneuver: after "guestimating" the lead angle, the pilot must turn the aircraft to that angle and keep the range pipper on the target.

The development of sighting equipment to fire by "guestimating" is undergoing testing.

Overall, the weapons factor as applied to combat methods determines the fighter's capability to destroy a target (both maneuvering and nonmaneuvering) at different ranges and different aspects. To increase their operational capability, aircraft are usually armed with missiles with different ranges when they are accomplishing the mission of protecting ground based or maritime objectives. Specifically, the short-range Sidewinder missiles are up-loaded on the F-14 along with the Phoenix missiles. When escorting aviation attack forces, four medium range Sparrows and four short range Sidewinders are the weapons load.

When accomplishing the air superiority mission, the F-15 (see colored insert) [insert not reproduced] has the following weapons loads: 2 Sparrows and 4 Sidewinders; 4 Sparrows and 2 Sidewinders; 4 missiles of both types.

The Factor of Timely Target Acquisition: In the formula cited above, this factor is only represented by the figure for warning equipment capabilities. The fact that it is raised to a power of three attests to the importance of the pilot's obtaining timely information on the danger of an attack. In analyzing the results of air combat, American specialists concluded that the pilot will only have an initial tactical advantage if he acquires the enemy in a timely manner.

In the classical intercept system, the enemy's initial position was determined by the capabilities of ground-based and internal acquisition and identification systems. The one that acquired the target first was the first to begin active operations. Only in this case can he evaluate the situation early enough, make a decision, take up an advantageous position for weapons employment and open fire--whether it is aerial combat using long or medium range missiles or a dogfight using short range missiles or guns. The foreign press points out that obtaining a warning on the enemy before he employs long range weapons is a complex problem but it is hard to count on success in modern air combat without a solution to it.

[No 3, Mar 79, pp 43-49]

The first part of this article discussed some of the basic data upon which foreign specialists base their evaluation of fighter capabilities and also the effect of weapons and timely target acquisition on air combat tactics. Data on the effect of the remaining factors are published below.

The Maneuverability Factor: This concept includes the aircraft thrust-to-weight ratio (P/G), specific wing loading (G/S) and a figure which reflects the effect of wing high-lift devices (M).

ORDNANCE magazine wrote that high, supersonic speeds and altitudes are no longer the most important fighter characteristics. After studying the experience of air combat in Vietnam, a high thrust-to-weight ratio, a low specific wing loading and the appropriate weapons systems have moved to the fore.

A high thrust-to-weight ratio--which is frequently estimated as the value for excess thrust--is especially required during the first phase and at the end of air combat, when it is necessary to climb quickly or increase speed to close with or disengage from the enemy.

In combat tactics, the amount of excess thrust is considered as a measure of the aircraft's capability to accelerate further during any section of the trajectory, including the vertical. In this case, the pilot can control his distance to the enemy, i.e., he can reduce it or increase it according to the requirements of the situation. Overall, it is believed that a higher aircraft thrust-to-weight ratio opens up the possibility of taking the offensive in air combat.

In the classical intercept system, the initial positions of the adversaries were to a significant degree dependent upon the capabilities of ground based and internal acquisition and identification systems. Closure began with target identification, and the rate of climb and aircraft acceleration--which were dependent upon the size of the excess thrust--became most important at this time. If the excess was greater than the enemy's, the aircraft could gain the altitude and speed required to carry out the attack quicker. If there was no superiority in thrust, the initiative was lost and the enemy began to dictate the terms of combat.

Wing loading is very important in dogfighting. Sustained turning speed is considered the primary characteristic of aircraft maneuverability. Foreign specialists point out the following in evaluating this parameter: approximately 85 percent of the increase in the rate of turn is attained by reducing wing loading and only 15 percent is attained by increasing the thrust-to-weight ratio. Target kill probability is more dependent upon excess thrust (Figure 1 A) and the fighter's survivability in combat is more dependent upon wing loading (Figure 1 B).

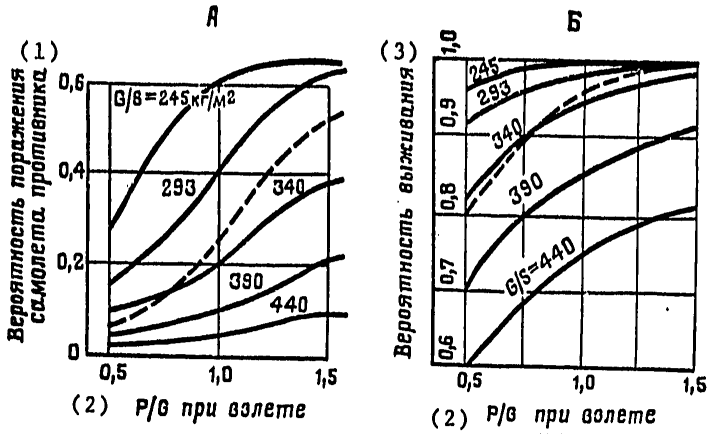


Figure 1. Graphs Showing Fighter Effectiveness in Air Combat: A. Target Kill Probability; B. Own Aircraft Probability of Surviving (enemy aircraft parameters: wing loading G/S = 340 kg/m$^2$; thrust-to-weight ratio P/G = 0.7). (From AIAA magazine)

Key:
1. Target kill probability.
2. Thrust-to-weight ratio at take off.
3. Survival probability.

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American specialists point out that pilots frequently exceed the allowable G-load for a coordinated maneuver and they reduce their forward speed when trying to turn on the enemy (or away from him) quicker. By decelerating, the rate of turn increases; its instaneous value is inversely proportional to the wing loading and it is not dependent upon the thrust-to-weight ratio.

The wing loading is raised to the second power in the formula. It is believed abroad that dogfighting has not lost its position under contemporary conditions. In this regard, FLUG REVUE magazine wrote: "As before, maneuverability which guarantees counteraction during an attack is of primary importance in air combat. Therefore, the number of turns sustained can be considered an efficient measure of the time of defensive combat, which will always be maneuverable in nature. The minimum required for counteraction is a function of the advantage in turning speed."

Wing high-lift devices. An improvement in aircraft maneuverability is also attained by installing aerodynamic devices on it which automatically change the wing load and thereby improve the aircraft's capability to quickly change the direction of flight.

An improvement in maneuverability via enhanced wing high-rise devices can be examined based on the example of the modification to the F-4 Phantom. In contrast to the F-4E which participated in the war in the Middle East, the latest version of it, the F-4F, does not have a boundary layer control system and leading-edge flaps; leading-edge slats were installed in it in place of them. This made it possible to increase lift, reduce drag at high attack angles and improve aircraft stability and handling throughout the flight envelope. The new fighter is more suitable for fluid combat. In comparison with the F-4E (Figure 2) [figure not reproduced], its time for accomplishing a sustained turn (at an altitude of 3,000 m with maximum thrust) was reduced from 19 to 14.2 seconds and its turning radius was reduced from 1.18 to 0.89 km. In modernizing the Phantom, special attention was devoted to improving maneuvering characteristics at altitudes lower than 9,000 m and at high subsonic speeds. The McDonnel Douglass Company hopes that the new version of the aircraft will meet the state-of-the-art for aircraft into the mid-80's.

The F-5E's maneuvering characteristics were also improved in the high subsonic flight envelope by improving the wing high-lift devices (in comparison with the previous versions--the F-5A, NF-5).

Formulating the logic of combat (based on a comparison of aircraft characteristics). Since the thrust-to-weight and wing loading indices are, in the opinion of foreign specialists, the primary indices for determining fighter advantages, they are used in modeling combat between specific adversaries (the effect of command, control and coordination factors relating to formation combat are not considered in this case).

The foreign press points out that the fighter with the greater kill zone for its internal weapons systems should dictate the combat tactics to its adversary. The chances for success are only reduced when the pilot is poorly trained and when he is not able to use the advantages of his aircraft. However, the experience of past wars shows that the sides usually had the same type of aircraft at their disposal: a fighter had superiority over his adversary in certain characteristics but was inferior in others. It was only possible to achieve success in combat when the pilot was able to make full use of the strong points of his aircraft and the weak points of the enemy's aircraft.

American fighter pilot training programs presently provide combat training against an "enemy" with dissimilar performance characteristics, for example, between the F-4 and the F-5E.* In this case, the pilot's actions are subordinated to a certain logic: carrying out maneuvers which are too complicated or disadvantageous for the "enemy."

In comparing aircraft characteristics, TECHNIK REVUE magazine writes that the pilot of the lighter F-5E must try to quickly transition to close-in combat and to maneuver at lower speeds than the F-4 in order to obtain an advantage in position. The F-4 is as good as the F-5E in turning speed but its turn radius is greater. Horizontal maneuvering without a loss in speed and altitude is the best tactic for the F-5E. If the "enemy" adopts this tactic, the F-5E pilot will take up an advantageous position within the short range weapons employment envelope first. In turn, due to its greater excess thrust, the F-4 has greater freedom of action in the vertical plane and it has a speed advantage in a horizontal maneuver during closure and disengagement--the pilot can impose a fight on the F-5E by controlling the distance. Its best tactic is a series of slashing attacks against the "enemy" without engaging in close-in combat. Moreover, primary emphasis is placed on surprise and using its better rate of climb to attack from behind and below. After losing the element of surprise, it is only advisable to maneuver for repeat straight-in attacks or to shift the fight to the low-altitude, high-G load envelope.

In developing requirements for the new F-15 (Figure 3) [figure not reproduced], USAF specialists pursued the task of guaranteeing it an advantage in all the parameters which have the greatest effect on aircraft capability for air combat: thrust-to-weight ratio (P/G = 1.2), wing loading (G/S = 293 kg/m$^2$) and armament for both dogfights and all-aspect intercepts.

The Energy Factor: As was already pointed out, foreign specialists include excess thrust--i.e., the size of the thrust available related to aircraft airborne weight after subtracting that part of it used to overcome drag--in the category of the most important parameters effecting combat. The specific excess power parameter (SEP)--which is the excess thrust produced by flight speed--is usually used in the foreign literature recently. The size of the SEP is a measure of the aircraft capability to obtain additional energy and, when modeling a battle, it makes it possible to show how quickly it can change altitude and speed or both together. Western experts believe that the correct use of energy and methods for accumulating it are now indicators of the fighter pilot's high level of skill and his readiness to oppose a strong enemy. Considering this innovative approach

*For more detail on this, see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 3, 1978, pp 53-60.--Ed.

to evaluation criteria, specialists in the United States and the other NATO countries are working on creating methods for managing aircraft energy and on designing instruments which indicate the level of energy and changes in it during flight.

One of these instruments was tested on the F-4. It displayed the aircraft's energy status and also the maximum values for speed and altitude at each energy level; these values helped the pilot fly the aircraft correctly when climbing to the required altitude or when accelerating to a high speed and they make it possible for him to maneuver more freely or to take timely actions to increase the aircraft's energy reserves.

The Invulnerability Factor: Foreign specialists include in this factor the aircraft's own invulnerability (N)--which is determined by the level of its armor, the effectiveness of self-defense equipment, etc.--and a value which is inversely proportional to its dimensions.

In the United States and other capitalist countries, special attention has recently been devoted to equipping aircraft with ECM equipment which operates in conjunction with the warning equipment. According to INTERAVIA magazine, the McDonnel-Douglass Company conducted tests which showed that losses of the new F-15 per 100 combat sorties could be: 12.5 aircraft without employing Electronic Warfare equipment and 5.5 when the individual protective equipment was completely installed. For the same number of sorties, F-4 losses could reach 20 and 12.5 aircraft, respectively.

Based on the experience of combat operations, exercises and tests, American specialists are working on the development of automated systems which could analyze the radar signals being received, determine their nature, the azimuth and range to the radar (which was painting the aircraft) and the degree of threat presented and communicate this to the pilot; it could also control the active jamming equipment.

The threat is countered by active jamming on a certain frequency, by dropping chaff or by releasing decoy targets. In addition, the pilot makes an avoidance maneuver after obtaining the signal on the danger of an attack. He selects the type of maneuver depending on the situation (enemy azimuth, range and vertical separation and the nature of his actions).

When new aircraft are being built, so-called passive defensive means--specifically, painting aircraft the color of the sky, clouds or ground or reducing the radar cross section by applying an absorptive or dispersing surface--are used widely.

In the opinion of foreign specialists, success in dogfighting in Vietnam and the Middle East was directly dependent upon the range for visual target detection. Therefore, they consider the capability for concealed operations as an important quality for fighters. Experiments have shown that an aircraft can remain undetected longer when it is small (as far as this is possible) in size, does not leave a smoke trail behind it from engine operations (like the F-4) and when it uses passive systems for target acquisition and weapons control.

It was pointed out that the F-15 fighter is as large as the F-4 and, therefore, it did not have any advantage in concealed operations in combat training with the latter. For example, pilots of the small F-5E had this advantage in simulated air combat with other types of fighters. As AIRCRAFT magazine wrote, the F-5E is practically invisible when airborne in the horizontal plane even at a distance of about 1.6 km, while the F-4, with afterburner engaged, is acquired by an experienced pilot at a range of 16 km. It is accepted abroad that the allowable speed during a sustained, banked turn should not exceed Mach 1.45 based on visibility conditions when the turn radius reaches 6.5 km. Exceeding these limits actually makes it impossible for the pilot to keep even a large target in view.

Foreign specialists emphasize that guns with optical sights for short range missiles with IR seekers were used in short range combat. However, they believe that it is not possible to relinquish active or semi-active methods of weapons guidance when attacking a target at medium and long ranges.

The Field of View and Handling Factors: The foreign press points out that, although it is difficult to link these two factors together, there is a firm, logical relationship between them (in relation to a dogfight). The view from the cockpit must enable the pilot to continually observe a target which is sharply changing its flight attitude, while aircraft handling should not hinder those maneuvers which guarantee the pilot's achieving and keeping a positional advantage in combat.

It was previously thought abroad that low seats and protecting the pilot with the fuselage increased the overall survivability of the fighter; however, survivability was significantly reduced due to the bad field of view. As shown by statistics, 80 percent of the American fighters shot down in Vietnam were hit from the rear hemisphere; moreover, a significant part of them were shot down due to the poor view from the cockpit, a view which made it difficult to conduct a 360-degree search. It was necessary to give up the "closed" canopies and "sunken" seats which were on the old generation of interceptors. As a result, high, tear-shaped

canopies were installed on the new American fighters (the F-14, F-15 and F-16), although this also caused a certain increase in aircraft drag.

As far as the problem of controllability is concerned, INTERAVIA magazine wrote that good flying characteristics make it possible to make better use of the entire range of the fighter's maneuvering potential and that air combat requires maximum attention from the pilot and it is completely impermissible that his attention be distracted by poor controllability This is exactly how it was on the F-4 where the pilot was frequently not engaged in sighting during a dogfight but was fighting with the instability at large angles of attack and fighting to prevent the aircraft from going into a wing stall.

Experience has shown that the aircraft's capability to come out of an unintentional spin is a great deal less important than its natural resistance to entering a spin. Therefore, foreign designers attempted to find the optimal combination between controllability and stability for the new fighters. Specifically, the F-15 has better controllability than the F-4. Its maximum attack angle is 26 degrees and this guarantees a sufficient reserve against stalling. The foreign press reported that, while demonstrating controllability during simulated air combat with an F-4, an F-15 pilot, while keeping the "enemy" in his sights, carried out maximum, steep turns with afterburner engaged; moreover, the F-15's engine speed did not exceed 86 percent of the maximum and air speed was maintained within the Mach 0.8-0.9 range.

The Deceleration Factor: It can be included in maneuverability--which includes acceleration and deceleration--but it is especially isolated to emphasize its importance in dogfighting tactics. Foreign specialists emphasize that a sharp reduction in forward speed does not contradict the principles of efficient energy use--the level of which reflects the aircraft's offensive capability--and that deceleration is only recommended in strictly defined situations to achieve important goals of combat. And, this element is only within reach of the experienced pilot who is able to correctly evaluate the situation and predict the enemy's behavior.

The foreign press provides certain recommendations on using deceleration. For example, after closing on head-on courses, the aircraft turned toward each other with the maximum allowable rate of turn in order to take up an advantageous position closer to the attack envelope. After passing abeam (the enemy is located precisely off to the side), the pilot sharply reverses the aircraft bank and begins to close again. The flight paths intersect and the one that lagged behind by climbing or extending the air brakes turns out to be in the

best position. This maneuver is called the "scissors" in the American press and the sliding deceleration during the turn is called a "reverse."

It is pointed out that the "reverse" should be accomplished in a timely and precise manner since it ends in an attack at low speed. A loss in energy without coming out into an attack can lead to a reversal in the pilots' roles: the attacker goes over to a passive defense and the defender takes the offensive. During offensive operations, an abrupt deceleration is also required when attacking a slow-flying target in order to reduce the high closure rate which prevents precise aiming.

When being attacked, it is only recommended that the pilot decelerate to escape from a critical situation when the enemy has reached his firing envelope. In this case, a delayed reaction by the attacker--who is engrossed in the pursuit--and an "overshoot" are relied upon. A sharp turn with a maximum G-load and a reduction in speed (by increasing the drag) is called a "break" ("break" or "brake").

If it is not possible to lure the enemy into an "overshoot," then maneuvering and periodic deceleration are used to escape to the side (to increase the angle of attack relative to the enemy's heading). The aircraft is placed in a position where its nose is a lot lower than the horizon and a turn with a transition into a dive is carried out. The engine speed is reduced and the air brakes are extended. This maneuver is called a "defensive spiral." It forces the enemy to increase the interval--to go to the outside which is not suitable for firing. After diving, it is recommended that the pilot put the aircraft in a steep, vertical climb while turning to the opposite side.

In this case, the attacker will have two options: to continue the pursuit by repeating the enemy's maneuvers or to remain on top and wait for a chance to reattack. Pursuit is related to the possibility of using the extreme edges of the flight envelope (low speed, high angles of attack). At this point, stability and controllability--which were discussed previously--begin to play a decisive role.

In summarizing some of the results of the studies of the effect of technology on the outcome of modern air combat, TRUPPENPRAXIS magazine wrote: "Although everybody agrees in principle that air superiority is needed, the problem of how to attain it remains open. It is clear that it is undoubtedly more difficult to do this today than it was in the past. It should be remembered that a comprehensive study of aircraft and weapons systems

capabilities should not replace the rule which is confirmed by experience: victory in air combat is more dependent on the pilot than on the equipment."



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WESTERN DEVELOPMENT OF AIRCRAFT CANNONS REVIEWED

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 pp 65-69

[Article by Engr-Lt Col N. Germanov: "The Development of Aircraft Cannons"]

[Excerpts] The experience of the conduct of air combat in the aggressive wars started by the U.S. imperialists in Southeast Asia and by Israel in the Near East has shown the rather high effectiveness of cannons. According to the data of the foreign press, out of the total number of losses suffered in air combat by the aviation opposing Israel, more than 15 percent of the aircraft were shot down by aircraft cannon fire. In considering that cannons play a marked role in the overall system of aircraft weapons, in the basic capitalist nations close attention is paid to their further improvement which, judging from materials in the foreign press, is closely related to the basic directions of airplane and helicopter development.

At present, according to the data of the Western press, in the United States and the European NATO countries, extensive scientific research and experimental design work is being carried out to develop new aircraft cannons and to modernize the ones already in use.

For carrying out the program of the U.S. Defense Department for developing high-speed and maneuverable fighters (of the F-16 and F-18 type) for winning air superiority, a new light rapid-firing cannon was required and which could also be used on other modern aircraft. It has been assumed that about 27.9 million dollars would be required for its development. According to an announcement in the foreign press, during the 1975-1976 fiscal year, 0.71 million dollars were allocated for research and development in this area of the U.S. Air Force, in the 1976-1977 fiscal year 0.8 million, and in the 1977-1978 year, 3.5 million. The financing is planned through the 1981-1982 fiscal year inclusively to the completion of the development program for the new cannon, after which they plan to carry out competitive testing of it and the 20-mm M61A1 Vulcan cannon which is presently in service. If the new weapon in terms of its performance is better, then a decision will be taken for its series production.

In arming the direct air support aircraft, in the NATO countries an important role is given to the cannon systems designed for hitting armored equipment on the battlefield. During the period from 1971 through 1974, General Electric developed the GAU-8/A cannon specifically for this purpose to be used on the A-10A attack plane. Its ground and flight test firing showed the high accuracy in hitting ground targets by using the 30-mm fragmentation-HE-incendiary and armor-piercing-incendiary shells. According to data published in the foreign press, during the flight test firing held at Nellis Air Force Base in Nevada, 24 passes by an A-10A aircraft were made against 15 tank targets, 7 of which were destroyed and the remainder put out of action. Firing was carried out at a rate of 2,100 and 4,200 rounds per minute at ranges of 18 meters, in bursts lasting 1 and 2 seconds. Firing accuracy was about 4 millirads.

In April 1976, the Air Force signed a contract with the firm to produce the cannon and ammunition for it for a total of 41.2 million dollars, in accord with which in the 1976-1977 fiscal year, 100 units were to be manufactured in order to ensure the planned delivery of all 173 cannons in the 1977-1978 fiscal year.

The GAU-8/A cannon[1] is a more advanced weapon in terms of design, as the proportion of ammunition for it in terms of weight of the entire cannon system is 82 percent, while in the 20-mm M61A1 it is just 19 percent. In the opinion of American specialists, in the following generation of cannons there will be a further increase in this indicator.

Under competitive conditions designing is being carried out for a light 30-mm aircraft gun called the CHAG (Compact Hi-Performance Aerial Gun) for a future air combat fighter. According to the conditions of the contracts concluded by the Air Force with Ford Aeronutronics and General Electric, each of them will deliver a working model of the gun and will fire 10,000 rounds each in the course of the ground testing. Overall leadership will be provided by the Air Force Weapons System Development and Testing Center located at Elgin Air Force Base in Florida. As Air Force officials have announced, this gun is designed only for future fighters and will not be mounted on existing aircraft. According to preliminary data, its rate of fire will be 2,000 rounds per minute and the weight is 135 kg.

One of the directions for increasing the effectiveness of cannons is research on the possibility of developing an aircraft cannon with a liquid propellant. Its design is based on a completely new principle, the essence of which is that the shot occurs as a result of the combustion of the liquid explosive which is sprayed into the shell space.[2] The research carried out by Grumman Aerospace has shown that such a cannon can be a

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[1]For more detail on the cannon see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 11, 1977, pp 57-58. Editors.

[2]For more detail see ibid. Editors.

very effective weapon for future fighter aircraft. In the opinion of the firm's specialists, the probability of hitting an airborne target in firing from it is 3-fold greater than in firing a standard 20-mm cannon with which modern fighters are armed.

The foreign press has stated that Hughes Aircraft is developing a 30-mm cannon with an "open" chamber for the Army helicopters and Naval aviation. It uses cartridgeless ammunition which is 20-25 percent lighter than the existing ammunition of the same caliber. This makes it possible to increase the battle scale of ammunition respectively. The rate of fire of the new cannon will be around 350 rounds per minute.

In the United States, along with developing new cannon systems, the existing ones are being improved. According to a statement in the Western press, at present a program is being carried out at the Air Force Weapons Systems Development and Testing Center for improving the M61A1 Vulcan 20-mm cannon and the ammunition for it. The program provides for an increase in the rate of fire for the cannon (from 6,000 to 7,200 rounds per minute) and the development of new shells which have a higher muzzle velocity (1,125 meters per second), improved aerodynamics and increased efficiency in comparison with the ammunition of the M50 series.

The foreign press has announced that the shells used in the NATO nations for aircraft cannona (fragmentation-HE, armor-piercing with a charge and armor-piercing with a core) basically will not undergo substantial changes. However work is being done to improve them, including an improvement in piercing performance, an increase in muzzle velocity, and so forth.

The problem of developing ammunition loaded with aero-shaped fragments is also at the center of attention of the U.S. military specialists. Research and test firing have shown that such elements manufactured from depleted uranium possess high armor-piercing properties.

In the opinion of foreign specialists, the practical realization of the above-given directions for a qualitative improvement in cannons and ammunition will make it possible to significantly increase the fire power of NATO aviation.

In addition to the United States, other nations and in particular the FRG are also concerned with improving cannon weapons. At present the FRG is developing a Mauser cannon with a caliber of 27 mm for the multipurpose Tornado fighter and the light Alpha Jet attack plane.

By the spring of 1976, according to the data of the foreign press, 32 test models of the Mauser cannon had been manufactured for conducting flight test firing. In April 1977, testing of the cannon located in a suspended container on an Alpha Jet aircraft was conducted in France. In each of the six aircraft sorties, 150 shells were used. Firing was carried out in bursts at a rate of 1,000 and 1,700 rounds per minute with a flight speed of 890 km per hour and accelerations from 0.5 to 5.0. The test results,

in the estimate of foreign specialists, showed the high firing and operational qualities of the new cannon.

The basic specifications of certain models of aircraft cannons in the capitalist states are given in the table [not reproduced].

The materials of the foreign press have pointed out that the United States and other countries of the NATO bloc are paying particular attention to standardizing the aircraft cannons. In particular, the range of the calibers for the cannons being developed in the United States will be 20-40 mm, and the step in the change of caliber should be 5 mm for cannons with conventional cartridge ammunition. For each caliber a minimum number of shell types has been established under the condition of their complete interchangeability.

For the purposes of implementing the U.S. standardization program for aviation ammunition, in 1976 a decision was taken to halt the development of the WECOM-30 shell for the 30-mm cannon and designed for use on future helicopters. Instead of them shells will be produced which are compatible with the 30-mm Aden and Defa cannons which are used in the air forces of the European NATO countries.

The military specialists of the United States and certain Western European countries feel that the further development of aircraft cannons in the capitalist countries will occur in the following basic directions: An increase in the caliber and rate of fire; a reduction in the overall weight, the dimensions of the cannon systems and an improvement in their operational qualities (reliability, barrel life, safety, and so forth); an increase in the muzzle velocity and destructive properties of the ammunition, as well as standardization and unification of cannon weapons within the countries of the NATO bloc.



10272
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DEVELOPMENT OF U.S. NUCLEAR SURFACE SHIPS DESCRIBED

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 pp 71-76

[Article by Engr-Capt 1st Rank N. Petrov: "Atomic Surface Vessels of the U.S. Navy"]

[Text] The U.S. Navy is a most important instrument for carrying out the aggressive policy of the ruling circles in that country. This was eloquently stated by the Secretary of the Navy in his report to Congress (February 1978) in which he emphasized that over the last 30 years, the U.S. Armed Forces had been involved in more than 200 conflicts, the Navy had been in 80 percent of them, and in 100 instances only naval forces had been used. The foreign press has pointed out that the Pentagon places the following missions on the Navy: The winning and maintaining of sea superiority, the making of nuclear missile strikes against enemy territory, supporting ground forces, conducting amphibious landing operations, transporting troops, weapons and supplies. Under peacetime conditions the U.S. Navy has been widely used for demonstrations of strength and for putting military and political pressure on foreign states.

In carrying out the designated tasks, a particular place has been given to the surface fleet, and in particular the atomic-powered carriers and cruisers which are part of it. The impetus for building these ships was provided by the rapid development of nuclear engineering.

At the beginning of the 1950's, the United States commenced research and development on ship nuclear propulsion plants (NPP) for submarines, and somewhat later for surface vessels as well. American specialists felt that in this instance the surface vessels would have the following advantages: Almost unlimited range and high speed which would increase the combat capabilities of the ships and significantly broaden the regions of their operations and the time which they could remain in these regions; a lesser dependence upon supply ships as a result of which there would be a reduction in the number of fuelings and during which the maneuvering of the ships was limited and they themselves would be more vulnerable to enemy attack;

greater adaptability for operations under the conditions of using weapons of mass destruction (atomic, biological and chemical) as atmospheric oxygen is not required for the operation of the NPP and the ship can be better sealed; a reduction in corrosion on antenna systems of radio electronic equipment due to the absence of smokestack gases which also complicate the deck landing conditions for the airplanes and helicopters.

All of the designated advantages seemingly opened up broad prospects for surface atomic-powered shipbuilding. However, at present within the American Navy there is a comparatively small number of atomic-powered surface ships. This is explained by their rather substantial drawbacks among which foreign specialists put: The greater weight of the NPP in comparison with other types of propulsion plants, and this makes it possible to use the NPP only on ships with a displacement tonnage of at least 8,000 tons; the complexity of manufacturing and operating the NPP; the high cost of building an atomic-powered ship.

The designated drawbacks have led to a situation where among the capitalist countries only the United States has been able to carry out individual and small-series construction of atomic-powered surface ships.

The first atomic-powered surface ships in the American Navy were the carrier "Enterprise" and the cruiser "Long Beach" (they were commissioned in 1961). Somewhat later the atomic cruisers "Bainbridge" and "Trakston" were built. Then followed a long break, and only from the middle of the 1970's were new atomic-powered carriers and cruisers commissioned for the Navy.

The development of the atomic-powered carrier was explained by the desire of the U.S. Naval Command to increase significantly the combat effectiveness of the carrier force. According to statements of American naval specialists, a force with an atomic-powered carrier is capable of remaining at sea without taking on provisions for over 30 days, attack coastal installations to a depth of 1,300-1,800 km, and move a distance up to 600 miles (around 1,110 km) in 24 hours. This impedes its detection, it provides surprise and makes it possible to arrive quickly in a region where a conflict has broken out. At the same time the presence of escort ships with conventional propulsion plants in such a force would substantially restrict its combat capabilities, since the advantages related to the use of the NPP could not be fully realized. For this reason the United States began building atomic-powered cruisers with a basic purpose of air and antisubmarine defense of the atomic-powered carriers.

At present the U.S. Navy has three atomic-powered carriers (the "Enterprise" and two of the class "Chester W. Nimitz"), the atomic-powered cruisers "Long Beach," "Bainbridge," and "Trakston," two of the "California" class and three of the "Virginia" class. In addition, one other ship of the "Chester W. Nimitz" class and one of the "Virginia" class are under construction. The basic specifications of the atomic-powered surface vessels are given in the table [not reproduced].

The "Enterprise" was started in February 1958 and was built in 3 years 8 months. The ship designs were based upon the conventional carriers of the "Forrestal" class with major changes being made in the architecture and design. These changes not only improved its performance but also substantially altered the appearance. This involved most of all the architecture of the superstructures of the so-called "island." The use of the NPP provided an opportunity to eliminate the smokestack and the air intakes of the boiler fans, as a result of which the dimensions of the "island" were reduced and its vulnerability was lowered. In addition the chemical, biological and radiological defense of the ship was significantly improved, and also it was possible to have a better placement of the radar antennas.

The leadership of the U.S. Navy, after the first period of operating the ship, noted a number of advantages which the carriers gained with a transition to nuclear power. First of all this was the capacity to rapidly pick up and drop speed, and this is very important with carrier flight operations. Smoke and smoke gases also disappeared and these not only had complicated the aircraft landing conditions, but also had a major corrosive effect on the radar antennas, the aircraft and the other equipment. The freeing of tanks of boiler fuel made it possible to increase the supplies of aviation fuel. The NPP completely supplied the operation of the steam catapults under various conditions and made it possible to have a reserve of steam for the immediate launching of the aircraft. The absence of a steam scarcity made it possible to increase the installed capacity of the turbogenerators and meet the ever-increasing needs for electric power. The atomic-powered carrier could hold almost double the amount of aviation fuel (11,000 tons in comparison with 6,000 tons carried on the ships of the "Forrestal" class) and 50 percent more ammunition for the aircraft than on a conventional carrier.

The plans of the ship also provided for the mounting of two Terrier antiaircraft guided missile complexes on its stern sponsons. However, due to the significant construction costs which greatly exceeded the planned, the Navy Command completely refused to outfit the carrier with rocket artillery weapons. Only in 1966, with the sending of the ship to participate in the aggressive war in Vietnam, were two Sea Sparrow antiaircraft guided missile launchers placed on it. During the reloading of the cores of the nuclear reactors in 1971, a third Sea Sparrow launcher was installed in addition.

The carrier is equipped with modern radar. First of all these are the AN/SPS-32 and -33 aircraft detection radars. In addition the ship carries the AN/SPS-10 sea search radars, the AN/SPN-6, -10 and -12 air traffic control radars with antennas in the upper portion of the superstructure, the Tacan navigation system and the NTDS [naval tactical data system].

The NPP of the ship consists of four Westinghouse main geared turbine units (MGTU), the steam for which is produced by eight Westinghouse water-cooled reactors of the A2W type (the heating capacity of each is 150 megawatts)

connected with 32 steam generators. The first nuclear reactor reached a critical level at the end of 1960, soon after the launching of the vessel. After 3 years of operation during which the ship traveled more than 200,000 miles, the cores of the nuclear reactors during the period from November 1964 through June 1965 were replaced. After this the carrier sailed about 300,000 miles. In the next reloading of the nuclear reactors during the overhauling of the ship (from October 1969 through January 1971), they were loaded with new cores the life of which, according to statements in the foreign press, is up to 13 years.

The carriers of the "Chester W. Nimitz" class are a further development of the "Enterprise" carriers. In terms of their architecture, weapons, the number and placement of the catapults and aircraft elevators (four each), as well as in terms of the number of aircraft based on them, these ships are virtually identical. However, the complete displacement tonnage of the new ships is 5,000-6,000 tons greater. In addition, they differ in the number of reactors (two A4W reactors are used instead of the eight A2W nuclear reactors) and the composition of the radio electronic weapons which include the following radars: The AN/SPS-46 and -55 sea search radars, the AN/SPN-42, -43 and -44 air traffic control and aircraft landing support radars, the AN/SPS-43A distant aircraft detection radars, the AN/SPS-48B three-coordinate radar, the AN/SPS-58 search and tracking radar for low-flying winged missiles and aircraft, as well as the NTDS.

The range of the carriers is 90 days, and the supplies of aviation fuel provide for continuous combat operations for approximately 2 weeks with two daily sorties for each aircraft.

The air wings based on the carriers of both classes include: Two fighter squadrons (24 aircraft), three attack plane squadrons (about 40), one squadron of antisubmarine aircraft (10), one squadron of antisubmarine helicopters (8) and one squadron of reconnaissance attack planes (3), detachments of airborne early warning airplanes (4), electronic warfare airplanes (4) and tanker aircraft (4).

The first American atomic-powered guided missile cruiser the "Long Beach" was commissioned in 1961. The use of the NPP solved the problem of the duration of traveling at full speed, as well as made it possible to dispense with smokestacks and have a new approach in designing the upper superstructures of the ship in the aim of providing the best conditions for the operation of electronic equipment. The elongated bow superstructure has the shape of a cube and on the sides of it are located the radar antenna systems. The ship is flush-deck, without armored plating.

It carries numerous and diverse electronic weapons, including the AN/SPS-32 and -33 aircraft detection radars, the AN/SPS-10 and -12 sea-search radars mounted on the walls of the bridge with antennas on the foremast and the NTDS.

Regardless of a number of positive factors (the use of the NPP and the arming of the ship with modern antiaircraft guided missile systems and electronic equipment), the high cost of building, the great displacement tonnage, the complexity of design and a number of other factors told on the plans for building atomic-powered cruisers. For this reason in the United States only one such ship was built.

The further search for optimum architectural and design decisions and weaponry led to the building of the atomic-powered guided-missile cruisers the "Bainbridge" and "Trakston."

Both cruisers have the same design of the bow and stern extremities, the elongated forecastle and the high freeboard in the bow and mid-sections, and this reduces the wetness of the ships. In the bulbous bow is located the sonar dome. The upper deck is unincumbered, and a majority of the deck mechanisms and devices have been put beneath it or inside the superstructures. The absence of smokestacks creates the best conditions for the placement and operation of electronic equipment.

The atomic-powered guided-missile cruiser "Trakston" was developed considering the experience of building and operating the preceding guided-missile cruiser the "Bainbridge." The specifications of the ships are basically the same, and there are certain differences in the weapons and displacement tonnage. The fourth atomic-powered guided-missile cruiser the "California" (the head ship in a series of two units) was commissioned almost 7 years after completing the construction of the atomic-powered guided-missile cruiser "Trakston." In 1975, the atomic-powered guided-missile cruiser "South Carolina" was commissioned, and this was a second ship of the "California" class. The displacement of the new ships is over 10,000 tons. In building them, according to the statements in the foreign press, great attention has been paid to standardizing the designs.

The radar equipment of the cruisers includes up to 7 different types of radars: The AN/SPS-48 three-coordinate radars, the AN/SPS-40 aircraft detection radar, the AN/SPS-55 sea-search and low-target radars, and the AN/SPG-51A missile and artillery fire control radar.

The guided-missile cruisers of the "Virginia" class in terms of their appearance and specifications are largely similar to the guided-missile cruisers of the "California" class.

The third carrier of the "Chester W. Nimitz" class (the "Carl Vinson") is to be commissioned in 1981. The further building of ships of this class as yet is not planned. The superior leadership of the U.S. Defense Department and Navy, in referring to the high cost of the atomic-powered carriers, in the future has proposed building carriers of smaller displacement tonnage with conventional type propulsion units.

The prospects for the development of atomic-powered cruisers are somewhat different. There are plans to build four atomic-powered guided-missile cruisers of the CGN42 class (the plans were worked out on the basis of the guided missile ship "Virginia"). The building of the head ship has been planned for the beginning of the 1980's. These cruisers will have a total displacement of 12,000 tons, and a top speed of 30 knots. Their weapons include: The IGIS antiaircraft guided missiles and the ASROC antisubmarine guided missiles, two 127-mm artillery guns, two 20-mm antiaircraft [automatic] guns, two triple tubes for firing antisubmarine torpedoes, and two Mk3 LEMPS helicopters. There are plans in the future to equip them with the Harpoon antishipping guided missiles. The new cruisers are designed for escorting atomic-powered carriers and conducting independent operations at sea.

[Caption of untranslated table:] Basic Specifications of Atomic-Powered Surface Vessels in the U.S. Navy



10272
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DEVELOPMENT OF NATO NAVAL ELECTRONIC WARFARE SYSTEMS VIEWED

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 pp 76-82

[Article by Engr-Capt 1st Rank P. Gindin, candidate of technical sciences, and Lt Capt S. Chukalin: "Naval Electronic Warfare Equipment of the European NATO Countries"]

[Excerpts] The ruling circles of the European members in the aggressive NATO bloc, under U.S. pressure, year after year have increased their military might. Here great attention has been given to further improving naval weaponry and military equipment, including electronic warfare (EW) equipment; this includes electronic intelligence (Elint) and electronic jamming (EJ) equipment.

The electronic intelligence equipment is being developed in a direction of further introducing digital data processing methods into it and can be used autonomously and jointly with the EJ equipment as a single electronic warfare complex.

Great Britain has developed a modern ship Elint the Suzy (three variations), for equipping surface ships and submarines.

In the British Navy and in the navies of the other NATO countries, as the Western press has shown, extensive use is made of el-int equipment of the RDL series produced by Decca. This is designed according to a modular principle, and this makes it possible to put together an optimum set of equipment considering the missions carried out by the specific carrier.

A standard set, the RDL-1BC is used on patrol boats.

For submarines, Decca produces the sets RDL-1BCS (a range of 2-12 gigahertz) and the RDL-4BCS (2.5-20 gigahertz). These operate together with an antenna system consisting of 16 antenna elements contained in hermetic capsules.

Decca has also developed the new ship el-int system, Cutlass. Instead of traditional signal search methods, it has used the principle of omnidirectional panoramic receiving.

Decca has also developed the MIR-2 small-sized radar detector. Judging from the recent information in the foreign press, they plan to install this on patrol boats.

From the data in the foreign press, the new Royal Navy cruisers and frigates are to be equipped with the Abbey Hill el-int equipment for automatic signal detection, identification of the type of radar and the class of carrier. In terms of its basic characteristics, it corresponds to the American AN/WLR-8.

Great Britain for the last several years has produced the Sari digital analysis and identification equipment designed for processing data received from ship radars. It automatically measures the pulse repetition rate, the repetition frequency oscillations, the pulse duration and the scanning periods. The operator can introduce additional signal characteristics (the values of the carrier frequency, bearing, the type of scanning, the type of modulation, and the particular features of frequency oscillation). All these parameters are compared with the standard recorded in the memory. The processing results which include the type of radar and class of carrier are displayed on a screen in an alphanumerical form. Identification takes less than 150 microseconds.

In France, the Thomson-CSF firm has developed the Arial analysis and identification equipment built according to the modular principle. The small dimensions and low weight of each instrument included in it make it possible to install this equipment on ships of all classes, submarines and naval aviation aircraft. The specific tactical and technical requirements are satisfied by selecting the required set of instruments and connecting them to the base DR-3012 signal-seeking receiver. This receiver provides omnidimensional search in a broad range of frequencies and makes it possible to detect at great distances signals from both pulse radars as well as continuous-sending radars, to measure the frequency, the pulse repetition period, and the bearing, with the automatic delivery of this information for subsequent analysis and identification.

On the ships of the basic classes in the Norwegian Navy, the SR-1A el-int radar is used and this has a tuned radio-frequency receiver (a band of 2.5-18 gigahertz). The antenna system includes a fixed antenna which consists of eight horns which provide omnidirectional receiving, and a turning directional antenna for direction finding. The accuracy of direction finding is 3.5°, and here the rotating speed of the antenna is automatically selected within the limits of 0-500 rpm, proceeding from the conditions for optimum detection of the radar signals.

On submarines and small ships, the VR-1B and VR-1C el-int radars, and these differ only in terms of antenna design. In the first instance the antenna is manufactured from stainless steel and is designed to be submerged to a

depth of 320 meters, and in the second, from lighter materials in the form of two semicircles placed around the mast. The antenna consists of eight groups of horns making it possible to provide omnidimensional receiving in a range of 2.5-18 gigahertz. The high sensitivity of the radar receiver makes it possible to detect radars over the horizon. Bearing is determined from the number of the group of horns receiving the signals, and for this reason the range-finding error may reach ±22.5°. The radar uses a detector receiver. The signal from its output goes to the analyzer indicator using a double-beam tube with a logarithmic time scan scale. This provides an opportunity for the operator to measure the duration and frequency of the pulse repetition without switching the metering limits.

For submarines a simple NE-10A radar warning receiver has been developed (its lightened model is produced in a waterproof housing and is mounted on ships and helicopters). The antenna system (weight 12 kg) is designed to be submerged to 300 meters, and provides omnidirectional receiving in horizontal (0-360°) and vertical (0-90°) planes. The receiver covers a frequency band of 2-11 gigahertz and captures signals within the limits of direct line of sight. Light and sound warning signals are emitted in detecting a radar signal.

The FRG produces the ND210 and ND260 el-int radars which cover, respectively, the bands of 170-470 megahertz and 450-1,000 megahertz. They employ logoperiodic antennas. The load factor of the frequency band with signals is indicated on the screen of a panoramic search receiver in the form of a brightness-modulated line under which is displayed a quartz frequency grid with an interval of 10 megahertz. This facilitates and accelerates the counting of the signal frequency. By a special device, up to 5 interceptor receivers can be connected to the search receiver. In addition a spectrum analyzer, a frequency meter and a range finder can be connected as part of these radars.

For the Italian Navy, the firm Electronica is producing the MM/SPR-A radar warning device (a range of 1-10.5 gigahertz). Its antenna system consists of four directional antennas with overlapping patterns. This makes it possible to provide omnidimensional receiving. The detector receiver of the radar is not designed to meter the parameters of the received signal.

Electronic jamming devices. According to the estimate of foreign specialists, Great Britain holds first place among the European NATO countries in terms of the quantity and development of naval EJ equipment. Britain has developed the Scimitar jammer which works together with the Suzy equipment (a range of 1-16 gigahertz). It has a jamming power of 200 watts under continuous sending and 600 watts under pulsed, and provides for the setting of various types of jamming.

Decca manufactures jammers of the RCM series which are employed with the RDL and Cutlass el-ints equipment. The jammers of this series have a variable jamming band and can emit both selective and barrage jamming. According

to information in the foreign press, they are capable of creating effective countermeasures for enemy observation, navigation, identification and control equipment.

Decca has also developed a new jammer within the development of the Cutlass system. This jammer, in contrast to the jammers of the RCM series, can automatically track the target both in terms of azimuth and elevation, and this provides a significantly higher level of emitted power (over 300 kilowatts).

The English Vickers firm supplies Corvus launchers for launching unguided missiles with antiradar reflectors. The ships of the basic classes carry two such units, and each includes a cylindrical turning part fastened on the deck with eight barrels which are located in three tiers with a fixed elevation angle of 30°. The Corvus units are widely used in the navies of Great Britain, France and certain other countries.

As the foreign press has announced, Great Britain has developed a new multicharge unit, called Protean, for dropping dipole reflectors. It has four rechargeable magazines (with 36 grenades in each). Firing is in salvoes of nine grenades from each magazine. Five seconds after the salvo, a cloud is formed at an altitude of 40-60 meters and this creates a radar defense within the bands of 5-10 and 15-20 gigahertz. The unit is controlled from the data of the ship el-ints equipment.

In France the Thomson-CSF firm produces the Alligator jammer which works compatibly with the Arial el-int equipment. For launching unguided missiles on the ships of the basic classes, the English-produced Corvus launchers are employed, and on small ships, the French-produced Sillex which are to be replaced by the more advanced Dagay.

The foreign press has also announced that on the ships of the Italian Navy, they are to employ the Sclar launchers produced by Breda Meccanica and designed for firing unguided missiles (a caliber of 105 mm) with dipole reflectors over a distance of up to 12 km. The unit has 20 guide tubes located in four rows. In addition to the rockets with dipole reflectors, it can fire rockets with infrared decoys. Usually a ship carries two such launchers (one on each side).

This, briefly, is the basic electronic warfare equipment used in the navies of a number of the European NATO countries.



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NATO NAVAL TRAINING EXERCISE DESCRIBED

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 2, Feb 79 signed to press 5 Feb 79 p 89

[Article by Capt 3d Rank V. Khomenskiy: "The NATO Navies in the Display Determination-78 Exercise"]

[Text] From 19 September through 13 October 1978, in the Southern European theater of military operations, as the foreign press has announced, an exercise of the NATO Joint Armed Forces was held under the code name "Display Determination-78" with the predominant involvement of the navies. Its basic aim was to shift the joint armed forces of the bloc in the theater of operations from a peacetime to a wartime footing, the reinforcing of the armed forces and the conducting of operations in the initial period of a war without using nuclear weapons.

Participating in the exercise were the commands and staffs of the joint and national armed forces, the NATO mobile forces, the units and subunits of ground forces, the 5th and 6th JTAC, the strike and joint NATO navies in the Mediterranean, individual marine units and subunits, over 100 combat ships and auxiliary vessels (including the American multipurpose carriers "Forrestal" and "John F. Kennedy," the English attack carrier "Arc Royal," and the French multipurpose carrier "Foch"), and over 250 combat airplanes and helicopters (including 150 carrier-based airplanes). The total number of personnel was 35,000 men, including 3,000 marines from the United States, Italy and Greece.

In the exercise they worked on the following procedures: The forming and deployment of operational formations and groups of different types in combat areas, the combating of "enemy" naval groupings in the interests of winning air and sea superiority, the conducting of amphibious landing operations, the providing of direct air support for ground forces fighting on coastal sectors, the escorting of convoys with troop reinforcements and protection of the sea lines of communications.

With the start of the exercise, three carrier strike groups were deployed (in the zone of the Straits of Gibraltar, and in the western and central parts of the Mediterranean), as well as ASW forces on the probable deployment routes of the "enemy" ship formations. The carrier-based aviation carried out missions of winning superiority in the given regions of the Mediterranean and escorted the ocean convoy from the Atlantic and an amphibious landing force from the Balearics.

After establishing superiority in the western Mediterranean, the deck-launched aviation from the carrier "Forrestal" and airplanes from the 5th JTAC began to provide direct air support to the ground forces fighting on the coastal sector in Northern Italy.

The landing of a landing party was carried out on 9 October in Western Thrace (Greece) by landing craft and helicopters.

The combat of the sides was conducted under conditions of electronic weapons and was supported by the NATO joint air defense system in Europe.



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END