JPRS-UFM-89-010
8 SEPTEMBER 1989

FOREIGN
BROADCAST
INFORMATION
SERVICE

JPRS Report

Soviet Union

FOREIGN MILITARY REVIEW

No 4, April 1989

Soviet Union
FOREIGN MILITARY REVIEW
No 4, April 1989

JPRS-UFM-89-010 8 September 1989

CONTENTS

[The following are translations of selected articles from the Russian-language monthly journal ZARUBEZHNOYE VOYENNOYE OBOZRENIYE published in Moscow by the Ministry of Defense. Refer to the table of contents for a listing of any articles not translated]

FOREIGN MILITARY REVIEW

No 4, April 1989

An Exploit With No Equal in History

18010800a Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 3-8

[Lead article by MSU N. Ogarkov]

[Text] Our country's workers and Army and Navy personnel celebrate the Soviet people's Victory Day in the Great Patriotic War as the brightest holiday. As we celebrate it this year, the processes of perestroyka and of renewal of all aspects of Soviet society's life have unfolded widely in the country. Creative revolutionary work is under way aimed at fulfilling resolutions of the 27th CPSU Congress, 19th All-Union Party Conference and subsequent CPSU Central Committee Plenums. These days Soviet citizens turn to historic events of the Great Patriotic War and to an analysis of its results and lessons as they resolve the most important problems of our country's further development as posed by the party and as they outline plans for the future.

I

The Great Patriotic War of 1941-1945 that was imposed on the Soviet Union was unprecedented in scope, bitterness of the battles that unfolded, and decisiveness of the opposing sides' objectives. This was fundamental, uncompromising single-combat by the world's first country of socialism against fascism, the most reactionary shock force of international imperialism. It took the lives of 20 million Soviet citizens. Sacrifices were supreme and the struggle was most severe, but the Soviet people, directed by the Communist Party, did not waver. They held out in this grandiose battle, blocked the fascist aggressors' path to world domination, and together with the allies utterly routed the fascist hordes and were victorious.

Therefore, in assessing the past one cannot forget (as often happens in our days) that this would have been impossible to do had our country not prepared to repel fascist aggression in advance in the prewar years. The Communist Party and the Soviet state constantly took account of that threat and put much effort into strengthening the country's defense. The military-industrial potential was being built up and the production of new kinds of arms was being arranged. New tanks, aircraft and ships were being delivered to the forces. A reorganization of the Armed Forces was under way, officer cadres were being trained intensively, and new divisions, corps and armies were being constituted. The Air Force and Navy were being strengthened. The system for management of the national economy and for command and control of forces and the procedure for mobilizing the Armed Forces were being improved. The strength of the Armed Forces more than doubled just in the two last prewar years.

But for a number of reasons we did not manage to do everything at that time to repel aggression on such a scale. It is common knowledge that our military doctrine then (just as now) was strictly defensive—the first country of socialism was not preparing for a predatory war. Its foreign policy course and socioeconomic development were subordinated above all to peaceful objectives with a simultaneous readiness to repel any possible aggression by imperialism if necessary. At the same time it is impossible not to note that many commanders and political officers, including the most experienced military leaders, were killed in the mid-1930's, because of groundless massive repressions of military cadres. The repressions led to a situation where by June 1941 only seven percent of all commanders in our Armed Forces had a higher military education and over a third of the officers had not even taken a training course at military secondary educational institutions. That was the condition in which we entered the initial, and for us the most difficult, period of the Great Patriotic War.

The miscalculation in estimating the possible time periods of an enemy attack also influenced the failures of the initial period of the war. The Germans succeeded in achieving operational surprise with a treacherous attack on our country. They hoped for a triumphal procession across the Soviet land, but encountered fierce resistance. Heavy, bloody fighting broke out across the entire Soviet-German front in the very first hours. As they defended and retreated, Soviet forces everywhere destroyed the hated enemy. In just the first two months of battles, fascist Germany's personnel losses at the Eastern Front exceeded its losses in all its military campaigns in Europe for the two previous years.

Our Communist Party became the inspirer and organizer of the Soviet people's struggle in the Great Patriotic War. In the very first days it assumed full responsibility for the fate of the homeland and socialism and worked out a program for shifting the country's life to a wartime footing and for mobilizing all its personnel and equipment for the struggle against the fascist German invaders. The party applied enormous effort to turn the country into a unified fighting camp. The State Defense Committee [GKO] headed up by I. V. Stalin was established to direct this all-encompassing activity. Having restructured their own ranks and the content, forms and methods of work, party entities introduced order and efficiency to the work of state and public organizations; gave all possible assistance to the Red Army; directed general mobilization, the construction of defensive works, establishment of hunter and partisan detachments, and the evacuation of the population and physical assets; and ensured the rapid conversion of plants and factories to the manufacture of military products. The Communist Party became a genuinely fighting party in the war years (more than three million party members fell in battle).

The titanic labor, high level of discipline and organization, and many-sided, purposeful activity united the Soviet people, inspired their Army and Navy to worthily rebuff and defeat the enemy, and produced the desired result. The staunchness of armed defenders and the force of their attacks on the enemy grew from day to day. Our Army's very first counterthrusts against fascist invaders near Yelnya and at Rostov and later the counteroffensive near Tikhvin and the heroic defense of Odessa, Smolensk and Leningrad cooled the enemy's offensive ardor.

II

The Battle of Moscow was the deciding event of the first year of the Great Patriotic War. Fierce engagements continued for more than six months here and the entire world followed their outcome with bated breath. Displaying unparalleled courage and unbending staunchness, Soviet forces were able to halt the enemy offensive. They wore down his best elite troops, then launched a counteroffensive and threw them back 150-400 km. At that time G. K. Zhukov commanded the Western Front in this battle and later he was Commander-in-Chief of the strategic Western Sector.

This was our major victory. It is difficult to overestimate its importance to the subsequent course of the war. The enemy suffered heavy losses in personnel and equipment, the myth of the German Army's invincibility was dispelled on the fields of Podmoskovye [near Moscow], and the fascist plan for a blitzkrieg was foiled. But its significance lies in more than this: the Soviet people saw with their own eyes the might of their Armed Forces and their capability for ultimately defeating the enemy. This firm conviction increased forces tenfold and generated an unprecedented upsurge of spirit and the massive heroism of Soviet citizens at the front and in the rear. This also lent strength to the resistance movement in countries enslaved by fascism. It was here at the walls of Moscow that the dawn of our Great Victory broke; this marked the beginning of a fundamental turning point in the Great Patriotic War.

In an attempt to get revenge for the defeat at Moscow, the fascist command took advantage of the absence of a second front in Europe and launched a new major offensive in the summer of 1942. Having concentrated their primary strike forces on the Southern Axis, the Germans were counting on deciding the fate of the war in their favor by fall. The greatest battle in history, the Battle of Stalingrad, broke out between the Don and the Volga and the battle for the Caucasus was fought in close operational-strategic connection with it.

Over 22 enemy divisions were encircled and destroyed or captured during the Battle of Stalingrad as a result of a counteroffensive by Soviet forces that was brilliant in concept and execution. During the battle on the Volga the fascist bloc lost a total of around 1.5 million persons, almost a quarter of its forces operating at the Soviet-German front at that time.

The Red Army's victory on the Volga was a most prominent military-political event which marked a fundamental turning point in the course of the Great Patriotic War and of all World War II. Hitler Germany's military might and prestige were undermined while the international authority of the USSR and its Armed Forces rose considerably. This victory was convincing proof for the entire world of the doom of fascism and the inevitability of its downfall and had a deciding influence on the political positions of neutral countries.

But after conducting total mobilization, Hitler's clique made one more attempt at achieving its adventuristic goals. In the summer of 1943 it again began a major offensive in the vicinity of the Kursk Salient, facilitated by the absence of a second front in Europe. The enemy concentrated powerful strike forces in the vicinity of Orel and Belgorod with an overall strength of more than 50 divisions, of which there were 20 panzer and motorized divisions armed with new tanks and self-propelled artillery. Primary combat aviation forces were rebased here as well. But the Soviet High Command uncovered the enemy's plan in time. A powerful defense of three fronts—the Central (under the command of K. K. Rokossovskiy), the Southwestern (N. F. Vatutin) and the Steppe (I. S. Konev)—was established on the most likely axes of upcoming operations. The German offensive which began on 5 July was preceded by a powerful counterpreparation by Soviet forces. Strong counterthrusts were made against the attacking fascist forces during the operation. For example, over 1,200 tanks and self-propelled guns were operating on the battlefield during the delivery of a counterthrust by 5th Guards Tank Army (P. A. Rotmistrov) near Prokhorovka. Having won the defensive engagement, our forces soon launched a decisive counteroffensive themselves and drove the enemy westward. Thirty enemy divisions were destroyed in 50 days of fighting. The enemy lost around 500,000 officers and men, 1,500 tanks, 3,000 guns and over 3,700 aircraft. Fascist Germany's last attempt to get back the lost strategic initiative suffered total failure.

The Battle of Kursk was a prominent event. A fundamental turning point in the course of the Great Patriotic War and of all World War II was finalized as a result of the victory won here. The first artillery salute sounded in Moscow to commemorate this victory. After this victory the strategic initiative was firmly retained by the Soviet Army. Our victorious offensive began, unfolding across a front up to 2,000 km wide. The Donbass and the Left-Bank Ukraine were liberated. Soviet troops liberated Novorossiysk, eliminated an enemy base of operations on the Taman Peninsula, made a forced crossing of the Dnieper and firmly consolidated on its right bank. The enemy was driven from Kiev on 6 November, on the eve of the 26th anniversary of the October Revolution. These powerful blows against the enemy were supplemented by a massive partisan movement which was especially strong on the territory of Belorussia. By the end of 1943 Soviet forces had cleared over half of the territory temporarily seized by the enemy, and around three-fourths already had been liberated by the summer of 1944.

It became clear to the entire world that the USSR was capable of routing fascism and liberating Europe with its own forces. Under these conditions the ruling circles of the U.S. and the UK were forced finally to open a second front in Europe, and in June 1944 the allied Anglo-American forces conducted a very large scale landing operation on the coast of German-occupied France. Even after this, however, the Soviet-German front remained the chief and deciding front where the principal forces of the German Army continued to be concentrated.

The great liberating campaign of the Soviet Army, which gave direct military assistance to the peoples of Europe in their struggle against fascist Germany, began in mid-1944 after a brilliantly executed Belorussian operation of four fronts—the 1st Belorussian (the commander was K. K. Rokossovskiy), the 2d Belorussian (G. F. Zakharov), the 3d Belorussian (I. D. Chernyakhovskiy) and the 1st Baltic (I. Kh. Bagramyan). Constituted on Soviet soil and outfitted with Soviet weapons and combat equipment, the Polish Army, the Czechoslovak Corps, and Romanian and Yugoslav units moved westward with the Soviet Army to liberate their land. Our combat alliance, which was born in joint struggle against a common foe, was strengthened and tempered.

The political and military results of the summer-fall 1944 campaign are grandiose. During this campaign the Red Army completed the liberation of Soviet soil and helped the peoples of Southeastern and Central Europe throw off the yoke of Hitler's tyranny. The liberated peoples began to build their life in a new way by establishing a people's democratic system. The coalition of fascist states collapsed. Peoples of Romania, Bulgaria and Hungary turned their weapons against fascist Germany. Finland was taken out of the war in the Northwest.

An offensive by allied Anglo-American and French forces unfolded at this time against the Germans in the West in coordination with operations by Soviet forces in the East. For example, when Anglo-American forces got into a difficult situation in the Ardennes in early 1945 the Soviet Army, true to its allied obligation, began a strategic offensive on 12 January (considerably earlier than the planned date) across a 1,200-km front from the Baltic Sea to the Carpathians, during which all of Poland and Hungary were cleared of occupation forces and a significant part of Czechoslovakia and Austria was liberated. Military operations shifted onto the territory of Germany itself.

The Red Army began the Berlin operation on 16 April 1945. The largest enemy force of up to a million officers and men was encircled and destroyed or partially captured during this operation, successfully conducted by the forces of the three fronts of Marshals Zhukov, Konev and Rokossovskiy. Stubborn street fighting went on for ten days in Berlin itself. Soviet soldiers burst into the Reichstag building on 30 April. The Victory Banner already was fluttering over the Reichstag early on the morning of 1 May and the Berlin garrison surrendered on 2 May. Fascist Germany signed the document of unconditional surrender, which signified a shameful end to the fascist regime, in Karlshorst (a Berlin suburb) on 8 May 1945. The war ended in the place from whence it came.

The victory over the fascist German invaders was won through joint efforts of many peoples. A powerful anti-Hitler coalition (USSR, United States, Great Britain) took shape in the course of the war. Allied forces from Poland, Czechoslovakia and Yugoslavia as well as of Bulgaria and Romania, and participants of the resistance movement in the occupied European states fought bravely against a common enemy. But the Soviet Union played the chief role in the defeat of fascist Germany and then of militarist Japan. Throughout the war the Soviet-German front was the chief and deciding front. In four years of war the Soviet Armed Forces routed and captured 607 divisions of the fascist bloc. The fascist German Army suffered over 70 percent personnel losses and up to 75 percent overall losses of tanks, self-propelled guns, artillery and aircraft at the Soviet-German front. It was the country of socialism that broke the enemy's back and saved mankind from the threat of fascist enslavement.

The main hero and creator of the Great Victory was the Soviet people, headed by the Communist Party, who fought at the front with unparalleled courage and heroism and who selflessly worked in the rear. The Great Patriotic War convincingly proved that friendship and brotherhood of USSR peoples are among the most important sources of combat might of our Armed Forces and of their invincibility. There are a great many examples of this. For example, the Brest Fortress was heroically defended by soldiers of over 30 nationalities. Among the Panfilovite heroes were sons of Russia, the Ukraine, Kazakhstan, Kirghizia and other republics. In the 64th Army alone representatives of 30 nationalities fought at the walls of Stalingrad, and how they fought!

The superiority of Soviet military science and art over that of the fascist Army was the most important factor assuring the USSR of victory in the war. The talent of prominent Soviet military leaders who emerged from among the people was widely revealed in grandiose and unprecedented engagements during the Great Patriotic War. They included G. K. Zhukov, A. M. Vasilevskiy, I. S. Konev, K. K. Rokossovskiy, R. Ya. Malinovskiy, N. F. Vatutin, F. I. Tolbukhin, K. A. Meretskov, L. A. Govorov, A. I. Yeremenko, I. Kh. Bagramyan, A. I. Antonov, I. Ye. Petrov, N. G. Kuznetsov, and other famed marshals, generals, admirals and officers who commanded fronts, fleets, armies, corps, divisions, regiments and subunits. Soviet leading military theory, the fundamentals of which were laid down before the war by M. N. Tukhachevskiy, A. I. Yegorov, V. K. Triandafillov, I. P. Uborevich, Ya. I. Alksnis and others, was developed brilliantly in the course of defensive and offensive operations and battles. The Great Patriotic War provided vivid examples of skillfully organized the coordination of the Ground Forces with the Air Force and Navy.

For many countries the defeat of German fascism and Japanese militarism signified not only liberation from a bloody fascist regime, but also the beginning of fundamental transformations on the path to socialism. The victory over fascism lifted up a powerful wave of people's democratic and socialist revolutions. Socialism moved its horizons far apart. A community of socialist states and a world system of socialism formed.

III

The lessons of the Great Patriotic War teach Soviet citizens supreme vigilance above all. A new war cannot be allowed to break out. With present-day development of the weapons of warfare and new weapons of mass destruction, war can lead to the end of civilization, and so war no longer can be a means of attaining the political goals states' and must be eliminated from society's life. The Soviet Union solemnly declared that we never will be first to employ not only nuclear weapons, but also conventional weapons. All of us see and know well the enormous efforts the USSR and other countries of socialism have been making to curb the arms race and the determination with which they are acting to ban and prevent war and have peace on our planet. Especially much has been done in recent years. Soviet-American relations and relations of Warsaw Pact states with countries of the North Atlantic Alliance have improved. The INF Treaty between the USSR and United States for eliminating intermediate and lesser range missiles has been signed, ratified and entered into force. Talks have stepped up in Geneva to reduce strategic nuclear arms and in Vienna to reduce armed forces and conventional arms. The Soviet Union's unilateral initiatives announced by M. S. Gorbachev before the UN General Assembly on 7 December 1988 and the USSR's practical actions to implement provisions of Soviet defensive military doctrine are common knowledge. Many other measures for building confidence among countries and peoples also have been undertaken. International tension has reduced noticeably as a result.

For now, however, this still does not at all mean that the threat of war and military conflicts has disappeared. It is common knowledge that revanchist forces are beginning to raise their heads again and from year to year heads of the U.S. administration and the Pentagon openly declare that with respect to the Soviet Union they have been conducting and intend to continue conducting policy "from a position of strength" and that they will not stop at employing weapons at any point on the planet where in their views a threat to their "vital interests" may arise. Unfortunately these are not just words, but a reality which cannot be ignored. Vietnam, Grenada, Nicaragua, Libya and the Near East are convincing confirmation of this. We must take a no less responsible and serious attitude toward practical U.S. and NATO actions in implementing their outlined programs for arms development and in appreciably building up their military efforts. One cannot help but see now that they are intensively creating a qualitatively new physical base for a so-called conventional war on the basis of a high scientific-technical potential and at the same time they are constantly keeping strategic deterrent forces in a high state of readiness. These are not conjectures at all. They do not spend hundreds of billions of dollars a year for amusement. These are actual U.S. and NATO military programs designed to achieve qualitative military superiority already in the 1990's, which in itself cannot help but be fraught with a threat to peace. Moreover it cannot be forgotten that the North Atlantic Alliance today keeps a grouping of armed forces numbering 3.5 million persons who are well outfitted with modern weapons in a high state of readiness in Europe and in adjoining water areas, a grouping which can grow considerably in a matter of weeks if necessary.

Therefore, one cannot help but consider existing realities in continuing and stepping up the campaign for peace and for a halt to the arms race and calling for a reduction in the parties' armed forces (and this is an urgent necessity in all cases). As we see, as of today imperialism has not yet ceased to represent a constant striving for violence and reaction, as V. I. Lenin pointed out.

Do the ruling circles of leading capitalist states really not see and understand that the Soviet Union really is sincerely striving for peace and is not creating any military threat to anyone whatsoever? They unquestionably see and understand, and even give us friendly praise for this in words. But at the same time they continue to persistently strive to achieve reliable military superiority, they stubbornly conduct a policy of neocolonialism and neoglobalism, and in reality they are implementing a strategy of direct confrontation with countries of socialism and of socialist orientation, not stopping at direct acts of domestic political and social-economic destabilization of the situation in those countries. While imperialism exists and "knits designs" of its expansionist policy, the danger of its aggressive aspirations, predatory wars and armed conflicts remains.

Under these conditions our determined campaign for peace, for peaceful coexistence of states, for relaxing international tension, for stopping the arms race and for preventing war must be combined soberly and skillfully with a constant readiness to offer a worthy, crushing rebuff to any aggressor should it be necessary. In other words, it is impossible and dangerous to lose vigilance, and we still have to "keep our powder dry."

In examining the Great Patriotic War's results and lessons, one cannot help but turn to M. S. Gorbachev's words at the ceremony dedicated to the 40th anniversary of our Great Victory. He said: "Realizing the scope of the military threat and aware of our responsibility for the fate of the world, we will not allow the military-strategic balance between the USSR and United States and between the Warsaw Pact Organization and NATO to be scrapped. We will continue to adhere to this policy, since we have firmly learned once and for all what the past has taught us." What was said is extremely clear and comprehensive and no explanation is needed. I would merely like to emphasize that military exploits and military valor do not go into the reserve or retire. Even today they remain in combat formation, giving the Motherland's present-day defenders inspiration and enthusiasm. It should not be forgotten that together with fraternal armies of other countries of the socialist community, the Soviet Armed Forces now are an important factor of peace on Earth and cannot help but be improved. Our soldiers constantly are on guard and ready should it be necessary to defend the revolutionary transformations occurring in the country and our perestroyka against an aggressor at any minute, and to honorably perform their patriotic and international duty, striving to equal the exploit of those who fought selflessly with unparalleled courage and heroism for their homeland and for the victory of socialism in the stern years of the Great Patriotic War.

New U.S. Secretary of Defense

18010800b Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) p 20

[Article by Col G. Gromov]

[Text] In connection with the U.S. Senate's rejection of the nomination of John Tower as secretary of defense (the Senate having accused him of compromising ties with military-industrial corporations and of dubious personal behavior), President Bush appointed Richard (Dick) Bruce Cheney, a member of the House of Representatives from the state of Wyoming, to this position.

Cheney was born 30 January 1941 in Lincoln, Nebraska. He completed the University of Wyoming in 1966 with a Master of Arts degree (he specialized in economics and political science). For the following two years he studied politics and the work of U.S. state agencies at the University of Wisconsin.

Cheney did not serve in the U.S. Armed Forces, and doubts are expressed in this regard as to his sufficient knowledge of real problems of military organizational development.

Cheney was appointed special assistant to the director of the Office of Economic Opportunity in the R. Nixon administration in 1969, became a White House staff assistant in 1970, and assistant of the President's Cost of Living Council in 1971. In all these positions Cheney worked under the direction of D. Rumsfeld, later U.S. secretary of defense.

In 1974 Cheney was invited to the post of deputy assistant to the President. After Rumsfeld's appointment as secretary of defense in 1975, Cheney received the position of White House chief of staff. He continuously represented the state of Wyoming in the U.S. Congress from 1978 through March 1989.

In the very first years after being elected to the House of Representatives Cheney succeeded in making a reputation for himself as a vigorous, purposeful, competent figure in the Republican Party. In political views he belongs to its right, conservative wing, as attested by his position on a number of key problems in the years he was in the House of Representatives. Cheney invariably voted for increasing military expenditures and carrying out new programs for creating military equipment, including production and deployment of the MX ICBM and construction of the "Ohio"-Class SSBN with new Trident II missiles. He spoke against reducing appropriations for implementing a program to create an ABM system with space-based elements within the framework of SDI. He also voted against a ban on the production of chemical weapons, voted for appropriating funds for assisting "freedom-fighters" in Nicaragua and Angola, and refused to support a law introducing sanctions against the racist regime of South Africa. At the same time the American press notes Cheney's ability to conduct polemics on controversial problems in such a way as not to give the impression of his excessively rightist position or inclination to extreme measures.

It has been announced that as secretary of defense, Cheney intends to follow a course toward further increasing the effectiveness of the Armed Forces and improving their structure and system of combat training so that they give the United States an opportunity to conduct a policy "from a position of strength" in the international arena.

The U.S. Senate approved Cheney's appointment as secretary of defense.

Organization and Operating Tactics of Turkish Army Infantry (Mechanized) Subunits

18010800c Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 21-30

[Article by Col (Res) I. Krymov]

[Text] As in the armies of the majority of world countries, infantry (mechanized) subunits are the basis of Turkish Army large and small combined-arms units. Organizationally they are consolidated into squads, platoons, companies and battalions, which essentially are no different than similar subunits of the U.S. Army and armies of other NATO countries. Their inventory includes pistols, rifles, machineguns, mortars and ATGM's produced under West German licenses by enterprises of the Turkish military industry, as well as antitank rocket launchers, recoilless guns and APC's of American production.

Combat training and day-to-day service in these subunits is arranged basically according to U.S. Army regulations and manuals that have been translated into Turkish, as well as in accordance with recommendations of American military advisers and instructors. The Turkish Army regularly participates in joint exercises and maneuvers of the NATO Allied Forces, during which modern methods of employing weapons and tactical procedures adopted in armies of leading bloc countries are practiced. At the same time, Turkish regulations and manuals have a number of features reflecting the presence of obsolete weapon models in the unit and subunit inventory, the absence of its own nuclear and chemical weapons, the predominance of infantry in the Army, as well as Turkish national interests.

The **infantry squad** (two sections) is the smallest tactical subunit. It consists of 11 persons: the squad leader (a sergeant), two section leaders (Pfc's), two automatic riflemen, two assistant automatic riflemen and four riflemen (all privates). The squad leader is responsible for maintaining military discipline and order in day-to-day service, organizing and conducting combat training, and controlling the squad on the battlefield. The squad is armed with two 7.62-mm automatic rifles and nine 7.62-mm rifles.

The **infantry platoon** (46 persons) also is the smallest tactical subunit. It consists of a headquarters team (aleader—a second or first lieutenant, and two messengers—privates), three infantry squads and a weapon squad. It has a total of two 7.62-mm machineguns, one 88.9-mm antitank rocket launcher, six 7.62-mm automatic rifles, 33 rifles, four 9-mm pistols, and one radio.

The *weapon squad* (ten persons) consists of two machinegun sections and an antitank rocket launcher section. The first includes a machinegunner, his assistant and an ammunition handler and the second includes an operator, assistant operator and ammunition bearer. The squad is armed with two 7.62-mm machineguns, one 88.9-mm antitank rocket launcher, six rifles and one 9-mm pistol.

The **infantry company** is considered by the Turkish command to be the Army's basic combat subunit. It includes a company headquarters (company commander—first lieutenant or captain, company first sergeant—sergeant major, food supply chief—sergeant, armorer—Pfc, clerk—Pfc, and three cooks, two radio operators, two telephone operators and a driver—all privates), three infantry platoons and a weapon platoon (the company organization, numerical strength and number of weapons are given in Fig. 1 and Table 1).

Fig. 1. Infantry company organization

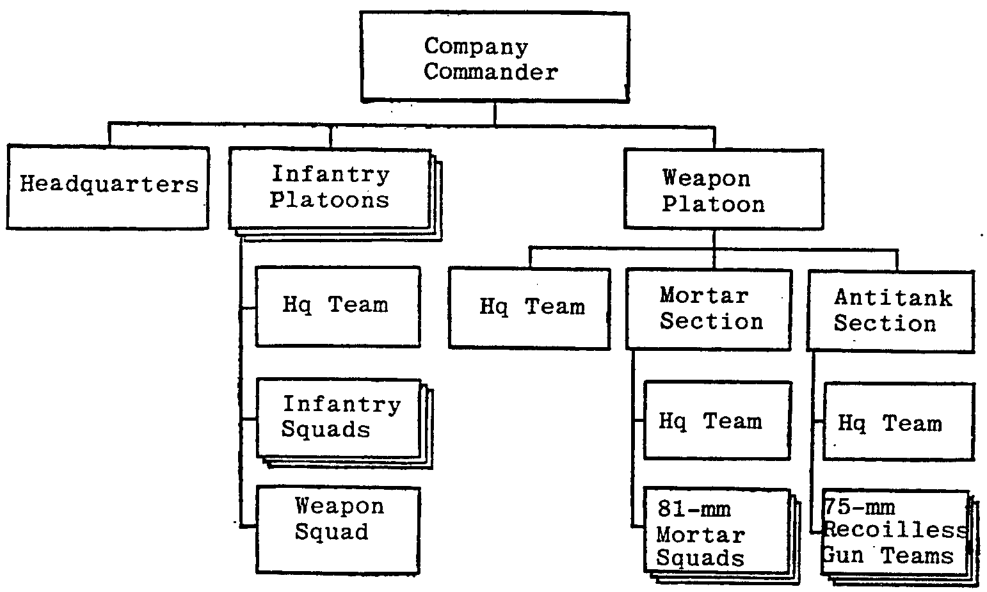


Table 1—Numerical Strength and Number of Weapons of Infantry Company

Personnel and Weapons	Company Hq	3 Infantry Platoons, in Each	Weapon Platoon	Total
Officers	1	1	1	5
Senior NCO's	1	-	1	2
Sergeants and privates	13	45	43	191
Total:	15	46	45	198
81-mm mortars	-	-	3	3
75-mm recoilless guns	-	-	3	3

Table 1—Numerical Strength and Number of Weapons of Infantry Company

Personnel and Weapons	Company Hq	3 Infantry Platoons, in Each	Weapon Platoon	Total
88.9-mm antitank rocket launchers	-	1	-	3
7.62-mm machineguns	-	2	-	6
7.62-mm automatic rifles	-	6	-	18
7.62-mm rifles	13	33	29	141
9-mm pistols	2	4	13	27
Radios	5	1	11	19
Telephone sets	2	-	-	2
Vehicles	1	-	6	7

The *weapon platoon* (45 persons) includes a headquarters team (platoon leader—second or first lieutenant, assistant platoon leader—sergeant, and driver); a mortar section, which includes a headquarters team (section leader—senior NCO, three forward observers—sergeants, two firing data preparation specialists—Pfc's, and four radiotelephone operators—privates) and three mortar squads (each with a squad leader—sergeant, gunner—Pfc, assistant gunner—private, and three ammunition bearers—privates); an antitank section with a headquarters team (section leader—sergeant, driver—private) and three 75-mm recoilless gun teams (each with a gun commander—sergeant, gunner—Pfc, assistant gunner—private, ammunition bearer—private). It is equipped with three 81-mm mortars, three 75-mm recoilless guns, 29 7.62-mm rifles, 13 pistols, six vehicles and 11 radios.

The **infantry battalion** is considered the basic tactical subunit of infantry regiments of infantry divisions, type A and B infantry divisions (they are also called mechanized divisions), as well as separate infantry brigades. It consists of a command element and staff, headquarters and service company, three infantry companies and a support company.

The *command element and staff* include the battalion commander (major or lieutenant colonel), assistant commander (captain or major), transportation chief (captain), supply chief (first lieutenant or captain), officers for personnel and ideological work and for intelligence and counterintelligence (lieutenants), battalion physician, and adjutant (second lieutenant or lieutenant).

The *headquarters and service company* consists of a company head-quarters (a commander—captain or major, company first sergeant—sergeant major, NBC instructor—senior NCO, driver-mechanic, armorer—senior NCO, two supply personnel—sergeants, senior clerk—senior NCO, driver-radio operator, driver-clerk, driver and two messengers—privates) and four platoons (headquarters, staff, signal, and supply and maintenance).

The *support company* includes a headquarters (company commander—captain, assistant company commander, company first sergeant, NBC instructor, supply specialist, two weapon repair technicians, two equipment repair tech-nicians, driver-mechanic, senior clerk, driver, driver-clerk, radio operator, three drivers) and four platoons: one mortar platoon (three mortar squads), two antitank platoons (each with three recoilless gun squads) and a machinegun platoon. The battalion organization, numerical strength and number of weapons are given in Fig. 2 and in Table 2.

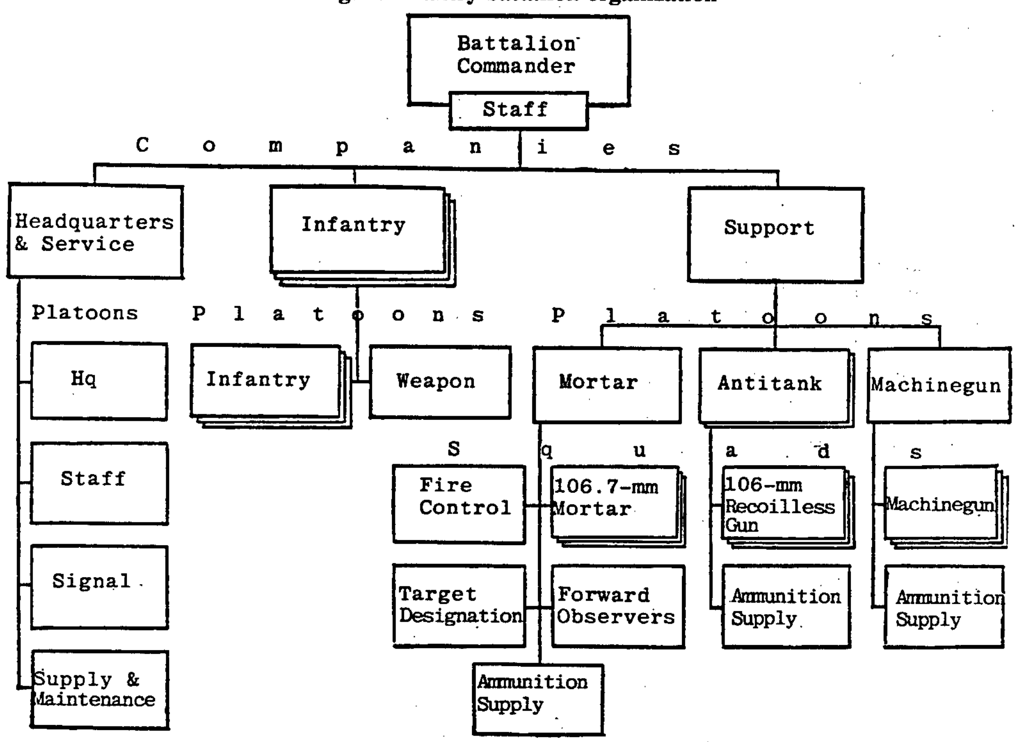
Table 2—Numerical Strength and Number of Weapons of Infantry Battalion

Personnel and Weapons	Command Element and Staff	Headquarters and Service	Companies 3 Infantry, in Each	Support	Total
Officers	8	5	5	6	34
Senior NCO's	4	16	2	22	48
Sergeants and privates	8	163	191	98	836
Total:	20	184	198	126	918
106.7-mm mortars	-	-	-	3	3
81-mm mortars	-	-	3	-	9
106-mm recoilless guns	-	-	-	6	6
75-mm recoilless guns	-	2	3	-	11
88.9-mm antitank rocket launchers	-	4	3	4	17
7.62-mm machineguns	-	1	6	3	22

Table 2—Numerical Strength and Number of Weapons of Infantry Battalion

Personnel and Weapons	Command Element and Staff	Headquarters and Service	Companies 3 Infantry, in Each	Support	Total
11.43-mm submachineguns	2	16	-	12	30
7.62-mm automatic rifles	-	-	18	-	54
7.62-mm rifles	8	147	141	96	674
9-mm pistols	10	21	27	18	130
Radios	-	23	19	10	90
Telephone sets	-	10	2	8	24
Vehicles	-	47	7	15	83

Fig. 2. Infantry battalion organization



The foreign military press reports that mechanized subunits are part of armored regiments (of type A infantry divisions), mechanized regiments (of type B infantry divisions and mechanized divisions) and mechanized battalions (of separate mechanized and armored brigades). They differ from infantry subunits basically in that their inventory includes APC's, which number 100, 160 and 500 respectively in the above divisions and around 90 in the brigades, judging from foreign press data.

The **mechanized squad** is the smallest tactical subunit. It numbers 12 personnel (a leader—senior NCO, assistant leader and APC commander—sergeant, and two machinegunners, two rocket launcher operators, five riflemen and a driver—privates), two 7.62-mm machineguns, two 66-mm rocket launchers, submachineguns, and rifles.

The **mechanized platoon** (46 persons) also is considered the smallest tactical subunit. It has a headquarters team (platoon leader—second or first lieutenant, assistant platoon leader—senior NCO, driver-mechanic—senior NCO, NBC instructor—senior NCO, radio operator, messenger, two rocket launcher men and two riflemen) and three mechanized squads. It has a total of three 7.62-mm machineguns, four 88.9-mm antitank rocket launchers, five submachineguns, 33 rifles, eight pistols, four M113 APC's and ten radios.

The **mechanized company** is the basic combat subunit. It is part of mechanized battalions of mechanized and armored regiments of mechanized and infantry divisions (types A and B), as well as of mechanized battalions of separate mechanized and armored brigades. The company includes a headquarters (similar to the infantry company) and three mechanized platoons (the number of personnel and weapons is given in Table 3).

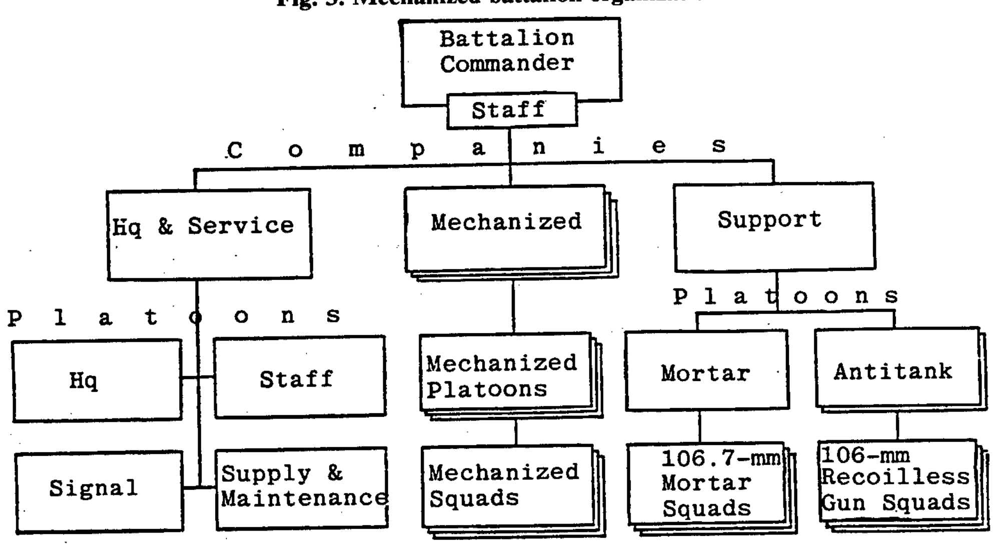
Table 3—Numerical Strength and Number of Weapons of Mechanized Battalion

Personnel and Weapons	Command Element and Staff	Companies Headquarters and Service	3 Mechanized, in Each	Support	Total
Officers	8	5	4	3	28
Senior NCO's	4	16	7	18	59
Sergeants and privates	8	163	142	86	683
Total:	20	184	153	107	770
106.7-mm self-propelled mortars	-	-	-	3	3
106-mm recoilless guns (on jeeps)	-	-	-	6	6
M113 APC's	2	1	13	2	44
66-mm antitank rocket launchers	-	4	12	4	44
7.62-mm machineguns	3	9	9	-	39
11.43-mm submachineguns	2	16	16	18	84
7.62-mm rifles	8	147	99	76	528
9-mm pistols	10	21	69	13	251
Radios	-	23	33	8	130
Telephone sets	-	10	2	2	18
Vehicles	-	47	4	12	71

The **mechanized battalion** is considered the basic tactical subunit of mechanized and armored regiments of mechanized and infantry divisions (types A and B), as well as of separate mechanized and armored brigades. It includes a command element and staff (the same as in the infantry battalion), a headquarters and service company, support company, and three mechanized companies (the organization, numerical strength, and number of weapons are given in Fig. 3 and in Table 3).

infantry (mechanized) subunits are capable of penetrating an enemy defense, destroying his personnel and equipment, conducting a pursuit, negotiating water obstacles, and taking territory and individual objectives; and on the defense they are capable of repelling enemy attacks and firmly holding occupied positions. As a rule, infantry (mechanized) subunits fight in dismounted formation. With a rapid enemy withdrawal, they are capable of organizing pursuit on

Fig. 3. Mechanized battalion organization



OPERATING TACTICS. Turkish regulations consider the infantry (mechanized infantry) as one of the main arms of the Army. In an attack from the move and in coordination with and supported by tanks, artillery, army and tactical aviation and other combat arms, APC's, other vehicles or tanks. They can be employed most effectively for holding strongpoints in the defense and fighting in the woods, on wooded mountainous terrain, in populated points and on water lines both day or night in any weather conditions.

The **infantry (mechanized)** squad operates in the attack usually as part of the platoon in dismounted formation or on an APC (see color insert [color insert not reproduced]). During operations in dismounted formation the squad can advance with a frontage of 50-100 m. While in the company concentration area before an attack, a squad is disposed in one place or in 2-3 groups depending on the situation, organizes surveillance and takes safety measures. The concentration area can be equipped with personnel shelters and be camouflaged. The squad leader receives the combat mission from the platoon leader, checks personnel readiness and weapon serviceability, and issues the attack order, which gives specific information about the enemy; the squad mission and procedure of operations (direction of attack; method of moving up to the assault position, which is designated 100-150 m from the enemy's main line of resistance; the assault objective; and procedure for conducting fire and providing artillery support); logistic support; locations of medical post and decontamination station; procedure for collecting wounded and victims; and organization of communications and coordination with adjacent units.

The movement to contact begins from the moment the squad crosses the line of departure (300-1,000 m from the enemy's main line of resistance). This is done surreptitiously, with maximum use of terrain relief. Depending on the nature of enemy fire pressure, the squad can move up to the assault position dispersed in columns by sections or in an extended line. If the enemy's fire prevents advancing at full strength, the squad can use the "infiltration" method, where every soldier surreptitiously advances to the assault position at a time set by the squad leader, taking maximum advantage of terrain conditions. The assault is launched at a command or signal from the squad leader.

To carry out an attack in dismounted formation the squad deploys into an extended line, and with a shout of "Allah, Allah!" it gets up simultaneously and rushes toward the assault objective. The squad leader is behind the squad in order to better observe the battlefield and control squad actions, while section leaders move at the head of their sections. The squad is controlled by voice or by signals; the squad leader maintains communications with the platoon leader by radio. On reaching the assault objective the squad peppers it with grenades and destroys personnel by fire, bayonets and butts. On taking the designated objective the squad continues the attack or organizes a defense and prepares to repel enemy counterattacks. When attacking with attached tanks, the squad advances behind them under their cover and first destroys enemy antitank weapons.

The **infantry (mechanized) squad in the defense** usually operates as part of a platoon, defending a position in the platoon strongpoint. Position frontage depends on the mission assigned, nature of enemy operations, and terrain relief and can be 50-125 m. The squad position includes infantry emplacements, emplacements for the squad leader and section leaders, and shelters and cover for personnel. Artificial obstacles and antipersonnel and antitank minefields are emplaced and antitank obstacles are organized ahead of the forward edge of the battle area [FEBA]. The squad prepares an alternate position along with the main position.

After issuing the defense order, the squad leader arranges observation, the digging and preparation of emplacements, trenches and connecting passages, and clearing of fields of fire; establishes contact with adjacent subunits and support subunits; and takes steps to ensure security and camouflage. A duty observer remains at the position during enemy fire preparation, while the others are in shelters. After fire preparation is over the personnel quickly occupy their emplacements and prepare to repel an attack. When the enemy closes to within range of effective fire of available weapons, the personnel open fire at the leader's command, increasing its intensity as the enemy advances to the FEBA.

Enemy tanks are destroyed by the fire of antitank weapons, and infantry accompanying the tanks is destroyed by small arms fire and grenades. In case tanks penetrate, the squad destroys them by all available means in coordination with adjacent units, cutting off the infantry at the same time. If the enemy wedges in, a portion of the squad withdraws to the alternate position and attempts to restore the position by joint efforts with other platoon subunits.

The **infantry (mechanized) platoon in the attack** usually fights as part of the company, operating in the first or second echelon (or reserve). Operating on the main axis, it can be reinforced by a mortar squad and antitank weapons. In the company first echelon the infantry (mechanized) platoon will advance with a frontage of 150-300 m from the move or after occupying a line of departure, depending on the nature of enemy operations. The platoon combat formation usually is organized in a line of squads (three squads in the first echelon or with one squad assigned as a reserve). The assault on the enemy's main line of resistance can be conducted in dismounted formation or on APC's in line, in an echelon left or right, or in an arrowhead or inverted arrowhead, employing various forms of maneuver. The infantry platoon weapon squad is at the platoon leader's disposal; it is recommended that its weapons be used to support the squad delivering a frontal attack.

The **infantry (mechanized) platoon in the defense** can be in the company first or second echelon (or reserve). To occupy a defense the platoon usually organizes a strongpoint (450 m wide and 200 m deep), which is the basis of the company strongpoint. Artificial obstacles and antipersonnel and antitank minefields are placed ahead of it, and main and alternate positions are prepared for APC's.

A platoon defending in the first echelon has the mission of inflicting maximum losses on the enemy and preventing him from penetrating the FEBA and capturing the platoon strongpoint. The platoon performs this mission in coordination with other company subunits as well as with attached and supporting forces and assets.

A platoon in the company second echelon (or reserve) gives fire support to first echelon platoons, secures the company flanks and rear and, in case the enemy penetrates, destroys him or throws him back by a counterattack to restore the initial position.

The **infantry (mechanized) company in the attack** operates as part of the battalion in the first or second echelon (or reserve). It can be reinforced by tanks, antitank weapons and mortars. The company combat formation is organized in one or two echelons depending on the nature of the enemy defense and the combat mission. The attack can be conducted from the move or after preliminary preparation with occupation of a concentration area. In dismounted formation the company usually advances with a frontage of from 1 to 1.5 km, and on APC's with a frontage of from 1.5 to 2 km. The company is assigned an immediate (1-1.5 km) and final (up to 3 km) assault objective. A company attack is preceded by the senior commander's fire preparation (approximately 30 minutes). With the arrival of the company first echelon at the assault position, artillery and mortar fire is shifted into the depth and the company assaults the enemy under its cover.

Turkish regulations note that having wedged into the defense, platoons of the company first echelon must develop the attack swiftly and try to destroy the opposing enemy. The company second echelon (reserve) moves forward after the first echelon at a distance ensuring timely commitment. Success of the company attack is ensured by continuous fire of supporting weapons. This is achieved by swift, timely change of firing positions and proper displacement of weapons during combat. It is recommended that mortar firing positions be changed so that two-thirds support the advancing infantry while one-third are changing positions.

After executing the assigned mission the company can consolidate in the captured position and prepare to repel enemy counterattacks or continue the attack.

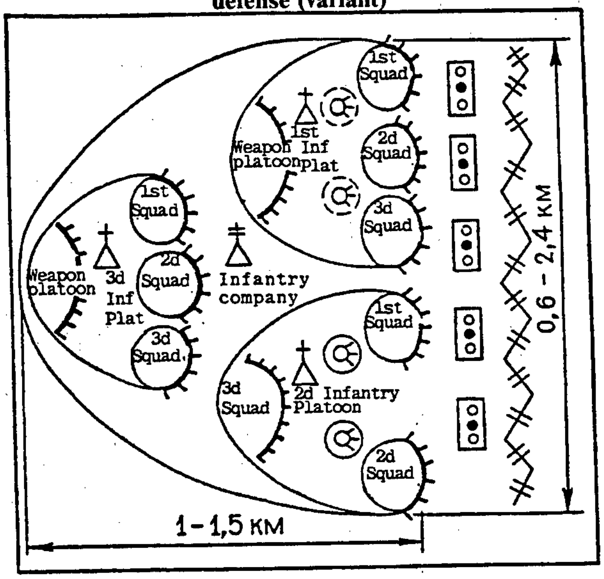
As a rule, the weapon platoon is employed in a centralized manner in the entire company's interests, but in some cases a portion of its organic and attached weapons can be resubordinated directly to commanders of infantry or mechanized platoons.

The **infantry (mechanized) company in the defense** (Fig. 4) operates as part of the battalion in its first or second echelon (or reserve). It also can defend a switch position or be in the regiment's (or division's) combat outposts.

Depending on the nature of terrain and the combat formation, a company in the first echelon of the battalion defense area can defend a company strongpoint 600 m-2.4 km wide and 1-1.5 km deep with field fortification and prepared for a perimeter defense.

A company in the second echelon (or reserve) is assigned a defense area 1.5-2 km wide and up to 2 km deep. In organizing the defense at a switch position, the company receives a position up to 2 km wide. In drawing up the fire support plan, its commander must consider the need to lay down a fixed barrage ahead of his FEBA, with the width of the barrage zone for one 81-mm mortar being 50 m, for three 81-mm mortars 100 m, for three 106.7-mm mortars 200 m, and for a battery of 105-mm howitzers 200 m.

Fig. 4. Infantry company combat formation in the defense (variant)



Local security (observation and listening posts) 400-500 m from the FEBA usually is assigned from a company defending in the battalion first echelon for operations in the forward defense area. Boundaries and flanks are secured by patrols.

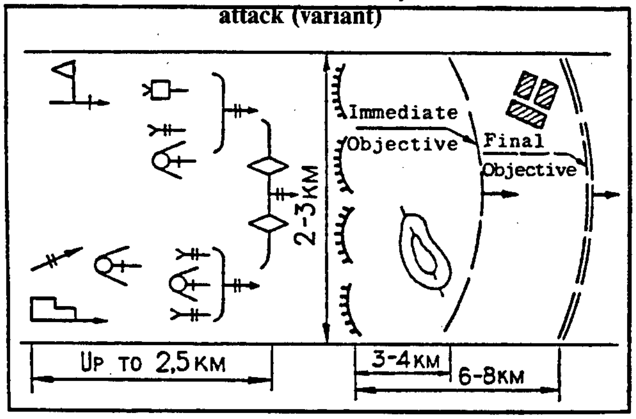
A company on defense is assigned the mission of inflicting maximum losses on the enemy, repelling his assaults and preventing penetration of the defense area in coordination with battalion subunits as well as with attached and supporting weapons. But if penetration has occurred, the company commander concentrates the fire of all available weapons on the enemy and tries to halt his further advance, and then he counterattacks with forces of the second echelon or reserve, destroys the enemy and restores the position. After repelling an assault the company commander must restore the fire plan, replenish the store of ammunition, restore defensive works and field fortifications, then prepare to repel repeat enemy assaults. The company may withdraw or disengage only by order of the battalion commander.

Weapons of the weapon platoon ordinarily are used in a centralized manner in the interests of the entire company. Firing positions are chosen for the 81-mm mortar section in the rear of the company defense area. The recoilless gun section is used by the company commander for screening likely avenues of tank approach.

The **infantry (mechanized) battalion in the attack** can operate as part of the regiment (or brigade) in its first or second echelon (or reserve), advance on the main or a secondary axis, or fight independently. In advancing in the regimental first echelon and on its main axis, the battalion can be reinforced with one or two tank companies, a battery of 105-mm (155-mm) howitzers, a company of 120-mm mortars, and antitank and reconnaissance subunits (the battalion's organic forces and assets with attached subunits form a battalion combat team).

The battalion is assigned an immediate and final assault objective; their distance from the FEBA can be 3-4 and 6-8 km respectively (Fig. 5).

Fig. 5. Combat formation of infantry battalion in the attack (variant)



The attack frontage of the battalion (2-3 km) is determined by the regimental (brigade) commander based on the assigned mission, availability of fire support assets, opposing enemy forces, place in the regimental (brigade) combat formation and situation.

The combat formation is aligned so as to ensure flexible, reliable control of subunits and their dispersal and to create a superiority over the enemy where the situation should require it. Depending on the method of launching an attack and the nature of the enemy defense, the combat formation is aligned in one or two echelons, echelon right or left, or in an arrowhead or inverted arrowhead. A combat formation in two echelons, two companies with attached tanks and antitank weapons in the first and one company with fire support assets in the second (reserve), is considered the most typical.

The battalion commander begins organizing the attack after receiving the combat mission from the regimental or brigade commander. Depending on the situation and availability of time, he gains a clear understanding of the combat mission, issues warning orders to subordinates, performs a time breakdown, estimates the situation, makes the decision and issues the combat order. The order gives information about the enemy, mission of the regiment or brigade, time for beginning the attack, mission to attached and supporting subunits, battalion mission and battle plan, missions for subordinate subunits, NBC measures, organization of reconnaissance and security, line of departure and procedure for moving up, questions of logistic support, organization of communications and command and control, command post location, and procedure for its displacement. As a rule fire preparation, in which battalion assets also participate, is conducted before the beginning of an assault on a deliberate enemy defense.

In accordance with provisions of regulations, on reaching the assault position the battalion must swiftly launch an assault, destroying enemy personnel and weapons. It is recommended that the attack be conducted decisively at a fast pace from objective to objective. It is prescribed that strongpoints offering heavy resistance be bypassed or destroyed by flank and rear attacks. On taking the immediate objective, first echelon companies replenish ammunition and restore coordination if necessary, and continue the attack. To build up success and maintain the rate of advance, a battalion commander can commit the second echelon, and in case of an enemy withdrawal he organizes pursuit so that he cannot occupy a defense at a new position. With the capture of the final objective the battalion consolidates at this position and prepares to repel enemy counterattacks and to continue the attack or assume a defense.

The battalion support company usually is immediately subordinate to the commander and is intended for fire support of first echelon companies, for repelling counterattacks and for performing other missions in the battalion's interests. In the dynamics of combat its subunits operate in gaps between first echelon companies and, as a rule, behind their combat formations.

The **infantry (mechanized) battalion in the defense** functions as part of the regiment or brigade in its first or second echelon (or reserve). In some cases it can execute missions independently. It is assigned a defense area 2.5-3 km wide and up to 2.5 km deep.

The battalion combat formation is aligned in one or two echelons. A combat formation in two echelons is considered the most typical: two companies in the first and one in the second echelon (or reserve). Depending on the situation, availability of forces and assets, the mission and its place in the regimental combat formation, a battalion can be given the attachment of one or two tank companies, one or two batteries of 105-mm (155-mm) howitzers, a combat engineer platoon, and ATGM and AAA subunits.

After receiving the order the battalion commander and his staff draw up a defense plan which includes a plan for maneuver of forces and assets and a fire support plan. A maneuver plan determines the tactically most important terrain sectors, where strength of the defense of the area as a whole depends on holding them; assigns forces and assets for holding the FEBA and subunits for combat outposts; outlines measures for antitank, antiaircraft, antilanding and NBC defense; clarifies questions of command and control of subunits; and prepares variants of counterattacks in case the enemy wedges into the defense.

The fire support plan gives special attention to organization of the fire plan, best use of terrain, provision for mutual support of subunits, and maximum use of natural obstacles and barriers.

A battalion in the second echelon (or reserve) of the regiment or brigade performs missions of destroying an enemy who has wedged into the defense, screening flanks in case he breaks through in adjacent sectors, and conducting counterattacks with the objective of destroying the enemy and restoring the initial position. Usually the battalion is dispersed near the defense area it has prepared, in readiness to occupy it rapidly or move up to a line of departure and conduct a counterattack.

It is recommended that the battalion support company be employed in the interests of the entire battalion. Antitank weapons (106-mm recoilless guns) are disposed on avenues of likely tank approach as close as possible to the FEBA to have an opportunity of destroying enemy tanks on distant approaches.

Belgian I Army Corps Exercise

18010800d Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 30-33

[Article by Col A. Simakov and Maj S. Blagov]

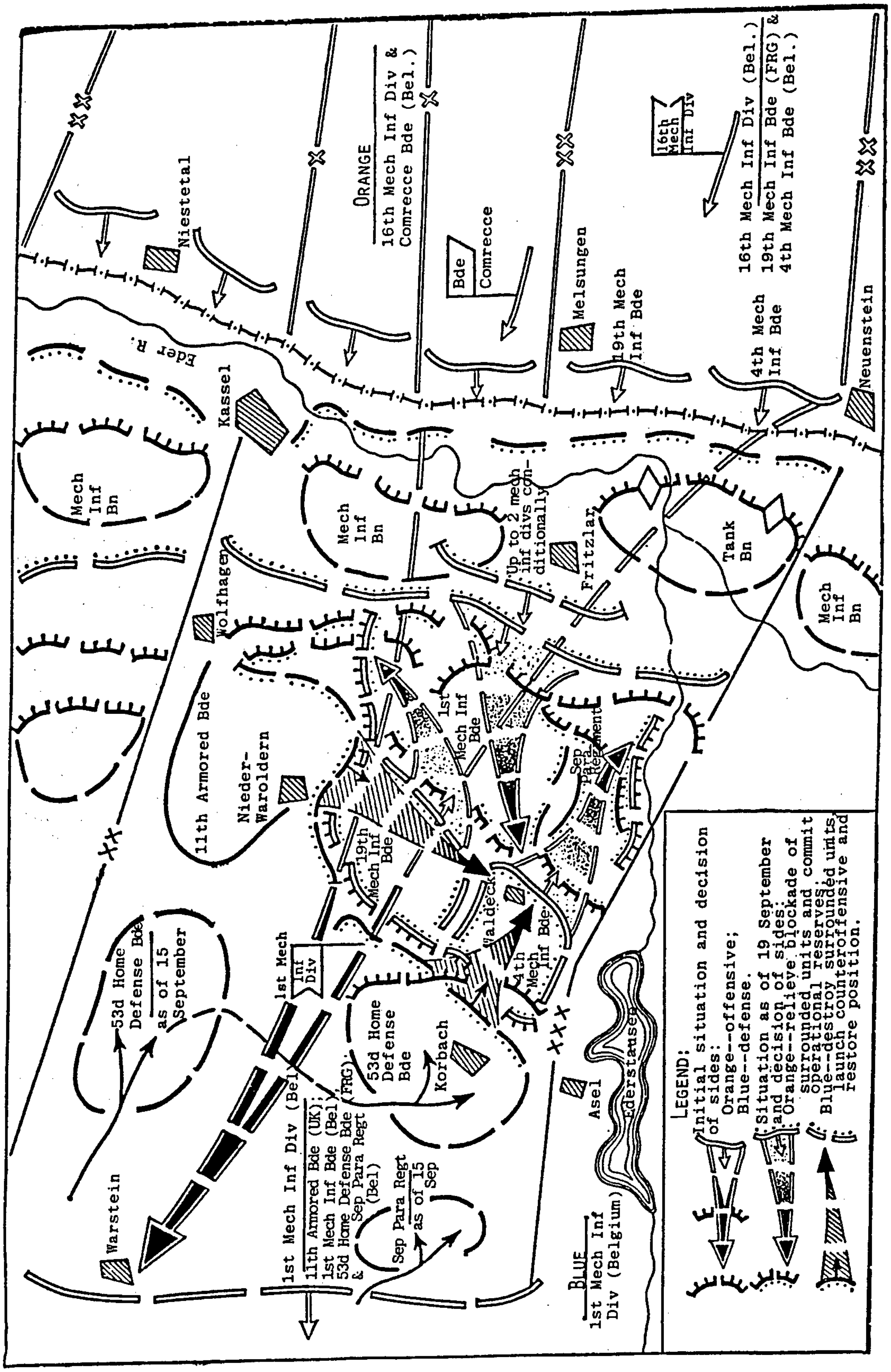
[Text] An operational-tactical exercise of the Belgian I Army Corps codenamed Golden Crown was held in the period from 12 through 23 September 1988 at the boundary of the lands of Hessen, Niedersachsen and Nordrhein-Westfalen (FRG) with the participation of FRG and UK units and subunits (see diagram). Its objective was to check and update certain elements of the operations plan for employing the army corps during operations of the initial period of a limited war in Europe as part of the Northern Army Group and to train staffs and troops to conduct various kinds of combat operations and organize the coordination and supply of large and small units of a coalition makeup.

The I Army Corps Headquarters, 1st Mechanized Infantry Brigade of 1st Mechanized Infantry Division, 4th Mechanized Infantry Brigade of 16th Mechanized Infantry Division, separate units and subunits of corps subordination and a separate commando parachute regiment were used for the exercise on the Belgian side; the 19th Mechanized Infantry Brigade of 7th Tank Division and the 53d Home Defense Brigade from the West German side; and the 11th Armored Brigade of 4th Armored Division from the British side. A total of 29,470 personnel (19,550 Belgian servicemen, 6,420 from the Bundeswehr, and 3,500 from the UK), 346 combat tanks (160, 100 and 86 respectively), 180 ATGM launchers, 127 field artillery pieces (100-mm caliber and up), and 75 combat helicopters including 15 antitank helicopters were active in this exercise. During the exercise 225 tactical air sorties were flown in the interests of army units and subunits as part of the NATO Allied Air Forces Exercise Cold Fire-88 in the Central European theater.

The 16th Mechanized Infantry Division (made up of the 4th Mechanized Infantry Brigade and separate units of the Belgian I Army Corps and the FRG 19th Mechanized Infantry Brigade) as well as the Comrecce Brigade constituted from separate subunits of corps subordination operated on the Orange side. On the Blue side was the 1st Mechanized Infantry Division (1st Mechanized Infantry Brigade and a separate commando parachute regiment of Belgium, the UK 11th Armored Brigade, and the FRG 53d Home Defense Brigade) and separate division and corps support and combat service support units and subunits. The Orange force grouping was commanded by Maj Gen Verstraeten, commander of the 16th Mechanized Infantry Division, and the Blue force grouping was commanded by Maj Gen Gusbin, commander of the 1st Mechanized Infantry Division. Lt Gen Deporter, commander of I Army Corps, had overall direction of the exercise.

In accordance with the exercise concept the Orange (the "enemy") surreptitiously conducted a redeployment under the guise of an exercise and suddenly crossed the Blue state border (it conditionally ran along the line Niestetal, Melsungen, Neuenstein and further south) with the objective of defeating troops of the Blue first echelon, supporting the commitment of operational reserves and seizing important economic and military objectives in the depth of the territory. Conducting delaying combat operations in the border area, the Blue withdrew to previously prepared defensive lines, on which they halted the Orange offensive. During defensive actions the Blue regrouped forces and, with the arrival of second echelons and reserves, launched a counteroffensive, inflicted defeat on the Orange forces and restored the initial position.

The exercise took place in three phases. Before it began (2-12 September 1988) there was a check of unit and subunit combat readiness at permanent stations as well as of the technical condition of weapons and military equipment. In the first phase (12-13 September 1988) the troops executed a march to concentration areas. Such missions as organizing and conducting combat operations were accomplished during the second phase (14-21 September 1988). From 14 through 17 September the Orange practiced problems of the offensive and the Blue practiced problems of conducting delaying and defensive actions. During 19-21 September the Blue attempted to destroy an encircled "enemy" force grouping, launch a counteroffensive together with approaching reserves and restore the position along the "state border"; the Orange attempted to relieve the blockade of encircled troops, support commitment of operational reserves and develop a further offensive westward. In the third phase (22-23 September 1988) the troops prepared for a march and then returned to permanent stations.


ORANGE
16th Mech Inf Div &
Comrecce Bde (Bel.)
16th Mech Inf Div
16th Mech Inf Div (Bel.)
19th Mech Inf Bde (FRG) &
4th Mech Inf Bde (Bel.)
Bde
Comrecce
Niestetal
Melsungen
19th Mech Inf Bde
4th Mech Inf Bde
Neuenstein
Eder R.
Kassel
Mech Inf Bn
Mech Inf Bn
Up to 2 mech inf divs conditionally
Fritzlar
Tank Bn
Mech Inf Bn
Wolfhagen
11th Armored Bde
Nieder-Waroldern
1st Mech Inf Bde
Sep Para Regiment
19th Mech Inf Bde
Waldeck
4th Mech Inf Bde
1st Mech Inf Div
53d Home Defense Bde as of 15 September
53d Home Defense Bde
Korbach
Asel
Ederstausee
Warstein
1st Mech Inf Div (Bel
11th Armored Bde (UK);
1st Mech Inf Bde (Bel);
53d Home Defense Bde (FRG)
& Sep Para Regt (Bel)
Sep Para Regt as of 15 Sep
BLUE
1st Mech Inf Div (Belgium)
LEGEND:
Initial situation and decision of sides:
Orange--offensive;
Blue--defense.
Situation as of 19 September and decision of sides:
Orange--relieve blockade of surrounded units and commit operational reserves;
Blue--destroy surrounded units, launch counteroffensive and restore position.

The active phase of the exercise began on the morning of 15 September. The Orange initiated military operations by delivering missile and air strikes and crossed the "state border." The 16th Mechanized Infantry Division advanced in the direction of Fritzlar-Warstein in a 27-km zone. Its combat formation was aligned in one echelon with the assignment of a reserve. Subunits of the Comrecce Brigade (two tank and two reconnaissance battalions) reinforced by an artillery battalion advanced on the right flank, the FRG 19th Mechanized Infantry Brigade in the center, and the Belgian 4th Mechanized Infantry Brigade on the left flank. In the course of border fighting the Orange succeeded in crossing the security area, moving up to the FEBA in some areas and wedging into the Blue defense to a depth of 3-4 km by committing brigade reserves, and then continued the offensive. By the end of 15 September, having uncovered the absence of immediate Orange reserves and having receiving reinforcements, the Blue decided to encircle the wedged-in force grouping. According to the plan of combat operations it was proposed to use delaying actions to draw the advancing enemy into the friendly defense and surround him by surprise counterblows from the flanks. In carrying out this plan the Blue 1st Mechanized Infantry Division conducted delaying actions with a portion of the forces and, having taken up a defense on a previously prepared line (Friedrichshaue, Wolfhagen, Nieder-Waroldern, Oberwerbe, Asel), stopped the Orange advance by the end of 16 September. The division defense area was up to 40 km wide and up to 60 km deep and the combat formation was aligned in two echelons: the 1st Mechanized Infantry Brigade and 11th Armored Brigade were in the first echelon and the 53d Brigade and separate commando parachute regiment in the second echelon. During delaying actions the 1st Mechanized Infantry Brigade supported the deployment and occupation of a defense by 53d Brigade, after which it was removed to the reserve to be brought up to strength.

On the night of 16/17 September the 1st Mechanized Infantry Brigade delivered surprise counterblows in coordination with the 11th Armored Brigade (on the left flank) and the separate commando parachute regiment (on the right flank) and by day's end completed encirclement of units of the 19th and 4th mechanized infantry brigades operating in the Orange first echelon. Simultaneously the Blue command began moving up operational reserves for final defeat of the encircled forces (conditionally) and for preparing a counteroffensive. Having begun moving up second echelons and reserves (conditionally), the Orange attempted to relieve the blockade of encircled units and continue the offensive by joint efforts. During 19-20 September the encircled force grouping used a portion of the forces (three battalions) to delay operations of the 11th Armored Brigade and 53d Home Defense Brigade. The others conducted combat operations to break the ring of encirclement with the objective of linking up with approaching second echelon units. By the end of 19 September the ring of encirclement had been broken, but the Orange could no longer conduct active combat operations. By this time, having regrouped forces, the Blue launched a counteroffensive. By the end of 20 September the Orange was forced to withdraw to initial positions and the Blue restored the initial position along the "state border." The active phase of the exercise concluded with this.

The western press noted that a number of features were identified during the exercise. In particular, this exercise was conducted by the "free game" method, which allowed a retreat from the initial concept and gave commanders greater initiative in decision-making in connection with the situation at hand. For example, taking into account the existing situation by the end of 16 September, the Blue command authority decided to conduct a counterattack on the morning of 17 September instead of 19 September as under the preliminary plan.

There was wide resubordination of subunits between large or small units of various nationality during the exercise. In particular, Belgian subunits were attached to West German and British brigades and an FRG tank company was attached to the Belgian Comrecce Brigade.

The combat mission for a subunit or unit usually gave sector boundaries; the objective (or area) which had to be taken in the offensive or to be held on the defense; time for executing the mission; and means of reinforcement. The width of the zone of advance for brigades was 6-12 km and for battalions 3-5 km. On the defense brigades occupied a terrain sector of up to 13 km in frontage and the battalions 6-8 km. The Orange was given up to three days to execute the mission of taking objectives at a depth of 70-80 km. The 1st Mechanized Infantry Division was assigned the mission of holding the defense for 72 hours, and first echelon brigades for 36 hours.

In the leadership's assessment, basic objectives of the I Army Corps operational-tactical exercise were achieved on the whole.

Plan for Establishing a Franco-West German Defense Council and Composite Brigade

18010800e Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 33-34

[Article by Col A. Alekhin]

[Text] An agreement establishing a Franco-West German defense council and composite brigade was signed in Paris in January 1988 within the framework of developing and deepening military-political cooperation between France and the FRG. The agreement emphasizes that the formation of this entity is dictated by the need to demonstrate responsibility for the fate of both countries and for further development of military ties. The council makeup includes the president of France, the FRG chancellor, ministers of foreign affairs and of defense of both states, the French chief of staff of the armed forces and the Bundeswehr general inspector. It has been determined that other responsible persons both of government and of military control entities can be involved in work on the council. It is planned to convene the defense council twice a year alternately in the FRG and France. A secretariat permanently located in Paris and three special groups became its working entities.

It is envisaged that defense council sessions will examine and coordinate plans for military organizational development of the states, questions of organizing and conducting joint operational and combat training of the armed forces, and views on their combat employment and operational-strategic employment in a crisis period and in wartime. It is proposed that special emphasis be placed on developing military-technical relations, including the organization of joint military-scientific research and the development and production of weapons and military equipment. The defense council also will be responsible for coordinating French and FRG positions on the most important problems of foreign and military policy. The agreement was ratified in late 1988.

A separate point in the agreement notes the defense council's right to establish a Franco-West German composite brigade, the organization and establishment of which was examined at a summit meeting (the brigade is to be constituted in late 1991). It is to include a headquarters (a total of 60 persons, 30 from each country); a headquarters company and supply battalion, which will be manned by an equal number of personnel of the West German and French armies; a mechanized infantry regiment and armored cavalry regiment from France; as well as a mechanized infantry battalion and artillery battalion from the FRG. The brigade's numerical strength is 4,200 persons and the headquarters is at Boeblingen (near Stuttgart, FRG). The press notes that units and subunits of the French forces being transferred to the brigade will be moved into West Germany.

French Brigadier General J. Sengeisen has been appointed brigade commander and Bundeswehr Col H. Wassenburg is his deputy. It is planned to replace the command element every two years. Subsequently a Bundeswehr representative will be the brigade commander and a Frenchman his deputy, and so on.

The complete set of brigade missions has not yet been determined. It is assumed that the brigade will be employed to support the deployment of French forces on FRG territory, to screen the rear zone, and for joint training by personnel of the French forces and Bundeswehr. The brigade's accomplishment of a number of other missions in NATO interests also is not precluded.

The leadership of France and the FRG highly regards the idea of establishing this brigade. In the opinion of the French president, the Franco-West German alliance is the prototype of a European defensive system, and the joint military formation is an embryo of future Western European armed forces.

Meteorological Support for U.S. Air Traffic Control Entities

18010800f Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 35-39

[Article by U. Travin]

[Text] U.S. air traffic control [ATC] entities have to promptly allocate the country's air space by time among 187,000 aircraft of various departments, companies and private individuals taking off from 14,000 airfields. This very difficult task also is complicated by the fact that weather constantly makes its own adjustments to the work of ATC entities.

In the assessments of American specialists, disruptions in air traffic schedules just on domestic air routes because of adverse weather conditions produce annual losses of up to $260 million. In addition, one mean statistical air catastrophe involving an aircraft entering a zone of dangerous weather phenomena does financial damage exceeding $125 million and takes a hundred human lives.

Studies by experts in Chicago showed that it is possible to carry out the day's planned flights with a saving of around 2,500 tons of fuel on the condition of precise consideration of weather conditions at 150 of the largest U.S. airports.

It is believed in the United States that to make an objective decision for any flight ATC entities need as a minimum the following weather information in real time;

—Three-dimensional disposition of zones of storm activity, turbulence and wind shear relative to the flight route;

—Disposition of zones of origin and movement paths of atmospheric vortices;

—Quantity, shape and altitude of clouds, visibility, weather phenomena, atmospheric pressure, temperature, dew point, and surface wind direction and velocity at take-off and landing points;

—Temperature and wind velocity and direction at flight altitudes.

In addition to the above data, ATC entities require a four-hour weather forecast for routes or sectors being serviced. In short, they have to know the real and forecast weather at the take-off point, along the route, at the landing airfield and at alternate airfields even before the take-off of each aircraft regardless of the area, time of year and weather situation in which the flight will be made.

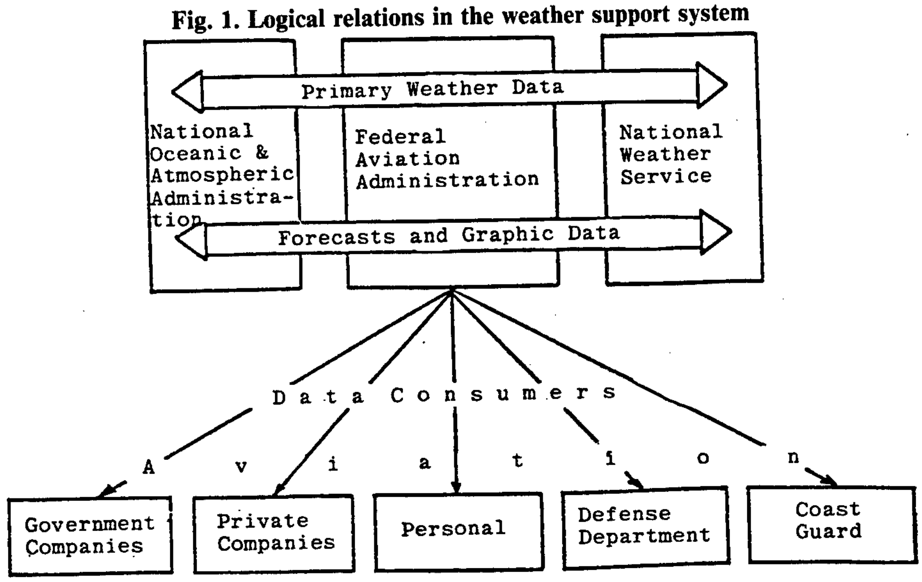
Therefore the U.S. Federal Aviation Administration (FAA)[1] considers weather support one of the most important kinds of flight support. In the opinion of FAA specialists, it is impossible to provide effective weather support to a large number of aircraft "manually." Precise forecasting of weather conditions is also hampered for the reason that marine air, which easily penetrates U.S. territory from the Atlantic and Caribbean, is distinguished by convective instability usually accompanied by weather phenomena which substantially limit air activity. An automated air weather support system has been developed and placed into operation on order from the FAA and Defense Department to ensure accurate, reliable and complete weather information as well as its timely receipt and convenient use.

When the system became operational there was an improvement in the capabilities of airport weather stations for constant observation and transmission of data on the cloud ceiling, the presence of freezing rain, visibility (ground visibility on the runway, slant visibility and vertical visibility), atmospheric pressure, temperature and humidity, as well as wind velocity and direction. Along with this came a change in periodicity of observations of weather elements, which presently is 1, 3, 5, 10 or 15 minutes. Data essentially is instantaneously read from sensors. Weather element sensors are disposed in the vicinity of the airport in such a way that under a specially developed program a microcomputer compiles a supershort-term forecast of the most important elements for a landing—visibility, cloud ceiling and wind shear—based on their data.

Much work also was done to automate data reception from stations used for radio and radar sounding of the atmosphere, as well as from systems that process, disseminate and display all meteorological data. This data is input to the computer, which outputs weather data at all airfields and in sectors of aircraft flight routes to ATC controllers on request in a form convenient for them and in real time.

The FAA and the National Oceanic and Atmospheric Administration (NOAA) are the principal departments providing weather support for ATC entities. An information exchange (Fig. 1) on actual weather (primary data) and weather data in alphanumeric and graphic form (forecasts, advisories, charts) has been arranged between these administrations with the participation of the National Weather Service.

Fig. 1. Logical relations in the weather support system



The automated weather support system presently functioning in the interests of ATC entities permits:

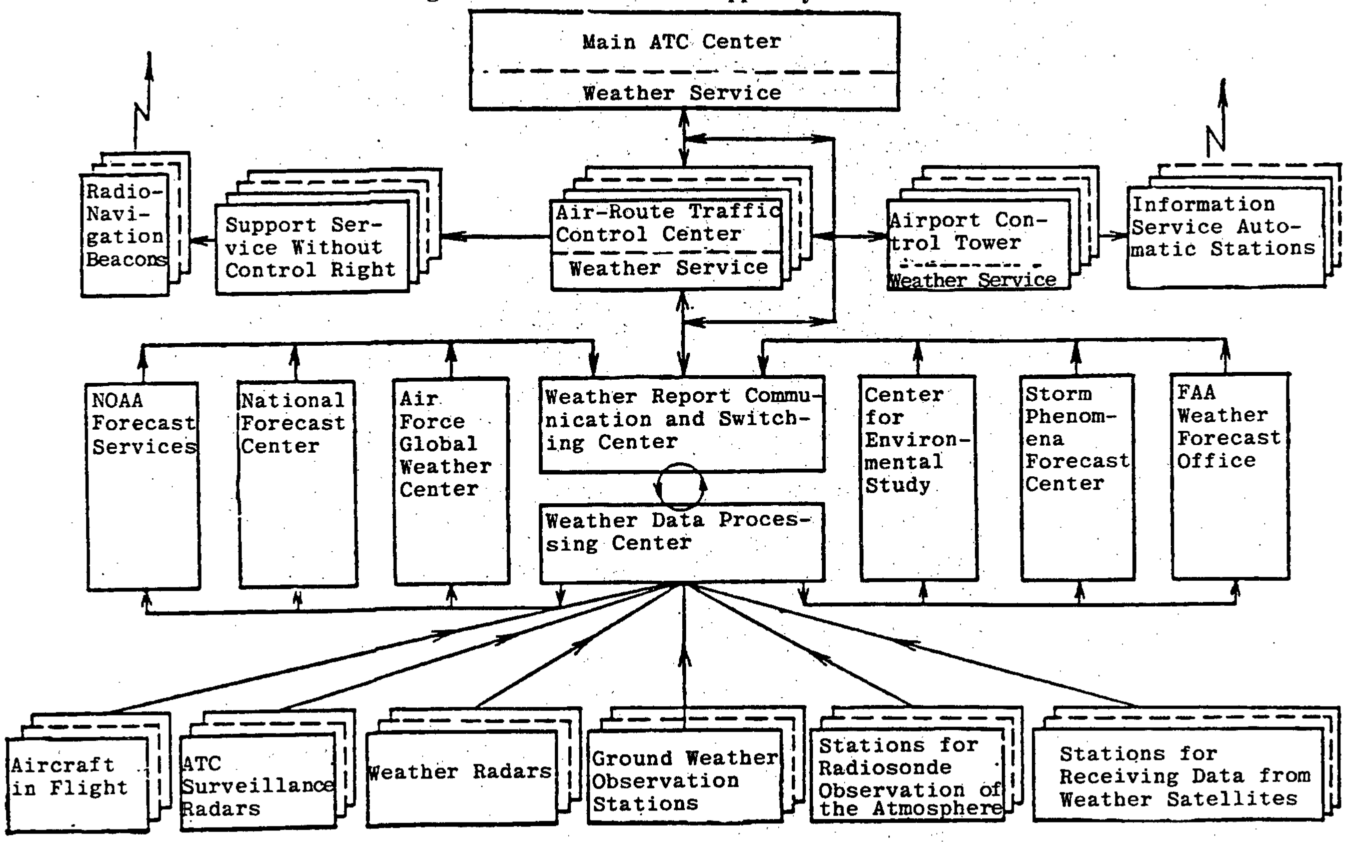
—Collecting, processing and transmitting weather data to consumers over various communication channels;

—Making prompt use of radar observation data as well as reports from crews of aircraft in the air;

—Performing a rapid analysis of all kinds of weather data with an indication of the data source, as well as determining areas with unfavorable or favorable weather relative to aircraft flight routes.

The weather support system of ATC entities consists of several units, each of which exists for accomplishing specific tasks. Its foundation is the primary weather data receiving unit consisting of ground weather observation stations of various departments, stations for receiving data from the GOES series of weather satellites, stations for radiosonde observation of the atmosphere, special WSR-57, -74 and -100 weather radars, and surveillance radars of ATC entities. In addition, the crews of aircraft

Fig. 2. Structure of weather support system



flying within zones of respon-sibility of U.S. ATC entities report information about the actual state of the weather.

The automated weather support system also includes units for primary data processing, data switching and transmission, and for getting the data to the consumer.

Primary data processing is accomplished in the weather data processing center in Kansas City, the FAA Weather Forecast Office, the National Forecasting Center, the Air Force Global Weather Center, the Center for Environmental Study, NOAA forecasting services, and a number of other establishments.

The weather report communication and switching center (Kansas City) transmits primary and processed data. It supports the circulation of primary data at an average rate of 300 bits per second. Processed weather data circulates over communication lines in the form of charts, tables and forecasts at a rate of from 600 to 1,200 bits per second. Radar data charts with identified zones of intense and moderate storm activity are among the charts transmitted by the center in addition to synoptic weather charts and aerological charts.

Airport weather stations (including ATIS information service automatic stations and radionavigation beacons), flight support service stations and weather services of ATC route and main centers provide weather data directly to ATC entities and aircraft crews. The weather support system structure is depicted in Fig. 2.

ATC airport control towers are provided with standard weather data presented in the form of synoptic weather charts, aerological charts and a number of other meteorological charts as well as forms for weather forecasts, storm warnings and the actual weather. Data on the cloud ceiling and visibility measured by airfield weather instruments are systematically confirmed by data being received from the crews of aircraft making take-offs and landings.

The ATC service controllers have specially equipped workstations where displays show not only information on air traffic, but also the weather situation in the form of graphic and alphanumeric data.

The following are output in alphanumeric form to the rectangular display at the controller console: data on weather in the airport vicinity based on weather service observations as well as on reports of aircraft crews; general purpose weather forecasts of varying term; forecasts of individual surface weather elements; weather and temperature forecasts at altitudes; information on atmospheric vortices; data of radar observations in the airport vicinity; storm data on dangerous weather phenomena; a supershort-term forecast of the cloud ceiling and visibility; data for responding to queries of aircraft crews; and other weather information needed by the controller in current operations.

Circular displays show graphic data in the form of weather charts and radar observation reports combined with air traffic information. That innovation led to an increased cost of terminal gear but on the other hand it significantly improved flight safety, in the assessment of American ATC specialists, inasmuch as the controller has an opportunity to monitor aircraft crews as they bypass zones with dangerous weather phenomena. In addition, the graphic data is more descriptive and more easily perceived by attendant personnel.

Specialists of FAA traffic services place special emphasis on accounting for atmospheric turbulence. This is not by chance, inasmuch as up to 22 percent of all air mishaps were connected with turbulence, according to statistics of the previous decade. To reduce the effect of this factor, systems were installed at 59 U.S. airports with the heaviest air traffic for determining wind shear at the surface. Such a system operates in an automatic mode and warns controllers controlling air traffic in the airport vicinity about wind parameters dangerous for aircraft take-off and landing.

New-generation weather radars permit tracking zones with dangerous turbulence values and displaying data on their spatial position on the screen. Automatic devices convert this information into figures used to present data on controller console displays about the intensity of turbulence, the diameter and altitude of the turbulent zone and its development trends.

In addition to this data, information on the position of zones of moderate and heavy rain as well as a supershort-term (from 5 to 30 minutes) forecast of these phenomena can be output to the circular displays. Such data on the controller's screen, which is almost pinpoint data, permits the controller to guide aircraft when dangerous weather phenomena are present in the zone of responsibility.

Weather specialists at the departure airport give a pre-flight consultation to aircraft crews directly or by telephone to the prescribed extent (data of latest weather observations at the departure and destination airport, weather forecasts and reports of crews who have flown this route). In advising the crew the specialists recommend that the pilot refrain from taking off if weather conditions are unfavorable for a flight.

Weather station specialists use data circulating over communication channels (actual and forecast state of the weather, facsimile weather charts and weather radar data) to respond to crew requests about weather in a particular area. Information passes over these same communication channels about phenomena dangerous for all types of aircraft such as thunderstorms, heavy icing and turbulence; data on phenomena dangerous to light-engine aircraft (large zones of fog, moderate icing, turbulence, and wind with a velocity exceeding 50 m/sec); as well as AIRMET and SIGMET reports.

Regardless of departmental affiliation, crews in the air receive all necessary weather data about the state of the weather in any sectors of the route or at airports from the controller who is controlling their flight at the given moment.

Crews can obtain information about airport weather by monitoring broadcasts of information service automatic stations. Radio beacons of major airports continuously transmit data over the air needed by crews for the landing approach. These transmissions in particular contain data of observations of the cloud ceiling and visibility obtained from weather situations and crews who previously made a landing or take-off.

A number of airports in the continental United States use a simplified version of an automatic weather observation system (AWOS-1). Data on wind velocity and direction, pressure, temperature, and humidity are registered and relayed over a VHF transmitter in a voice mode every 60 seconds.

The crews of aircraft in flight transmit information about weather conditions along the route to ATC service controllers, who relay this information to all interested agencies and crews. Although this information does not always reflect the true weather situation in real time, nevertheless it orients the controller service and aircraft crews in the air about weather conditions along the flight route.

All data in the automated weather support system of ATC entities is collected, processed and distributed by means of a central 9020 computer. Each air-route traffic control center has a microcomputer for processing, distributing and displaying weather data, compiling short-term weather forecasts, and interworking with the central computer.

The weather service of air-route traffic control centers performs the following tasks:

—Informs center personnel of expected weather conditions along the route, and especially about areas with weather conditions dangerous for aviation;

—Receives data from radiosonde observation stations located on monitored territory about distribution of weather elements by altitudes (temperature, humidity, wind), analyzes it and puts it in a form convenient for consumers;

—Receives reports on visual and radar observations of the weather situation from aircraft and weather data from satellites, analyzes them and gets them to interested consumers in accessible form;

—Informs ATC controllers about sharp changes in the weather, especially in areas with dangerous weather phenomena;

—Compiles short-term forecasts for airports served by the center;

—Coordinates short-term weather forecasts with forecasting centers (National Weather Service, main ATC center, Air Force weather service and other departments);

—Prepares and holds classes on meteorology with air-route traffic control center personnel.

Tasks of the main ATC center weather service are similar to those of the service of route centers, but they are considerably broader in view of the need to monitor the work of lower echelons and the large volume of data being processed and put out.

Judging from American press materials, FAA heads assess the work of the automated weather support system as fully satisfactory. Nevertheless, the FAA together with NOAA and the Defense Department continues to finance work to upgrade weather sensors; systems for collecting, processing and disseminating information; as well as models for calculating individual weather elements and compiling varying-term aviation forecasts.

Footnotes

1. Also called the Federal Civil Aviation Administration—Ed.

Tactical Aircraft Engines

18010800g Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 39-46

[Part One of article by Col Yu. Alekseyev, candidate of technical sciences]

[Text] Foreign specialists categorize tactical aircraft—fighters and attack aircraft—as among the most dynamically developing kinds. They are present in the armed forces of the majority of capitalist and developing countries. Judging from assessments by foreign experts, generations of tactical fighters and attack aircraft are replaced every 15-20 years, with the next generation expected in the mid-1990's. The development of new-generation tactical aircraft in leading capitalist countries is accompanied by creation of their corresponding engines. Different modifications of one and the same engine can be used in different aircraft. For example, the American F100 engine is installed in both F-15 as well as F-16 fighters.

Characteristics of Basic Turbojet and Turbofan Engines of Tactical Aircraft

Engine Designation (Country)	Maximum Thrust, kg(f): Without Afterburning/With Afterburning	Specific Fuel Consumption, kg/kg(f)-hr: Without Afterburning/With Afterburning	Air Mass Flow, kg/sec/Pressure Ratio	Gas Temperature Ahead of Turbine, °C/Bypass Ratio (Only for Bypass Engines)	Dry Weight, kg/ Length x Diameter, m	Aircraft in Which Installed
1	2	3	4	5	6	7
Turbojet Engines						
J52-P-408 (USA)	5080/-	0.89/-	65/14.6	./-	1050/3.0x0.97	A-4F & M Skyhawk, EA-6B Prowler
J57-P-35 (USA)	4950/7710	0.92/.	91/12.5	./-	./.	F-102A Delta Dagger
J75-P-17 (USA)	./11120	./2.15	./12.1	./-	2260/6.05x1.09	F-106A Delta Dart
J75-P-19W (USA)	7300/12000	0.79/2.2	120/12	./-	2700/6.59x1.09	F-105D & F Thunderchief, TR-1
J79-GE-11A (USA)	4500/7170	0.84/1.97	./11.87	./-	1650/5.28x0.97	F-104G Starfighter
J79-GE-15 (USA)	./7700	./1.94	./12.9	./-	1680/5.28x0.97	F-4C & D, RF-4C Phantom II
J79-GE-17[1], -19 & -119 (USA)	5390/8120	0.84/1.93	77/13.4	987/-	1750/5.3x0.99	F-4E, G & F Phantom II, F-104S (J79-GE-19), Kfir-C.2
J85-GE-13A[2] & D (USA)	1230/1850	1.03/2.2	20/6.9	./-	270/2.68x0.53	F-5A Freedom Fighter, G-91Y
J85-GE-15 (USA)	./1950	1.03/2.2	20/6.9	./-	280/2.68x0.66	CF-5

Characteristics of Basic Turbojet and Turbofan Engines of Tactical Aircraft

Engine Designation (Country)	Maximum Thrust, kg(f): Without Afterburning/With Afterburning	Specific Fuel Consumption, kg/kg(f)-hr: Without Afterburning/With Afterburning	Air Mass Flow, kg/sec/Pressure Ratio	Gas Temperature Ahead of Turbine, °C/Bypass Ratio (Only for Bypass Engines)	Dry Weight, kg/ Length x Diameter, m	Aircraft in Which Installed
1	2	3	4	5	6	7
J85-GE-17 (USA)	1300/-	0.95/-	20/6.9	930/-	180/1.03x0.45	A-37B Dragonfly
J85-GE-21 (USA)	1600/2270	1.0/2.13	24/8.3	980/-	310/2.85x0.53	F-5E Tiger II
Avon-Mk 302 (UK)	5760/7400	0.85/2.0	80/8.4	./-	1720/6.5x1.07	Lightning-F.6
Avon-Mk 207 (UK)	4540/-	0.88/-	./.	./-	1300/3.12x1.05	Hunter-FGA.9
Viper-Mk 535 & 540 (UK)	1550/-	0.99/-	24/5.6	890/-	345/2.34x0.5	BAC-167 Strikemaster, MB.326G (Viper-Mk 540)
Viper-Mk 600M (UK)	1820/-	0.9/-	26.5/5.8	867/-	345/2.16x0.62	MB.326, MB.339A
Viper-Mk 680 (UK)	2020/-	0.96/-	./5.8	./-	360/1.8x0.82	MB.339K
Atar-9C (France)	4280/6200	1.01/2.03	68/5.7	890/-	1420/5.94x0.79	Mirage III-E, Mirage 5
Atar-9K50 (France)	5000/7300	0.97/1.96	72/6.15	930/-	1580/5.94x1.02	Mirage F.1C
Atar-8K50 (France)	5000/-	0.97/-	72/6.15	930/-	1160/3.94x1.02	Super Etendard
RM6B (Sweden)	5000/6000	./1.7	71/7.7	./-	1700/7.62x1.07	J35A Draken
RM6C (Sweden)	5750/7800	./1.9	79/8.4	./-	1770/8.14x1.07	J35D, E & F Draken, RF-35
			Turbofan engines			
F100-PW-100 & 200 (USA)	6800/11300[3]	0.72/2.12	103/25	1400/0.7	1370/4. 85x1.18	F-15A Eagle, F-16A Fighting Falcon (F100-PW-200)
F100-PW-220[4] (USA)	6800/11300	0.68/2.12	103/25	1400/0.7	1450/5.28x1.18	F-15C & D; F-16C & D
F110-GE-100 (USA)	7750/13150	0.66/2.01	120/30	1370/0.85	1700/4.62x1.18	C ompetitive development for F-15 and F-16
F110-GE-129 (USA)	7750/13100	0.66/2.01	122/30	./0.85	1740/4.62x1.18	Same as above
F404-GE-400 (USA)	4040/7260	0.75/1.62	63.8/25	1315/0.34	910/4.03x0.88	F-18A Hornet, X-29A
F404-GE-100A (USA)	4950/8150	0.75/1.79	64/26	1335/0.34	1050/4.03x4.88	F-20 Tigershark
TF30-P-3 (USA)	5670/9070	0.63/2.50	106/17	1150/1.1	1840/6.15x0.97	F-111A
TF30-P-8 (USA)	5540/-	0.63/-	116/18.8	./0.99	1150/3.25x0.97	A-7A Corsair II
TF30-P-9 (USA)	./9440	./2.61	./18.1	./1.1	1840/6.15x0.97	F-111D
TF30-P-100 (USA)	./11370	./2.45	./22	./.	1820/6.15x0.97	F-111F
TF30-P-414A (USA)	5600/9500	0.69/2.78	110/19.8	585[5]/0.9	1900/6. 0x1.3	F-14A Tomcat
TF34-GE-100 (USA)	4110/-	0.37/-	153/21	1225/6.2	645/2.54x1.26	A-10A Thunderbolt II
TF41-A-1 (USA)	6460/-	0.63/-	117/21.1	1150 (560)[5]/0.76	1440/2.9x1.0	A.7D Corsair II
TF41-A-2 (USA)	6800/-	0.66/-	120/21.7	1170 (570)[5]/0.74	1450/2.9x1.0	A-7E Corsair II
TFE731 (USA)	1600/-	0.5/-	51/14	1010/2.7	330/1.26x1.0	C-101 (E-25)

Characteristics of Basic Turbojet and Turbofan Engines of Tactical Aircraft

Engine Designation (Country)	Maximum Thrust, kg(f): Without Afterburning/With Afterburning	Specific Fuel Consumption, kg/kg(f)-hr: Without Afterburning/With Afterburning	Air Mass Flow, kg/sec/Pressure Ratio	Gas Temperature Ahead of Turbine, °C/Bypass Ratio (Only for Bypass Engines)	Dry Weight, kg/ Length x Diameter, m	Aircraft in Which Installed
1	2	3	4	5	6	7
J85-GE-17 (USA)	1300/-	0.95/-	20/6.9	930/-	180/1.03x0.45	A-37B Dragonfly
PW1120 (USA)	6150[6]/9360	0.8[6]/1.86	81/27	1400/ 0.2)Tc1290/ 4.1x1.02	Under development	
PW1129 (USA)	8100[6]/13200	0.74[6]/2.05	./.	./.	16 50/5.28x1.18	Competitive development for F-15 & F-16
F402-RR-406A (UK, USA)	9970/-	0.67/-	196/14	./1.4	1470[7]/ 2.51[8]x1.22	AV-8B
Pegasus-11-21 Mk 105 (UK)	9970/-	0.67/-	196/14	./1.4	1470[7]/ 2.51[8]x1.22	Harrier-GR.5
F402-RR-402 (UK, USA)	9750/-	0.60/-	204/14	./1.5	1270[7]/ 2.51[8]x1.22	AV-8A
Pegasus 11 Mk 103 (UK)	9750/-	0.60/-	204/14	./1.5	1270[7]/ 2.51[8]x1.22	Harrier-GR.3, Sea Harrier
RB.168-25R (UK)	5690/9660	0.63/1.95	95/20	1100/0.7	1630/5.2x0.97	F-4K & M
Larzac-04C20 (France, FRG)	1440/-	0.74/-	./11.3	./.	290/1.18x0.6	Alpha Jet
Larzac-04C6 (France, FRG)	1350/-	0.71/-	27.6/10.65	1130/1.13	290/1.18x0.6	Alpha Jet
Adour-Mk 104 (France, UK)	2300/3580	0.79/.	./11	./0.8	710/2.97x0.76	Jaguar
Adour-Mk 102 (France, UK)	2100/3300	0.74/1.5	./11	./0.8	700/2.97x0.76	Jaguar
Adour-Mk 151 & 851 (France, UK)	2360/-	0.76/-	./11	./0.8	570/1.96x0.76	Hawk (Adour-Mk 851 for export versions)
Adour-Mk 804 (France, UK)	2360/3650	0.79/.	./11	./0.8	710/2.97x0.76	Jaguar (Export)
Adour-Mk 861 (France, UK)	2580/-	0.76/-	./11.3	./0.8	580/1.96x0.76	Hawk
Adour-Mk 811, 815 (France, UK)	2580/3800	0.76/.	./11.3	./0.8	740/2.97x0.76	Jaguar (Export)
M53-P-2 (France)	6550/9700	0.87/2.03	94/9.8	1275/0.3	1450/4.85x1.06	Mirage-2000
M88-15 (France)	5500/7500	0.8/1.8	./24	1550/0.5	850/3.53x.	Being developed for series aircraft being created on the basis of the Rafale aircraft
RB.199-34R Mk 101 (FRG, UK, Italy)	4100/7250	0.45[9]/2.17	70/23.1	1327/1.25	900[10]/3.20x0.87	Tornado
RB.199-34R Mk 103 (FRG, UK, Italy)	4300/7530	0.45[9]/2.5	71.5/23.5	Over 1327/1.25	860[10]/3.20x0.87	Tornado
RM8A (Sweden)	6700/11800	0.62/2.6	146/16.5	./1	2100/6.0x1.35	AJ-37 Viggen, SF-37, SH-37, SK-37
RM8B (Sweden)	7350/12750	0.64/2.31	148/17	1250/1	2270/6.25x1.35	J A-37 Viggen

Characteristics of Basic Turbojet and Turbofan Engines of Tactical Aircraft

Engine Designation (Country)	Maximum Thrust, kg(f): Without Afterburning/With Afterburning	Specific Fuel Consumption, kg/kg(f)-hr: Without Afterburning/With Afterburning	Air Mass Flow, kg/sec/Pressure Ratio	Gas Temperature Ahead of Turbine, °C/Bypass Ratio (Only for Bypass Engines)	Dry Weight, kg/ Length x Diameter, m	Aircraft in Which Installed
1	2	3	4	5	6	7
J85-GE-17 (USA)	1300/-	0.95/-	20/6.9	930/-	180/1.03x0.45	A-37B Dragonfly
RM12 (Sweden)	5500/8200	./1.79	68/26	1420/0.28	1050/4.03x0.88	Bei ng developed for JAS-39 Gripen
F100-IHI-100[11] (Japan)	6800/11300	0.68/2.15	103/25	1400/0.7	1370/4.85x1.18	F-15J
TF40-IHI-801A[12] (Japan)	2320/3310	0.74/1.5	./11	./0.8	700/2.97x0.76	F-1
EJ.200 (UK, FRG, Italy)	6050/9050	./.	74/25	1525/0.4	900/.	Being developed for EFA Advanced European Fighter
Spey-Mk 807 (Italy)	5000/-	./-	./16.3	./.	1120/2.46x0.94	AMX

1. Also produced in Japan under American license for the F-4EJ aircraft under the designation J79-IHI-17.
2. Produced in Italy under American license for the G-91Y aircraft.
3. According to other data, engine thrust on the F-16A is 10,800 kg(f).
4. According to certain other data, engine thrust in the maximum setting is increased to 7,700 kg(f), and in afterburning up to 12,400 kg(f); mass air flow is 110 kg/sec, and specific fuel consumption with afterburning is 2.15 kg/kg(f)-hr.
5. Gas temperature behind the turbine.
6. Intermediate setting.
7. Weight without nozzles.
8. Length without nozzles (with nozzles 3.49 m).
9. According to other data, 0.61.
10. Weight without reversal (with thrust reverser 1,080 kg)
11. Produced under American license.
12. Produced under British license.

Power plants of fighters and attack aircraft presently use essentially only gas turbine engines: turbojet and turbofan. The light OV-10A Bronco (USA) and IA-58 Pucara (Argentina) attack aircraft, which are fitted with turboprop engines, as well as the Italian SF.260W with piston engine are the exception.

Turbojet engines have seen greatest development in power plants of supersonic aircraft (the American F-104 Starfighter and F-4 Phantom, the French Mirage III, and the British Lightning); afterburning turbojet engines (with a thrust up to 12,000 kg(f)) are used in fighters, while nonafterburning engines (5,000 kg(f) and up) are used in attack aircraft. The turbojet engine realizes the most important demands on tactical aircraft—high speed and acceleration characteristics and sufficiently large combat payloads.

In the 1970's the sphere of application of turbojet engines in new tactical aircraft was reduced considerably. This is explained by the fact that turbofan engines which had been created by that time permitted a substantial increase in aircraft radius of action (through a lesser specific fuel consumption) and with equal thrust were much lighter than turbojet engines. Although turbojet engines are simpler in design and operation, they continued to be used only in some light attack aircraft and tactical fighters (the British Viper series engines in the Strikemaster, MB.336 and MB.339K attack aircraft, and the American J85 series in F-5 fighters produced basically for export).

Because of a delay in creating a turbofan engine, the French Mirage F.1 and Super Etendard aircraft also were fitted with turbojet engines.

According to foreign press announcements, with regard to modern concepts turbojet engines have comparatively low gas-dynamic parameters; in particular, gas temperature ahead of the turbine is around 1,000°C and the pressure ratio is less than 15. New turbojet engines are not being developed in leading capitalist countries at the present time.

Bypass engines (also called turbofan engines) saw widespread use in tactical aviation in the mid-1970's, when new-generation fighters and attack aircraft were created abroad: the American F-14, F-15, F-16 and A-10; the Anglo-French Jaguar; and the Franco-West German Alpha Jet (see color insert [color insert not reproduced]). Although the design configuration of the turbofan had been known for a long time, creation of effective engines of this type became possible as a result of fulfillment of major R&D programs in the sphere of engine design, materials and technology.

As early as the mid-1980's characteristics of turbofan engines for tactical aircraft had been substantially improved compared with the most up-to-date turbojet engines and the first turbofan engines. Gas temperatures ahead of the turbine increased by approximately 50 percent, reaching 1,400°C in series engines and almost 1,600°C in engines under development. The pressure ratio rose to 26 and 30 respectively. Basic specifications and performance characteristics of the most widespread turbojet and turbofan engines in foreign tactical aircraft are given in the table.

Modern tactical aircraft engines operate on JP (Jet Propulsion) fuels. The standard fuel in the U.S. Air Force is JP-4 and in Naval Aviation it is JP-5 (similar to JP-4, but less of a fire hazard, which is necessary because of its storage conditions aboard carriers). Fuels of NATO countries correspond to American standards. The U.S. and NATO air forces adopted JP-8, a long-distillate fuel, as a reserve fuel. It is cheaper than JP-4, but of somewhat inferior quality. In many countries tactical aircraft engines operate on fuels being used in civilian jet aviation, but it is believed that performance characteristics worsen and service life is reduced with lengthy operation of engines on nonstandard fuels.

Engine control systems. Control systems of the majority of modern foreign turbojet and turbofan engines which are part of the power plants of tactical aircraft use hydromechanical controllers. Electronics are only beginning to be introduced in the form of individual correcting devices, although rather active studies and practical development of electronic control systems already are being conducted. A research program carried out jointly in the United States by the Air Force and NASA during 1985-1986 to evaluate capabilities of a tactical fighter electronic engine control system (flight tests were conducted on the F-15) is typical in this respect.

The study showed that hydromechanical controllers cannot ensure reliable control of the modern engine with a constantly growing number of parameters and input data to be regulated. Under these conditions electronic digital control systems have wide capabilities. From the standpoint of reliability, hydromechanical controllers are comparable with electronic digital systems with 3-4 parameters to be regulated. Attempts to use hydromechanical fuel feed controllers in modern engines with six or more parameters to be controlled demonstrated their poor reliability.

With regard to the cost of an engine life cycle, an electronic digital system provides a saving of up to 6 percent of service life only by a reduction in the time for controlling the engine power settings, especially for afterburning. In addition, digital electronics provides, first of all, simplicity in changing the logic and laws of engine control and convenience of integrating the engine control system with aircraft systems using digital data buses; and secondly, a solution to difficult problems connected with control systems of engines with a variable work cycle.

Angles of attack and slip, altitude, and the position of the aircraft control stick and rudder were considered as input data in the course of tests of the electronic digital system for controlling F-100-PW-100 engines in the F-15. The system was designed as a special unit with several microcomputers. Judging from foreign press announcements, test results are being evaluated positively. The electronic system supported reliable engine operation with lesser reserves for fan and compressor surging (in cases where a large reserve was not required), the necessary reserve for surging under conditions of critical flight modes, and flying an optimum profile with minimum climb time when intercepting an airborne target. American specialists believe that just in adequacy of surging reserve the electronic control system can provide an increase in thrust and a reduction in fuel consumption by 6-8 percent at high subsonic flight speeds. In addition, the range of permissible flight configurations with afterburning widens.

Results of these developments already essentially are being adopted in the Air Force. It is reported in particular that an electronic digital system has been used in F-100-PW-220 engines which outfit F-15C and F-16C tactical fighters. The system controls both nonafterburning and afterburning engine power settings. It uses data reflecting the engine power setting (temperature, pressure, rpm, position of controlled low and high pressure compressor stator blades, fuel feed to the main and afterburning combustion chambers, and nozzle position) and flight configuration (Mach number and position of throttle levers). In addition, the electronic engine control system made it possible to remove limitations on lever displacement in the entire range of flight configurations; to expand the range of permissible flight configurations with an in-flight start; to cut the time for taking engines from low-throttle to maximum power setting from 7 to 4 seconds; to increase engine thrust by optimality of power settings; to eliminate the need to regulate power settings on the ground; and to increase inner duct service life between repairs to 4,000 standard work cycles.

In the opinion of foreign specialists, further development of electronic engine control systems will follow the direction of creating full-fledged electronic digital systems known as FADEC (Full-Authority Digital Engine Control), which have been included in the common aircraft control loop on an equal basis with other on-board systems. Such a system already is being developed for the F119 engine of the American ATF advanced tactical fighter. At the same time, the question of where to install the FADEC system (directly on the engine or outside it) remains controversial. American experts prefer to install it on the engine. Modern technology supports system working capacity at a temperature up to 90°C (a brief increase to 150°C is permissible), but it requires cooling when those values are exceeded. The electronic control system unit is fuel-cooled on the F100-PW-220 engine, but the majority of western developers believe that air-cooling must be used in the future.

Starting systems. Three types of starters are used in tactical aircraft engine starting systems: electric, air-turbine, and gas-turbine. Electric starters (or starter-generators) are used primarily on relatively low-thrust engines (to 2,000-2,500 kg(f)) installed in light fighters and attack aircraft. Air-turbine engine starting systems are used on all types of aircraft, and in many cases explosive cartridges can be used in them in place of compressed air. Gas-turbine starters are becoming more and more widespread. They start engines of any thrust and are autonomous inasmuch as they operate on the very same fuel as the aircraft engines. It is sufficient to have an on-board storage battery to start the gas-turbine starters themselves, which are small gas-turbine engines. Engines can be started from an auxiliary power plant if the aircraft has one. In such cases the plant itself is started by an electric starter from on-board storage batteries.

Power plant development prospects. R&D in capitalist countries in the sphere of creating tactical aircraft engines is being conducted above all in the direction of developing turbofan engines for the U.S. ATF and the Western European EFA advanced tactical fighters. The engine for the ATF is being created under the ATFE (Advanced Tactical Fighter Engine) program with consideration of experience gained in designing the F100 turbofan. Above all, requirements on dimensions of the ATFE engine were specified and its development began three years before creation of the ATF airframe. The American firms of Pratt and Whitney and General Electric are participating in competitive development of the engine.

General requirements for the engine also have been specified: thrust with afterburning in the 13,000 kg(f) class, without afterburning 9,000 kg(f), and weight specific thrust 10; support flight at supersonic speed and combat maneuvering in a nonafterburning regime (at Mach 1.8 and 6 g's); capability of operating for a lengthy time (45-60 minutes) at high gas temperature values ahead of the turbine (1,630-1,730°C); and presence of a thrust vector control nozzle. The latter requirement is not considered mandatory, but is desirable.

The Pratt and Whitney engine was designated the YF119 (firm designation PW5000); bench tests of its demonstration model have been conducted since mid-1986 and in 1988 it was proposed to begin similar tests of a model intended for installation in the aircraft. The engine is being developed with a bypass ratio of 0.2, which is considered the minimum necessary for ensuring reliable afterburner cooling. The General Electric engine was designated YF120 (firm designation GE37). It is assumed that developers are studying the possibility of creating it in the version of a variable cycle engine with variable bypass ratio: greater at subsonic speeds and less at supersonic cruising speed. Competitive flight tests of the YF119 and YF120 engines are to begin in 1990.

In developing an engine for the ATF (it is planned to complete development in the mid-1990's), the U.S. Air Force determined the main objectives in the sphere of advanced fighter engines—attainment of a weight specific thrust greater than 20 and creation of the technology of an engine for hypersonic flight speeds by the year 2000.

It is planned to use engine technology being developed for hypersonic flight speeds in power plants of different classes of aircraft, from fighters to aerospace craft. American specialists believe that an engine operating in a turbojet or turbofan mode up to Mach 3-3.5 and in a ramjet mode at Mach 3-6 can fit in with the power plant of an aircraft optimized for hypersonic speed of Mach 6. General Electric is conducting studies on an engine with turbofan and ramjet cycles. Such an engine functions as a turbofan at an aircraft speed up to Mach 3.5, and at greater speed the inner loop is disconnected (shifted to a low-throttle setting), the fan shifts to an autorotation mode and the engine to a ramjet mode. According to studies conducted by the firm, the air mass flow through the autorotating fan is quite sufficient for supporting combustion in the ramjet mode.

Creation of aircraft with hypersonic flight speeds demands a closer tie-in of the choice of engine and airframe materials with the fuel type than ever before. It is assumed that contemporary advanced materials permit achieving a speed of Mach 5. New materials or active airframe cooling may be required at higher speeds; this can be ensured in particular in case of the use of endothermic hydrocarbon fuel. When heat is absorbed in such a fuel, chemical reactions occur with the formation (release) of hydrogen. It will be used either for supplemental cooling or as a fuel at hypersonic flight speed.

With regard to the ramjet work cycle at hypersonic flight speeds, it is believed that up to Mach 6 combustion can occur in the engine in a subsonic flow (air entering the engine is retarded in a series of shock waves and then supplied to the combustion chamber). At higher flight speeds the ramjet must operate in a mode of fuel combustion in a supersonic flow (such an engine was designated the supersonic-combustion ramjet [scramjet]). Mach 6 is considered the minimum speed for the scramjet. In such an engine air is not retarded at the intake. This circumstance dictates various demands on the geometry of the engine intake and combustion chamber for the ramjet and scramjet. It is very difficult to realize these demands in one engine, and so American experts especially emphasize the need to avoid the cumbersome nature of a design supporting a transition from the ramjet to the scramjet cycle. In their opinion, creation of aircraft and engines for hypersonic flight speeds (especially high speeds) depends above all on machine simulation inasmuch as ground equipment permits simulating regimes up to Mach 8-10.

Power plants for short take-off and vertical landing [STOVL] aircraft. In recent years the idea of creating power plants giving tactical aircraft a short take-off and vertical landing has drawn more and more attention of specialists of leading capitalist countries. Work in this area has been done jointly by the United States and Great Britain in particular since 1983. A protocol which they signed in 1986 envisages the study of possible engine types suitable for a supersonic STOVL aircraft, which is expected to become operational during 2000-2010. It is assumed that such an aircraft is necessary for replacing the AV-8 Harrier and F-16 Fighting Falcon.

The basic problem in creating an engine for a supersonic STOVL aircraft is considered to be ensuring its high thrust-to-weight ratio. Work in this sphere has been done in the United States by the engine construction firms of General Electric, Pratt and Whitney, and Allison together with the aircraft construction firms of McDonnell Douglas, Grumman, General Dynamics and Lockheed. According to the 1986 protocol, four engine concepts are being studied, with each aircraft construction firm oriented on one of them.

The *engine with rotating nozzles and plenum-chamber burning (PCB)* was chosen by McDonnell Douglas. It is assumed that the technology of such an engine capable of providing a 100-percent increase in thrust with vertical take-off and landing and flight at supersonic speed can be created on the basis of existing Pegasus engines. Boosting is possible at any nozzle rotation angle. A shortcoming of such a configuration is that hot air hits the airframe and suspended weapons, and air from forward nozzles can end up in the engine air intake. In addition, such an engine has a high noise level.

The *RALS (Remote Augmented Lift System) engine* was chosen by Grumman. In it air of the second loop is supplied to a forward combustion chamber which has a nozzle directed downward. In horizontal flight this air can be supplied to a separate nozzle with a reheating system activated in flight at supersonic speed, or be mixed with inner loop air ahead of the combustion chamber.

The *engine with an ejector system for creating lift* was chosen by General Dynamics. In it second loop air is supplied to two ejector devices in the wing roots having several nozzles each. By ejecting atmospheric air it is possible to provide a 70-percent thrust increase without boosting. The ejector system is compatible with an engine of conventional configuration; its shortcomings are the possibility of ejector damage and the wing volume they occupy.

In the *tandem-fan engine* chosen by Lockheed a gas generator drives two separate fans through a single shaft. A shut-off valve, upper supplemental air intake, and ventral nozzle are located in the air duct between them. Such an engine is similar to the variable cycle engine. In horizontal flight it operates as an afterburning turbofan with low bypass ratio. In creating additional lift the duct between the fans is closed by the valve and air from the forward fan goes to the ventral nozzle with a boosting system. In this case air goes to the rear fan and gas generator through the upper air intake. In an engine with such a configuration air mass flow in the mode of creating additional lift can be increased by 60 percent, which ensures lower temperatures of exhaust gases with identical thrust (compared with engines of other configurations).

Engines of the very same configurations are being studied in Great Britain by the firms of Rolls Royce (engine building) and British Aerospace (aircraft construction). American and British developers hope to select one or two of the concepts being considered in the mid-1990's for demonstration flight tests with subsequent full-scale development (over a period of 7-10 years) of a series engine in the 16,000-18,000 kg(f) thrust class for a single-engine aircraft.

Advanced materials and technology. Capabilities of creating new-generation engines abroad satisfying demands of the late-1990's and the period after the year 2000 largely are linked with developments of new structural materials. The problem of using metal and composite materials, ceramics and heat-resistant coatings is being analyzed. In recent years more and more attention also is being given to lubrication systems of high-temperature engines. For example, some NASA specialists engaged in studies in the sphere of aircraft engines see great prospects in the use of solid lubricants. They believe that contemporary synthetic liquid lubricants are capable of supporting prolonged engine operation at a temperature up to 235°C, and advanced lubricants up to 350°C. Solid lubricants permit higher working temperatures, but the problem is that single-component lubricants cannot support lubrication of bearings and the operation of seals in the entire range of engine temperature regimes. Therefore creation of solid lubricants of complex compositions is being examined as a possible way to solve it.

One such composition consists of light oxides (PbO, CaF_2, BaF_2) and silver in a nichrome or carbide matrix and has a working temperature up to 900°C. The lubricant is applied in the form of coatings 0.025-0.25 mm thick. Such a composition in a carbide matrix successfully passed tests as a reserve lubricant for shaft high-temperature gas bearings.

(To be continued)

The Japanese Fleet

18010800h Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 47-55

[Part One of article by Capt 1st Rank F. Rubin]

[Text] Cloaked in demagogic fabrications about a "growth of the Soviet military threat," Japan's militarist circles are systematically and persistently building up the might of the Armed Forces, including the Navy. The foreign press emphasizes that the Navy is actively preparing for joint combat operations with the U.S. Seventh Fleet in the Western Pacific at a distance of up to 1,000 nm from the Japanese islands. Primary attention in their operational and combat training is given to practicing missions of operational deployment; engaging submarines, surface combatants and aviation of the probable enemy; and blockading the international straits of La Perouse, Tsugaru (Sangari) and Korea. The Fleet, which includes submarine, escort, and minesweeping forces as well as aviation and other large and small units, must play an ever increasing role in naval operations.

The **Fleet**, the primary naval formation,[1] is officially called the "Self-Defense Fleet." Its establishment began and was legally formalized back within the scope of the "Naval Police Corps." Initially (constituted 1 April 1953) it included a total of two flotillas of escort ships and one flotilla of minesweepers. Subsequently there was a buildup in escort and minesweeping forces, then also of aviation as well as submarine forces. Thus, the 3d Flotilla of escort ships was formed in December 1960; the Escort Forces Command, the 2d Flotilla of minesweepers and the Fleet Air Command were formed as of September 1961; the 1st Submarine Flotilla in February 1965; and the Submarine Force in February 1981. Improvement in the fleet organization and establishment is a continuous process; its numerical strength exceeds 21,000 persons.

In its administrative organization (Fig. 1) the Japanese Fleet includes a staff (Yokosuka Main Naval Base), four commands (submarine forces, escort forces, air, and training), two minesweeper flotillas, a separate division of tank landing ships, three centers (Acoustic Analysis, computer and EW) as well as individual ships and vessels and service subunits. A commander exercises overall direction of the Fleet through a chief of staff (authorized categories of both are vice admiral). An assistant and an inspector are immediately subordinate to the commander.

A characteristic feature of the Japanese Fleet organization and establishment is the absence in its makeup of special logistic support formations (with the exception of the submarine forces and aviation). This is explained by the fact that functions of logistic support and certain kinds of combat (operational) support are the responsibility of naval region commandants and chiefs of respective naval bases at which fleet ships and vessels are registered.

An operational organization also functions during major exercises according to which up to five task forces of mixed forces are formed within the Japanese Fleet. They include task groups, which are divided into task units and task elements. In addition, temporary task forces (groups, units and elements) of type or mixed forces also are established for performing certain missions. The numbering and makeup of operational formations are temporary; forces included in them (submarines, escort ships, minesweepers, landing ships and aviation) are transferred from corresponding large and small units of the Japanese Fleet.

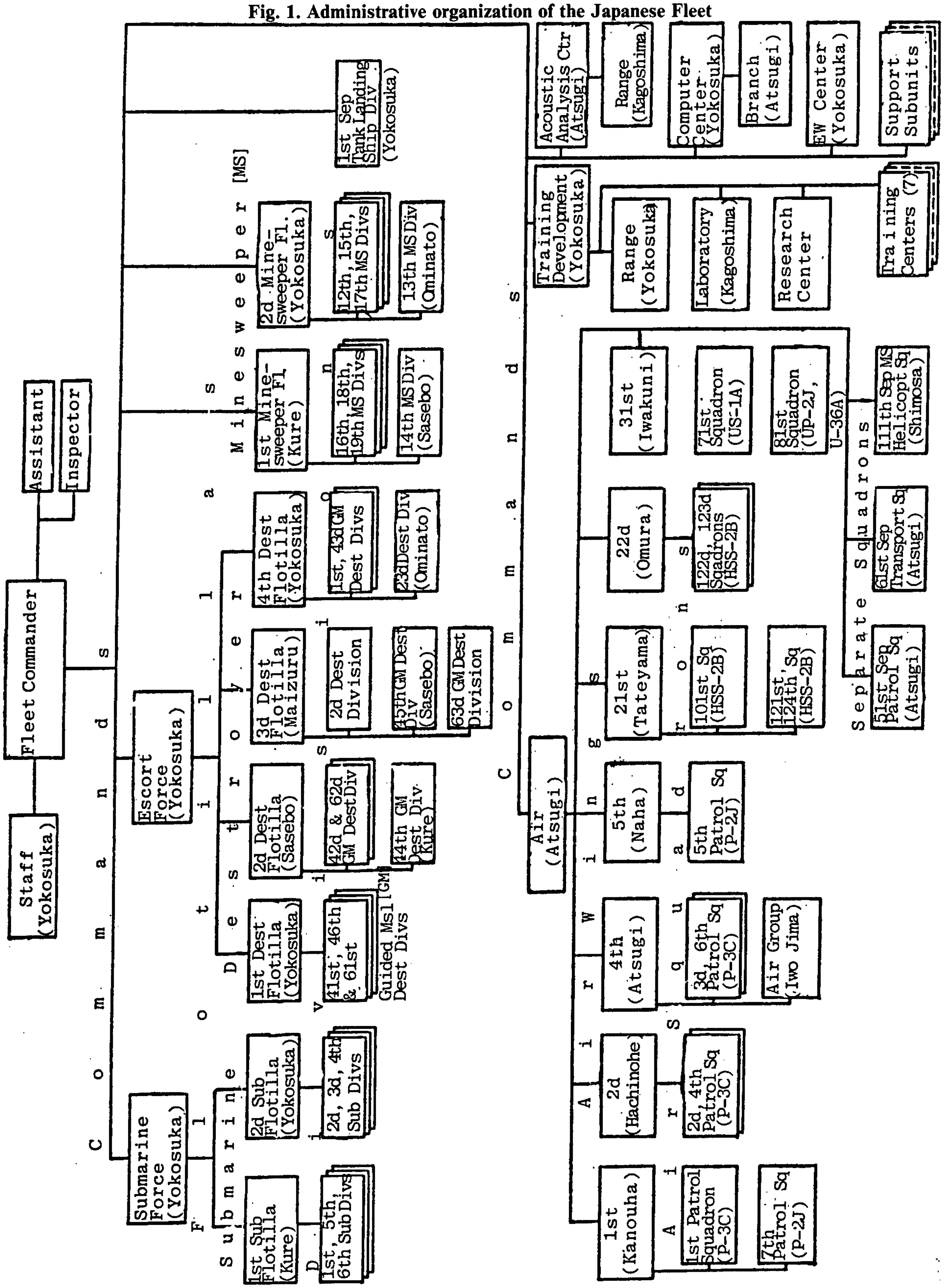
The *Submarine Command* (Submarine Force) is headed by a commander (authorized category vice admiral), who has a subordinate staff, two submarine flotillas and a submarine training detachment (Kure Naval Base). The Submarine Force headquarters is located at Yokosuka Main Naval Base, with the authorized category of its chief being rear admiral. Each flotilla includes a headquarters, three submarine divisions and a base detachment. A division usually includes two or three submarines. In addition, flagships and separate vessels are subordinate to the flotilla commanders (authorized category captain 1st rank, rear admiral). The numerical strength of the Submarine Force does not exceed 2,000 persons. The main ship order of battle in the Submarine Force is represented by 14 submarines (ten "Yushio"-Class, Fig. 2 [figure not reproduced], and four "Uzushio"-Class).

The 1st Submarine Flotilla (headquarters at Kure) includes the 1st, 5th and 6th submarine divisions (a total of seven submarines), and a deployment staff is accommodated aboard the rescue ship ASR 402 "Fusimi." The reserve destroyer ASU 7008 "Harusame" and the training submarine ATSS "Isoshio," performing the role of Submarine Force combat training support ships (the first is to be scrapped and replaced by another in the near future), also are subordinate to the flotilla. The 2d Flotilla includes the 2d, 3d and 4th submarine divisions (a total of seven ships), which are registered at Yokosuka Main Naval Base. The deployment staff of this submarine flotilla is aboard the rescue ship "Chiyoda" (Fig. 3 [figure not reproduced]).

The *Escort Force* is headed by a commander (authorized category vice admiral), who has a subordinate staff and four destroyer flotillas. The Escort Force headquarters is located at Yokosuka Main Naval Base and the escort force flagship (the destroyer "Murakumo") is used to accommodate the deployment staff. Each flotilla has a headquarters and three divisions (each with 2-3 ships). Flagships also are subordinate to the flotilla commanders, with helicopter destroyers used as flagships. The authorized category of the Escort Force chief of staff and destroyer flotilla commanders is rear admiral, and that of flotilla chiefs of staff, division commanders and ship commanders is captain 1st rank (captain). Numerical strength of the fleet escort forces is around 7,500 persons, and there is a total of 34 ships including 4 helicopter destroyers and 24 guided missile destroyers (see color insert [color insert not reproduced]).

The 1st and 2d destroyer flotillas consist of guided missile destroyer divisions. They have been converted to a new organization and establishment, "Flotilla 8-8,"[2] and include eight ships each with eight deck-based antisubmarine helicopters. Ships of the 1st Destroyer Flotilla (41st, 46th and 61st guided missile destroyer divisions) are based at Yokosuka Main Naval Base. Helicopters of 121st Squadron, 21st Air Wing (Tateyama Air Base) are assigned to them. The headquarters of the 2d Destroyer Flotilla and the bulk of the ships (42d and 62d guided missile destroyer divisions) are stationed at Sasebo Naval Base, and the 44th Guided Missile Destroyer Division (two ships) at Kure Naval Base. Helicopters of 122d Squadron, 22d Air Wing (Omura Air Base) are assigned to ships of the 2d Flotilla.

Fig. 1. Administrative organization of the Japanese Fleet



The 3d and 4th destroyer flotillas are making a gradual transition to a new organization and establishment to be completed in the first half of the 1990's with the arrival in the fleet of six new guided missile destroyers of the "Asagiri"-Class (4 ships) and DDG 173-Class, as well as with the modernization of some existing ships. In particular, in FY 1989 the 3d Flotilla will be reorganized under the "Flotilla 8-8" structure, and it is planned to resubordinate the 2d Destroyer Division to the Maizuru Naval Region.

The headquarters of the 3d Destroyer Flotilla is stationed at Maizuru Naval Base, and half of the flotilla ships (2d Destroyer Division and 63d Guided Missile Destroyer Division) also are registered there. The other four (the helicopter destroyer "Haruna" and the 45th Guided Missile Destroyer Division) are based at Sasebo Naval Base. Antisubmarine helicopters of 123d Squadron, 22d Air Wing (Omura Air Base) are assigned to them.

The 4th Destroyer Flotilla includes a headquarters (Yokosuka Main Naval Base) as well as the 1st, 23d and 43d divisions. The first two include obsolete ships, which are to be phased out for new ones. The bulk of flotilla ships are based at Yokosuka, and the others (23d Destroyer Division) are registered at Ominato Naval Base. Deck-based helicopters of 124th Squadron, 21st Air Wing (Tateyama Air Base) are assigned to the modern ships.

The *fleet minesweeping forces* include two minesweeping flotillas, each consisting of a headquarters and four minesweeping divisions. Flagships also are subordinate to minesweeping flotilla commanders (authorized category rear admiral). The minelayers "Hayase"[3] and "Souya" are used as flagships. Each minesweeping division has 2-3 ships. The main ship order of battle of fleet minesweeping forces is represented by "Hatsushima"-Class coastal minesweepers (19 ships, Fig. 4 [figure not reproduced]), and there are fewer than 1,500 persons.

The 1st Flotilla (headquarters at Kure) includes the minelayer "Hayase," the 16th, 18th and 19th (Kure) as well as the 14th (Sasebo) minesweeping divisions; the 2d (with headquarters at Yokosuka Main Naval Base) includes the 12th, 15th and 17th (Yokosuka) as well as the 13th (Ominato) divisions and the flotilla flagship, the minelayer MMC 951 "Souya." Three minesweeping divisions (12th, 14th and 19th) have three minesweepers each, and the others have two each.

The *1st Separate Tank Landing Ship Division* includes three "Miura"-Class tank landing ships (Fig. 5 [figure not reproduced]), which are registered at Yokosuka Main Naval Base. The authorized category of its commander is captain 1st rank.

The *Air Fleet Force* is headed by a commander (authorized category vice admiral), who has a subordinate staff, seven air wings and three separate air squadrons as well as support subunits. The numerical strength of fleet aviation exceeds 8,500 persons and the aircraft pool numbers over 145 aircraft and helicopters of various types: 45 P-3C, 22 P-2J, 1 UP-2J, 2 UP-2JE, 2 U-36A, 2 SH-60J, 47 HSS-2B (including 38 deck-based), 4 V-107A, 7 US-1A, 4 YS-11MA, 1 LC-90 and 9 S-61A.

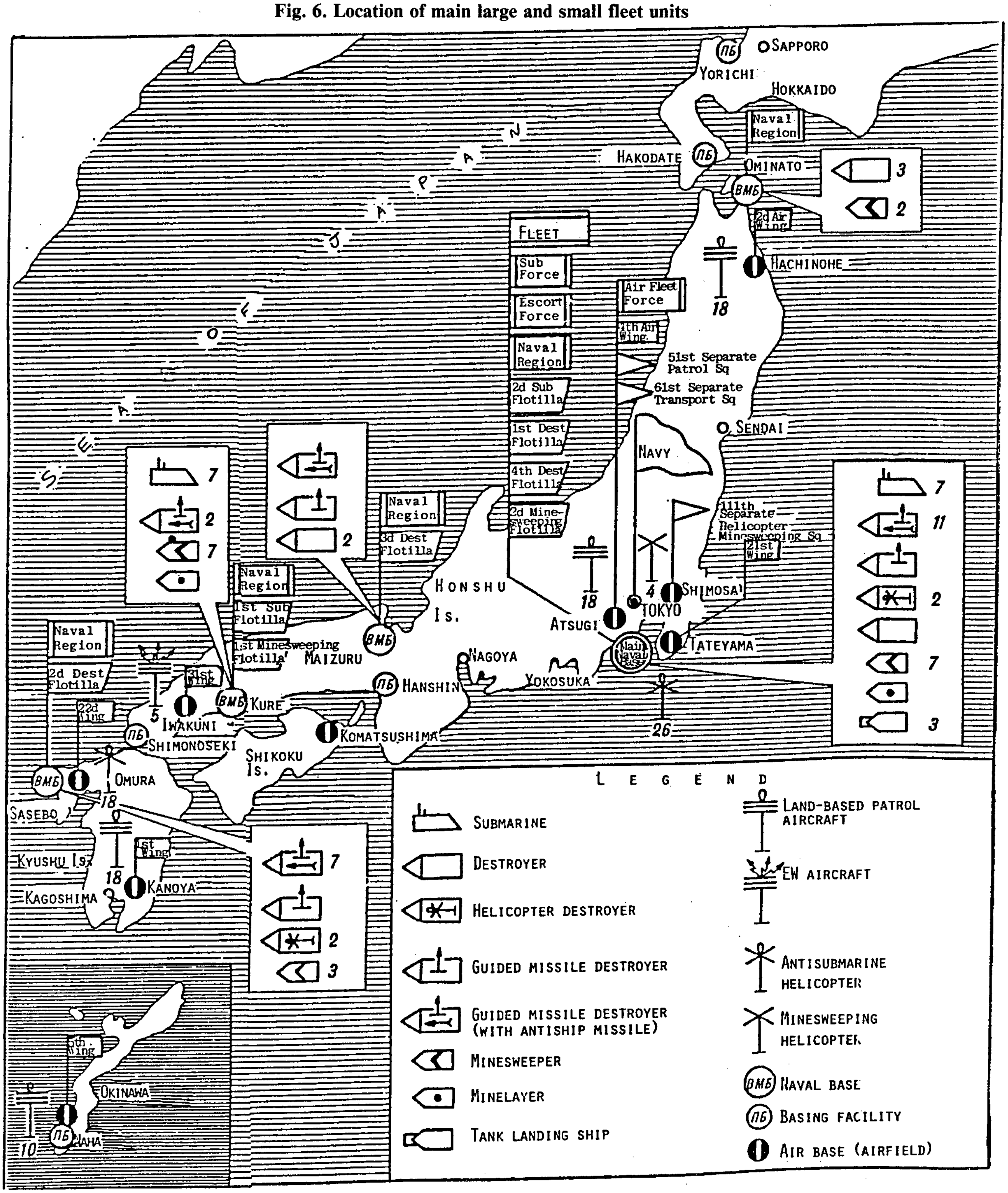
The headquarters of fleet aviation (Atsugi Air Base) is headed by a chief (authorized category rear admiral), and he also has a subordinate command post, communication center and antisubmarine warfare operations center. The air wing is the main tactical unit of the Air Fleet Force. The commander of each air wing (authorized category rear admiral) has a subordinate staff, up to three air squadrons, and support subunits. The air squadrons have an air detachment of flight personnel (up to three flights) and detachments of technical personnel (aircraft technicians). Flight personnel of the detachments and flights are consolidated in crews (up to one and a half crews for each aircraft).

The 1st, 2d and 4th patrol wings each include two air squadrons (the 1st and 7th, 2d and 4th, 3d and 6th patrol squadrons respectively) and the 5th Wing has one (5th). In addition, the 4th Wing includes a separate air group on Iwo Jima which chiefly handles matters of aviation engineer support and airfield technical support of patrol aircraft which periodically fly to this island (it has three S-61A search and rescue helicopters). Five patrol squadrons (1st, 2d, 3d, 4th and 6th) have completed re-equipping with P-3C aircraft (8-9 aircraft in each). The other two squadrons (5th and 7th) each have ten obsolete P-2J patrol aircraft, which are to be replaced with new ones (P-3C) in the next two years. The airfield technical support groups of the 1st, 2d and 4th air wings have search and rescue detachments (each with two S-61A helicopters). The patrol wings are stationed at Kanoua (1st), Hachinohe (2d), Atsugi (4th) and Naha (5th) air bases.

The 21st and 22d air wings are equipped with HSS-2B shore-based and deck-based antisubmarine helicopters and they are stationed at Tateyama and Omura air bases respectively. The 101st Squadron, 21st Wing (eight HSS-2B helicopters) usually is used in zones of responsibility of Yokosuka or Maizuru naval regions inasmuch as they lack authorized shore-based helicopter squadrons for now. Deck-based helicopters (36) are organizationally consolidated into four squadrons (121st-124th). On completion of conversion of the Fleet Escort Force to the "Flotilla 8-8" organization and establishment, it is planned to bring the number of ship helicopters to 48: 12 (8 organic and 4 reserve) in each of the above squadrons, which are assigned to ships of the 1st-4th destroyer flotillas respectively. At the present time they each have nine HSS-2B helicopters (on the average).

The 31st Air Wing includes a headquarters (Iwakuni Air Base) and two squadrons (71st) (7 US-1A search and rescue seaplanes) and 81st (EW and combat training support aircraft—1 UP-2J, 2 UP-2JE and 2 U-36A). The other squadrons of the Air Fleet Force consist of a headquarters, up to two air detachments (each with 2-3 flights) and an aviation engineer support detachment. The 51st Separate Patrol (Test) Squadron is intended for

Fig. 6. Location of main large and small fleet units



testing new aircraft equipment and for studying procedures of tactical employment of existing models of aircraft and helicopters. It has ten flying craft (three each P-3C and HSS-2B as well as two each P-2J and SH-60J) and is stationed at Atsugi Air Base. The 61st Separate Transport Squadron (4 YS-11MA and 1 LC-90) also is stationed here. The 111th Separate Minesweeping Helicopter Squadron (4 V-107A) is based at Shimosa Air Base.[4] Fig. 6 shows a diagram of the stationing of the main large and small units of the Japanese Fleet.

The *Fleet Training Development Command* is headed by a commander (authorized category vice admiral), who has a subordinate staff and a number of formations (all at Yokosuka): a range for testing new models of weapons and naval equipment (Weapon Evaluation Group), a research center for operational-tactical employment of naval forces (Operational Development Group), Tactical Trainer Center and Missile Training Center, as well as five training centers (Fleet Training Groups) for training fleet specialists among junior officers, petty officers and enlisted personnel (1st at Yokosuka, 2d at Kure, 3d at Sasebo, 4th at Maizuru, 11th on Eta-Jima Island, Kure area), and a ship weapon test laboratory (Kagoshima). Around ten obsolete ships, small craft and vessels (including the reserve destroyer "Akizuki," the experimental ship "Kurihama" and three former minesweepers) are assigned to support the activity of this command's units and subunits. The authorized category of the range chief is rear admiral, that of chiefs of the experimental laboratory and the 11th Training Center is captain 2d rank (commander), and that of chiefs of the other training and research centers is captain 1st rank.

Three centers are immediately subordinate to the fleet commander: Acoustic Analysis, Computer and EW. The *Acoustic Analysis Center* is located at Atsugi Air Base and is engaged in generalizing the data coming from ships, vessels, aircraft and helicopters as well as fixed equipment on ocean sonar conditions and characteristics of the acoustic field of ships of the Japanese Fleet and navies of other countries. It closely coordinates its work in questions of classifying detected targets with the ASW operations center of the Air Fleet Force. A sonar range at Kagoshima is subordinate to it.

The *Computer Center* (Yokosuka Main Naval Base) conducts the processing and output of data for the highest echelons of the Fleet and Navy. The primary data exchange is accomplished for permanent functioning of the automated system for combat control of Japanese Fleet forces, the SF-System. A branch of the Computer Center, the Ground Support Computer Complex, is located at Atsugi Air Base.

The *EW Center* (Funakoshi, Yokosuka area) engages in organizing SIGINT and ELINT in the interests of EW, coordinating these measures with EW services of the Army and Air Force, organizing research in the EW sphere, developing measures and equipment for protecting naval electronics, and monitoring the prescribed operating regime of radiotechnical equipment of the naval forces.

The order of battle and basing of the Japanese Fleet are given in the table.

Japanese Fleet Order of Battle and Basing

Formations, Large and Small Units	Ships and Vessels Types (Subtypes)	Number	Side Numbers and Names	Station or Base of Registry
1	2	3	4	5
Fleet headquarters				Yokosuka
	General purpose supply transports	2	AOE 412 "Sagami"	Kure
			AOE 422 "Towada"	Kure
	Combat training support ship	1	ATS 4202 "Kurobe"	Kure
Submarine Force				Yokosuka
1st Submarine Flotilla	Flagship (rescue ship)	1	ASR 402 "Fusimi"	Kure
	Combat training support ship (reserve destroyer)	1	ASU 7008 "Harusame"	Kure
	Training submarine	1	ATSS "Isoshio"	Kure
1st Division	Submarine	3	SS 573 "Yuushio"	Kure
			SS 574 "Mochishio"	Kure
			SS 579 "Akishio"	Kure
5th Division	Submarine	2	SS 569 "Narushio"	Kure
			SS 570 "Kuroshio"	Kure
6th Division	Submarine	2	SS 571 "Takashio"	Kure
			SS 572 "Yaeshio"	Kure

Japanese Fleet Order of Battle and Basing

Formations, Large and Small Units	Ships and Vessels Types (Subtypes)	Number	Side Numbers and Names	Station or Base of Registry
2d Submarine Flotilla	Flagship (rescue ship)	1	AS 405 "Chiyoda"	Yokosuka
2d Division	Submarine	2	SS 577 "Nadashio"	Yokosuka
			SS 578 "Hamashio"	Yokosuka
3d Division	Submarine	2	SS 575 "Setoshio"	Yokosuka
			SS 576 "Okishio"	Yokosuka
4th Division	Submarine	3	SS 580 "Takeshio"	Yokosuka
			SS 581 "Yukishio"	Yokosuka
			SS 582 "Sachishio"	Yokosuka
Escort Force	Flagship (destroyer)	1	DDK 118 "Murakumo"	Yokosuka
1st Destroyer Flotilla	Flagship (helicopter destroyer)	1	DDH 143 "Shirane"	Yokosuka
41st Division	Guided missile destroyer	3	DD 122 "Hatsuyuki"	Yokosuka
			DD 123 "Shirayuki"	Yokosuka
			DD 125 "Sawayuki"	Yokosuka
46th Division	Guided missile destroyer	2	DD 153 "Yuugiri"	Yokosuka
			DD 154 "Amagiri"	Yokosuka
61st Division	Guided missile destroyer	2	DDG 169 "Asakaze"	Yokosuka
			DDG 171 "Hatakaze"	Yokosuka
2d Destroyer Flotilla	Flagship (helicopter destroyer)	1	DDH 144 "Kurama"	Sasebo
42d Division	Guided missile destroyer	3	DD 124 "Mineyuki"	Sasebo
			DD 151 "Asagiri"	Sasebo
			DD 152 "Yamagiri"	Sasebo
44th Division	Guided missile destroyer	2	DD 129 "Yamayuki"	Kure
			DD 130 "Matsuyuki"	Kure
62d Division	Guided missile destroyer	2	DDG 168 "Tachikaze"	Sasebo
			DDG 170 "Sawakaze"	Sasebo
3d Destroyer Flotilla				Maizuru
	Flagship (helicopter destroyer)	1	DDH 141 "Haruna"	Sasebo
2d Division	Destroyer	2	DDA 166 "Mochizuki"	Maizuru
			DDA 167 "Nagatsuki"	Maizuru
45th Division	Guided missile destroyer	3	DD 131 "Setoyuki"	Sasebo
			DD 132 "Asayuki"	Sasebo
			DD 133 "Shimayuki"	Sasebo
63d Division	Guided missile destroyer	2	DDG 163 "Amatsukaze"	Maizuru
			DDG 172 "Shimakaze"	Maizuru
4th Destroyer Flotilla	Flagship (helicopter destroyer)	1	DDH 142 "Hiei"	Yokosuka
1st Division	Guided missile destroyer	2	DD 164 "Takatsuki"	Yokosuka
			DD 165 "Kikuzuki"	Yokosuka
23d Division	Destroyer	3	DDK 119 "Aokumo"	Ominato
			DDK 120 "Akigumo"	Ominato
			DDK 121 "Yugumo"	Ominato

Japanese Fleet Order of Battle and Basing

Formations, Large and Small Units	Ships and Vessels Types (Subtypes)	Number	Side Numbers and Names	Station or Base of Registry
43d Division	Guided missile destroyer	3	DD 126 "Hamayuki"	Yokosuka
			DD 127 "Isoyuki"	Yokosuka
			DD 128 "Haruyuki"	Yokosuka
Minesweeping forces				
1st Minesweeping Flotilla	Flagship (minelayer)	1	MST 462 "Hayase"	Kure
14th Division	Minesweeper	3	MSC 656 "Yakushima"	Sasebo
			MSC 657 "Narushima"	Sasebo
			MSC 669 "Hikoshima"	Sasebo
16th Division	Minesweeper	2	MSC 662 "Nuwajima"	Kure
			MSC 663 "Etajima"	Kure
18th Division	Minesweeper	2	MSC 661 "Takashima"	Kure
			MSC 665 "Himeshima"	Kure
19th Division	Minesweeper	3	MSC 666 "Ogishima"	Kure
			MSC 667 "Moroshima"	Kure
			MSC 668 "Yurishima"	Kure
2d Minesweeping Flotilla	Flagship (minelayer)	1	MMC 951 "Souya"	Yokosuka
12th Division	Minesweeper	3	MSC 649 "Hatsushima"	Yokosuka
			MSC 652 "Enoshima"	Yokosuka
			MSC 653 "Ukishima"	Yokosuka
13th Division	Minesweeper	2	MSC 654 "Ooshima"	Ominato
			MSC 655 "Niijima"	Ominato
15th Division	Minesweeper	2	MSC 658 "Chichijima"	Yokosuka
			MSC 659 "Torishima"	Yokosuka
17th Division	Minesweeper	2	MSC 660 "Hahajima"	Yokosuka
			MSC 664 "Kamishima"	Yokosuka
1st Separate Tank Landing Ship Division	Tank landing ship	3	LST 4151 "Miura"	Yokosuka
			LST 4152 "Ojika"	Yokosuka
			LST 4153 "Satsuma"	Yokosuka
Air Fleet Force				Atsugi
Training Development Command	Reserve destroyer	1	ASU 7010 "Akizuki"	Yokosuka
	Experimental ship	1	ASE 6101 "Kurihama"	Yokosuka
Units of direct subordination and service subunits				Yokosuka, Atsugi, Kagoshima

(To be concluded)

Footnotes

1. In addition to the Fleet, the Japanese Navy includes five naval regions, an air training command, a squadron of training ships, and central units and establishments. For more details on this see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 8, 1983, pp 64-72; No 5, 1987, pp 47-54; No 8, 1988, pp 47-52—Ed.

2. For more details on this see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 3, 1986, pp 47-55—Ed.

3. Under the Japanese classification, the minelayer MST 462 "Hayase" is considered a minesweeper support ship—Ed.

4. For more details on fleet aviation and development prospects see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 8, 1988, pp 47-52; No 9, 1988, pp 52-59—Ed.

SSBN Missile Systems of NATO Countries

18010800i Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 55-62

[Article by Capt 2d Rank V. Krasenskiy and Capt 1st Rank V. Grabov]

[Text] In general, strategic sea-launched missile systems include submarine-launched ballistic missiles [SLBM's], launchers, a missile fire control system and other equipment (the launch complex) accommodated aboard nuclear-powered submarines [SSBN's]. In the assessment of foreign specialists, SSBN missile systems in the inventory of navies of the United States, Great Britain and France provide a long range of fire and high accuracy in delivering nuclear warheads to the target with relatively small launch vehicle dimensions. This is achieved through the solution of a number of engineering problems such as choice of missile shape and design and creation of effective solid propellants, specialized materials, launchers for an underwater launch, as well as missile control and guidance systems.

Submarine-launched ballistic missiles deliver nuclear warheads to enemy targets at a distance of several thousand kilometers with a hit accuracy to hundreds of meters. Modern SLBM's include two or three stages, an instrumentation compartment and a nose section loaded with one or several warheads (their specifications and performance characteristics are given in the table). As a rule, SLBM's have two solid-propellant stages connected by an interstage. One foreign missile (Trident I) which has become operational is made in a three-stage configuration. The third stage is accommodated in the central opening of the instrumentation compartment and reentry vehicle. Comparative dimensions of missiles are shown in Fig. 1 [figure not reproduced]).

Principal Specifications and Performance Characteristics of Modern SLBM's of NATO Countries

	United States				Great Britain		France		
Characteristics	Polaris A-3 (1964)	Poseidon C-3 (1971)	Trident I (1979)	Trident II (1989)	Polaris A-3TK (1982)	Trident II (1991)	M-20 (1977)	M-4 (1985)	M-4-71 (.)
Range (maximum), km	4600	5200 or 4000	7400	11000	4000	11000	3200	4500	5000
Launch weight, tons	15.9	29.5	32	57.5	15.9	57.5	21	35	35
Length, m	9.85	10.36	10.36	13.95	9.85	13.95	10.4	11.05	11.0 5
Maximum diameter, m	1.37	1.88	1.88	2.1	1.37	2.1	1.5	1.93	1.93
Accuracy (CEP[1]), m	900	450-550	300-450	100-120	450-500	.	1000	.	.
Type reentry vehicle	MRV (Mk 2)	MIRV (Mk 3)	MIRV (Mk 4)	MIRV (Mk 4 or 5)	MIRV (Chevaline)	MIRV	Single warhead	MIRV (TN-70)	MIRV (TN-71)
Number of warheads and their yield, MT	3x0.2	10x0.05 or 14x0.05	8x0.1	8x0.475 or 13x0.1	6x0.04-0.05	.	1x1	6x0.15	6x0.15
Type warhead	W-58	W-68	W-76	W-76 or W-88 (W-87)	.	.	MR-60	MR-70	MR-71
Guidance system	Inertial	Inertial	Inertial with astrocorrection	Inertial with astrocorrection	Inertial	Inertial with astrocorrection	Inertial	Inertial	Inertial

1. CEP (Circular Error Probable) is the value describing the accuracy of fire of the SLBM equal to the radius of a circle containing the impact points of 50 percent of launched missiles or warheads.

Solid-propellant rocket motors of all three Trident I stages were newly developed, their cases were fabricated from materials with improved characteristics (kevlar-49 aramid fiber with epoxy resin used as a binder), and they have a lightweight swiveling nozzle. Motor cases of other types of SLBM's (Polaris and Poseidon) are made of steel or glass-reinforced plastic (glass-fiber reinforced epoxy resin). Kevlar-49 material has a higher specific strength and higher elastic modulus compared with glass fiber. The foreign press emphasizes that the choice of aramid fiber provided a weight advantage as well as increased range of fire of the SLBM.

Missile motors are filled with high-energy solid-propellant. In particular, Trident I SLBM motors use nitrolane fuel with a density of 1.84 g/cm^3 and a specific impulse of 271 kg(f)/kg (231 kg(f)/kg in Polaris SLBM motors). Polyurethane rubber is used as a plasticizer. Nominal thrust of the solid-propellant rocket motor of the Trident I SLBM second stage is 54.4 tons force with a fuel weight of 7.26 tons (Poseidon C-3 has 36.3 tons force with the very same weight), and that of the third stage is 18.1 tons force with a fuel weight of 1.81 tons. The developers assert that using dibasic fuel with high density, large specific impulse and cross-linkages in these missiles provided around a 40 percent increase in range of fire. Each stage of the Trident I missile, as in the Poseidon C-3 SLBM, has one swiveling nozzle providing pitch and yaw control (gas jet deflectors and hinged nozzles were used in Polaris missiles). The nozzle is made of composite materials (based on graphite) with lesser weight and great erosion resistance.

Thrust vector control in pitch and yaw in the boost phase is accomplished by deflecting the nozzles, and there is no roll control on the mid-course leg. Roll deflection which accumulates during operation of the solid-propellant rocket motor is compensated during operation of the reentry vehicle propulsion unit.

All three Trident I SLBM stages have thrust vector control systems. Angles of rotation of thrust vector control nozzles are small and do not exceed 6-7°. The maximum nozzle rotation angle is determined based on the magnitude of possible random deviations caused by the underwater launch and missile's turn. The nozzle rotation angle with stage separation (for correcting the trajectory) usually is 2-3°, and during the rest of the flight it is 0.5°.

The first and second missile stages have the same thrust vector control design, but in the third stage it is of considerably lesser size. The system includes three main elements: solid-propellant gas generator supplying gas (temperature 1,200°C) to the hydraulic unit; and a turbine, which activates a centrifugal pump and hydraulic drive with lines. The operating rotation rate of the turbine and of the centrifugal pump rigidly connected with it is 100,000-130,000 rpm. In contrast to the Poseidon C-3, the Trident I missile thrust vector control system does not have a gear reducer connecting the turbine with the pump and reducing the pump rotation rate (to 6,000 rpm). In the assessment of foreign specialists, this led to a decrease in their weight and an increase in reliability. In addition, in the thrust vector control system the steel hydraulic lines used in the Poseidon C-3 missile have been replaced with teflon lines. Hydraulic fluid in the centrifugal pump has a working temperature of 200-260°C. The solid-propellant rocket motors of all Trident I SLBM stages operate until complete fuel burn-out.

The use of lighter materials in solid-propellant rocket motor cases, nozzles and elements of the thrust vector control devices as well as use of rocket fuel with large specific impulse, modernization of the thrust vector control device and introduction of a third stage permitted increasing the range of fire of the Trident I missile by approximately 2,300 km compared with the Poseidon C-3.

The instrumentation compartment, which serves to accommodate elements of the missile guidance and control system, holds a special place in the design of any missile. Depending on the type of SLBM, this compartment is installed in the upper section of the final stage or in the missile reentry vehicle.

The guidance system of the Trident I SLBM controls missile flight both on the mid-course leg and in the warhead separation phase. The principal elements of the guidance system are a gyro-stabilized platform accommodating gyro instruments and stellar sensor, as well as an on-board computer which generates control signals. A thermostatic control subsystem which includes temperature sensors and inertial instrumentation heaters as well as water cooling is used in the guidance system to ensure its normal operation. The instrumentation compartment in the Trident I SLBM is located in the missile third stage. It accommodates gear and instruments of the inertial guidance system with astrocorrection. The inertial navigation instruments of the missiles have a cumulative range error of 1,480 m per hour of flight. To reduce this error astrocorrection was introduced to the Trident I SLBM in addition to upgrading the mechanical assemblies of inertial instruments, particularly by using air bearings for gyroscopes (this permitted avoiding errors caused by heating, wear, and thermal effect of a rotating bearing contacting the surface). Astrocorrection is performed by updating the missile's location in space by observing one or two stars located near the zenith in the target area. Measurements of a star's angular altitude relative to the local vertical at launch are used for range correction, and results of measurements of the horizontal component are used for azimuth correction. To perform astronavigational measurements Trident I missiles are equipped with an optical telescope and vidicon star sensor, which make up a single unit with the set of inertial instruments.

Using new achievements in microelectronics in the Trident I SLBM permitted reducing the weight of the electronics unit in the guidance and flight control system by 50 percent compared with a similar unit in the Poseidon C-3 missile. In particular, the electronic equipment integration coefficient in Polaris A-3 missiles was 0.25 conditional elements per cm^3, in the Poseidon C-3 it was 1, and in the Trident I it was 30 (thanks to the use of thin-film hybrid circuits).

The missile reentry vehicle serves for accommodating, guiding and launching warheads to designated targets. SLBM's are equipped with three types of reentry vehicles: single-warhead, MRV, and MIRV.

Single-warhead reentry vehicles were installed in the first American Polaris A-1 and Polaris A-2 SLBM's as well as on the French M-2 and M-20. They had one warhead with a yield of 0.5-1 MT.

MRV reentry vehicles were fitted on Polaris A-3 missiles. They were loaded with three 200 KT warheads which are simultaneously fired off at a given point on the flight path and fly to the target area along ballistic trajectories that are close to each other.

A typical feature of the MRV and single-warhead reentry vehicles is the absence of their own propulsion system.

MIRV's have several individually guided warheads aimed at different targets in turn. Poseidon C-3, Polaris A-3TK, M-4 and Trident I SLBM's are equipped with them. The makeup of the reentry vehicles is approximately the same, with their fundamental difference being in the number and types of warheads.

Judging from western press reports, a MARV (loaded with individually guided maneuverable warheads) presently is being developed.

The reentry vehicle of Trident I missiles consists of a warhead compartment, a warhead separation system or stage, guidance subsystem and nose fairing with aerodynamic nose spike.

The warhead compartment carries eight W-76 warheads arranged in a circle. Each has a yield of around 100 KT.

The warhead separation system compensates for errors in taking the reentry vehicle to the target and performs a correcting maneuver when aiming the warheads. It includes a propulsion system consisting of two solid-propellant gas generators and a subsystem of small nozzles with controlled valves by which the reentry vehicle speed is adjusted and it is oriented and stabilized when warheads are separated. The gas generator's role is performed by a solid-propellant gas generator (working temperature 1,650°C, specific impulse 236 kg(f)/kg, high pressure 33 kg(f)/cm^2, low pressure 12 kg(f)/cm^2). Previously the working temperature of gas in the Poseidon C-3 SLBM warhead separation system was 450°C lower and specific impulse was 15 percent less.

Gas is delivered through an intake line to four nozzle control units feeding a sum total of 16 nozzles (four forward, four aft and eight for roll stabilization). The warhead separation system weighs 295 kg, the fuel weight is 193 kg and maximum time of operation after third stage separation is 7 minutes.

The nose fairing of the Trident I SLBM is made of special spruce veneer and its reentry vehicle is made of phenolic glass reinforced plastic. The foreign press notes that the use of special spruce veneer provided considerably better reentry vehicle characteristics on exiting the atmosphere than other tested materials. With the exit from dense layers of the atmosphere there is carbonization only of the external layer of the fairing, while the other layers provide good protection for the instrumentation compartment and reentry vehicle components. Jettisoning of the fairing (and removal from the missile flight path) occurs in the second-stage motor operating sector with the help of solid-propellant motors.

An aerodynamic nose spike is used on Trident (Fig. 2 [figure not reproduced]) and Poseidon C-3 missiles to reduce aerodynamic drag and increase the range of fire with the existing shape of their nose fairings.

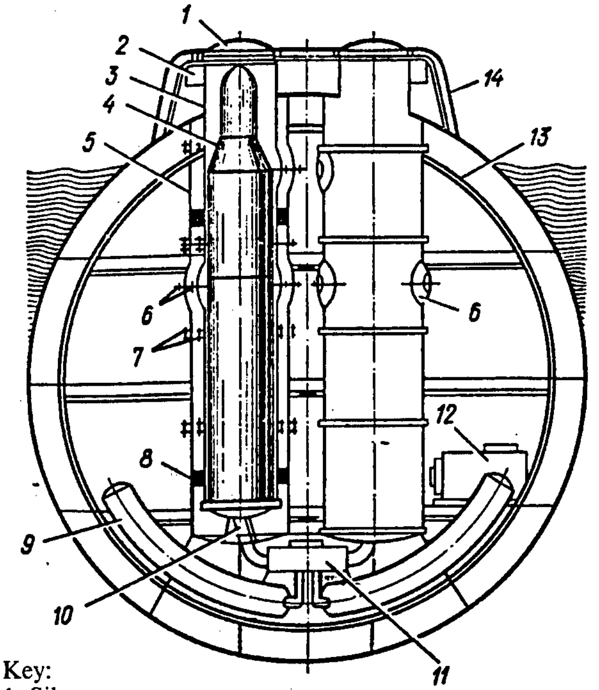
On the Trident I SLBM the aerodynamic spike is recessed in the fairing and its six parts extend telescopically in 100 milliseconds at a height of 600 m under the effect of the solid-propellant gas generator. The spike reduces the maximum value of the force of aerodynamic drag in the boost phase from 18,000 to 9,000 kg(f). Use of this configuration provided an increase in range of fire of 550 km for the Trident I SLBM and of 325 km for the Poseidon C-3 compared with the Polaris A-3 missile, which has a similarly shaped nose fairing.

SLBM launchers are the most important component of the launch system and are intended for missile storage, maintenance and launch. The principal components of each launcher are a silo, launch housing, hydropneumatic system, diaphragm, valves, plug connector, steam feed subsystem, and subsystem for monitoring and checking all launcher assemblies.

The silo is a cylindrical steel structure immovably fixed in the SSBN hull. It is closed on top by a cover with hydraulic drive (of equal strength with the SSBN pressure hull), beneath which is a diaphragm preventing outside water from getting into the silo when the cover is open. A steel launch housing is installed inside the silo. The annular gap between the walls of the silo and the housing is filled with an elastomeric polymer. Shock-absorbing and obturating bands are accommodated in the gap between the inner surface of the housing and the missile. The SLBM is installed in the launch housing on a supporting ring which ensures its azimuthal adjustment. The lower part of the missile has four shock absorbers and four centering cylinders. Some of the devices (shock absorbers) for damping impact loads on the missile are accommodated in the gap between the silo walls and launch housing. An improvement in these devices and a reduction in the gap between the silo and launch housing in the 1970's permitted installing SLBM's of larger size (Poseidon C-3) in the Polaris A-3 missile silo.

The Polaris SLBM launch housing (Fig. 3) and, according to the data of some foreign sources, also that of the Trident I is mounted on the SSBN pressure hull on 20-30 shoes resting on hydraulic shock absorbers. The top of the Trident I missile launch housing is covered by a diaphragm similar to that used in the Poseidon missile system. The rigid membrane of the diaphragm 6.3 mm thick has an arched shape (its diameter is 2.02 m and its height is 0.71 m). It is made of asbestos-reinforced phenolic resin. Low-density open-cell polyurethane foam and a honeycomb material made in the shape of the missile reentry vehicle is glued to the inner surface of the diaphragm. This provides protection for the SLBM against power and heat loads when the diaphragm is opened using shaped explosive charges mounted on the

Fig. 3. Polaris SLBM launcher



Key:
1. Silo pressure cover
2. Cover opening mechanism
3. Launch housing
4. Missile
5. Outer launch-silo cylinder
6. Inspection hatches
7. Flange joints of silo cylinder section
8. Shock absorbers
9. Missile system high pressure air cylinders
10. Launch housing centering device and axial support
11. Distributing box of missile system high pressure air system
12. Electrocompressor of missile system high pressure air system
13. Pressure hull
14. SSBN outer hull

inner surface of the membrane. On opening, the membrane breaks up into several parts: a central part and lateral parts.

Each silo has a manhole and hatches located at different levels for access to missile systems and assemblies for their inspection and maintenance. The Trident I SLBM launch silo (Fig. 4 [figure not reproduced]) is equipped with a new type of plug connector for connecting missile instruments with the on-board fire control system. It automatically disengages at the moment of missile launch.

High pressure air was used in the Polaris missile system for ejecting the missile from the silo, and each silo was equipped with an autonomous air system for this purpose. The air was stored in spherical cylinders 1.2 m in diameter. The capacity of a cylinder designed for a pressure of 315 kg/cm^2 was 0.9-0.95 m^3, and the overall missile system high pressure air reserve, such as aboard the SSBN "George Washington," was 14-15 m^3.

A solid-propellant gas generator is used for firing Poseidon C-3 and Trident I missiles from the silo. The gases it generates pass through a water chamber and are partially cooled. The low-temperature steam thus formed enters the lower part of the launch housing and shoves out the missile. In the assessment of American specialists, the conversion to steam and gas permitted increasing the missile's firing weight without increasing the volume of the ejection system.

A system for creating overpressure before missile launch, a cooling chamber and a new type of silo closure were introduced in the Trident I SLBM launch silo. The launch housing on an "Ohio"-Class SSBN is 15 percent larger in diameter and 30 percent higher than for "Lafayette"-Class submarines. This was done with consideration of the possibility of subsequently accommodating Trident II SLBM's aboard the first eight "Ohio"-Class submarines.

The missile fire control system is intended for calculating firing data and inputting them to the missile, accomplishing a prelaunch check and monitoring the gear's readiness for launch. The Mk 88 Mod 2 missile fire control system has been installed aboard "Lafayette"-Class SSBN's and a new Mk 98 Mod 0 system has been developed for "Ohio"-Class submarines. In contrast to similar systems of the Polaris missile system, they permit retargeting missiles in the silos of SSBN's on patrol to newly assigned targets.

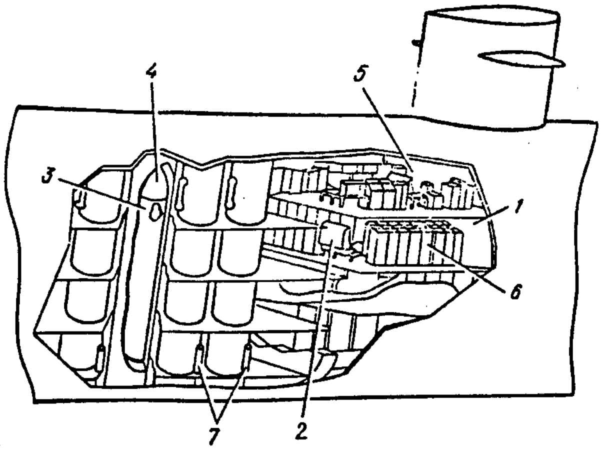
The missile fire control system includes a missile launch control station, navigation station and station for monitoring the subsystem for ejecting missiles from the silo. It is based on a computer.

The missile fire control station is located in the SSBN control room (Fig. 5). Necessary data describing the status of all missiles and preparation of auxiliary subsystems for firing are displayed on its special console. Such a console aboard "Lafayette"-Class SSBN's includes 16 rows of green indicator lights showing preparation stages and the degree of readiness for flight. There is an opening for the launch key in the center of the lower part of the console.

The navigation system issues data describing the platform's location and motion as well as values of the Earth's magnetic and gravitational fields at the SSBN's location. These data, as well as data from the missile monitoring and ejection subsystem, are input to the ship computer.

Missile system functioning. On receiving the signal-order for missile launch, the submarine commander announces general quarters. After checking the order's authenticity, the commander gives the order to place the submarine in technical readiness 1SQ, which is the highest readiness condition. At this command the ship's

Fig. 5. Location of main stations and assemblies of missile fire control system aboard "Ohio"-Class SSBN



Key:
1. Missile fire control station
2. Missile fire control console
3. SLBM instrumentation compartment
4. Missile reentry vehicle
5. Navigation station
6. Ship computer
7. Equipment of system for ejecting missiles from silos

coordinates are updated, speed is reduced to values supporting missile launch, and the submarine comes up to a depth of around 30 m.

On readiness of the navigation system as well as the missile monitoring and ejection subsystem station, the SSBN commander inserts the launch key in the appropriate opening of the fire control console and switches it. By this action he gives the command to the submarine missile compartment for immediate prelaunch preparation of the missile system.

Before missile launch, pressure in the launch silo is equalized with outside pressure, then the silo pressure cover is opened. After this, access of outside water is blocked only by the relatively thin diaphragm situated beneath the cover.

Immediate missile launch is accomplished by the weapon (missile-torpedo) department head using a launch mechanism with a red lever (black for practice launches), which is connected to the computer by a special cable. Then the solid-propellant gas generator is turned on and the gases it generates pass through the water chamber and partially cool. The low-temperature steam thus formed enters the lower part of the launch housing and shoves the missile out of the silo.

The Polaris missile system used high pressure air which was delivered beneath the missile obturator through a system of valves according to a strictly defined schedule precisely maintained by special automatic gear. This ensured desired missile movement conditions in the launch housing and its acceleration to 10 g's at a silo exit speed of 45-50 m/sec.

In moving upward the missile breaks the diaphragm and outside water freely enters the silo. After the missile exits, the silo cover automatically closes and outside water in the silo is drained into a special compensating tank within the submarine pressure hull.

With a missile moving in the launch housing, the SSBN is subjected to the effect of significant reactive force, and after the missile emerges from the silo she is subjected to the pressure of incoming outside water. The helmsman keeps the submarine from going deeper using special automatic equipment which controls the operation of gyroscopic stabilizing devices and transfer of water ballast.

After uncontrolled movement in the water, the missile surfaces. The SLBM first stage motor ignites at a height of 10-30 m above the sea at a signal from the acceleration transducer. Pieces of the launch housing seal are ejected to the surface together with the missile.

Then the missile ascends vertically and begins to execute the given flight program on reaching a certain speed. At the end of first stage motor operation at an altitude of approximately 20 km the first stage separates, the second stage motor ignites, and the first stage airframe is fired away. Ignition of the Trident I SLBM third stage motor occurs in a similar manner. When the missile is moving on the mid-course leg its flight is controlled by deflecting nozzles of the stages' motors. After third stage separation the warhead separation phase begins. The reentry vehicle with instrumentation compartment continues to fly along a ballistic trajectory. The flight trajectory is corrected by the reentry vehicle motor and the warheads are aimed and fired.

The MIRV reentry vehicle uses the so-called "bus principle": after correcting its position, the reentry vehicle aims at the first target and fires a warhead, which flies to the target on a ballistic trajectory; then after correcting its position using the warhead separation system propulsion unit, the reentry vehicle (the "bus") aims at the second target and fires the next warhead. A similar procedure is repeated for each warhead. If it is necessary to engage one target, then a program is entered in the reentry vehicle which permits delivering a strike with time separation (in the MRV reentry vehicle all warheads are fired simultaneously after aiming by the second stage motor). The warheads reach the target 15-40 minutes after missile launch. Approach time depends on the distance of the SSBN firing position area from the target and the missile flight trajectory.

Command authorities of navies of the United States, France and Great Britain are constantly working to upgrade sea-launched strategic missiles to increase SLBM combat capabilities of engaging different targets. Capabilities for penetrating an enemy ABM defense are increased by including decoys in the reentry vehicle, creating MARV maneuvering reentry vehicles and maneuvering warheads, reducing radar cross-section, and creating thermal protection for warheads against laser emissions.

Scorpio Sentry Remotely Controlled Mine Countermeasures Vehicle

18010800j Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) p 62

[Article by Capt 1st Rank A. Prostakov]

[Text] The United States has created a self-propelled remotely controlled mine countermeasures vehicle designated Scorpio Sentry intended for identifying and destroying mines detected by minesweepers during a hunt. In contrast to previously created mine countermeasures vehicles of similar purpose, the new vehicle (see figure [figure not reproduced]) has small dimensions and light weight and can be employed not only from mine countermeasures ships, but also from other floating craft designated for minesweeping.

The mine countermeasures vehicle uses a propeller-rudder system called a "tandem screw system," which gives the vehicle six degrees of freedom and a maximum speed of 6 knots. The system has two variable-pitch contrarotating propellers mounted at the forward and aft ends of the vehicle. Propeller blades are rotated simultaneously to a certain angle, or the angle of rotation of each blade can change according to a given law as the propeller turns. The combination of the propellers' features and their tandem installation gives the mine countermeasures vehicle very high maneuverability and permits it to move in any direction as well as to turn about its axes. The large screw diameter ensures effective thrust with lesser rotation speed, which improves the propeller's gravitational characteristics. Wide use of nonmagnetic materials in the mine countermeasures vehicle design reduces its magnetic signature.

A sonar is installed in the vehicle which provides a survey of space along the movement heading, and a highly sensitive television camera operates with a low level of illumination. The mine countermeasures vehicle carries a releasable charge for subsequent remote detonation of a seabed mine, or an explosive cutter for breaking a moored mine's mooring. On-board mechanisms can receive electrical power from the vehicle's own batteries or over a cable from a ship or vessel.

Egypt's Military-Industrial Cooperation with Western Countries

18010800k Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 63-68

[Article by Lt Col V. Ivanov]

[Text] Over the last ten years the Arab Republic of Egypt [ARE] has been making vigorous efforts to develop military industry and is rapidly becoming one of the main third world exporters and re-exporters of weapons and military equipment. The scope of this process is reflected in the increase in overall volume of arms production in Egypt from $30 million in 1973 to $500 million in 1986 and of weapons export from $4 million during the period 1970 through 1976 to almost one billion dollars in 1982 (partially thanks to the re-export of previously supplied Soviet arms).

A ten-year plan for modernizing the country's Armed Forces was announced in 1979. Along with the purchase of a wide product list of modern arms, the plan envisaged organizing arms production in Egypt as well as modernizing existing arms. These programs are connected above all with the establishment of close relations with western countries with the objective of receiving modern military technologies from them.

Technologies presently being used for producing arms and military equipment are for the most part French or American, and relations with these countries, especially with the United States, continue to strengthen.

For example, an agreement was signed with the United States in the fall of 1988 about assembling M1A1 Abrams tanks in Egypt under American license. Under this agreement the first 15 tanks will be delivered to Egypt in 1991 and then will be completely disassembled and reassembled, this time by Egyptian specialists. The subsequent lot of 540 tanks will be assembled in country over a ten-year period from assemblies and machine units being supplied from the United States. Construction of Tank Plant No 200 is being completed at the present time in the populated point of Abu-Zaabal near Cairo for assembling these machines. It is also planned that some assemblies will be produced in Egypt.

There also are reports about completion of construction by the American company of Ford Aerospace on a plant for producing Sidewinder air-to-air guided missiles.

World War II, which made it necessary to supply British forces stationed in Egypt, marked the beginning of Egyptian military industry. Several plants were built during the war for producing ammunition, torpedoes and artillery systems. These enterprise only partially satisfied the needs of British forces in Egypt as well as the Egyptian Army, which was established in 1936.

A new impetus for developing Egypt's military industry came with the arrival to power of the "Free Officers" organization under the direction of Nasser in July 1952.

The country's obvious military weakness as well as a lack of desire on the part of western states to supply Egypt with modern weapon systems in that period accelerated a solution to the problem of establishing Egypt's own military industry.

Three military plants were built by mid-1954. Plants for producing small-caliber artillery shells became operational in Alexandria in July and in the country's capital of Cairo in September, and a plant for producing large-caliber artillery rounds became operational in Cairo in August.

Egyptian military industry began to develop at faster tempos after the 1956 Suez War, and by the end of 1960 another five plants had been built for producing aircraft armament and artillery systems.

The **aircraft plant** (Plant No 36) in the city of Helwan became Egypt's main aviation complex. It specialized in the production of HA-200 Saeta (Egyptian name Al-Kahira) operational trainer (light attack) aircraft under Spanish license, used for training air college cadets. A total of 65 aircraft were assembled, but their production was stopped in 1969 for economic reasons. The plant also made attempts to arrange production of the Spanish-developed HA-300 supersonic fighter. A total of three prototypes of this aircraft were assembled.

An **aircraft engine plant** (Plant No 35) was built in the city of Helwan in the early 1960's. It produced the E-200 and E-300 aircraft engines for the HA-200 and HA-300. A total of 200 E-200 engines were manufactured. E-300 engines were used in the Indian HF-24 Marut fighter within the framework of joint Egyptian-Indian production.

The Soviet Union gave Egypt much help in that period in outfitting its Armed Forces with modern weapons and in developing national military industry. The **Sakr Factory for Developed Industries** (Plant No 333) was founded in Heliopolis (near Cairo) in 1963 for producing surface-to-surface missiles and spare parts for combat aircraft.

But despite the successful development of Egyptian military industry in the 1950's and early 1960's, its structure had considerable inherent deficiencies, which led to stagnation in the late 1960's.

A real solution to problems facing the country began to appear by the mid-1970's, when Egypt succeeded in attracting capital of Arab Persian Gulf oil-producing countries for satisfying the needs of the national military industry. At Egypt's initiative the Arab Organization for Industrialization was established in April 1975 with the participation of four countries: the ARE, Saudi Arabia, Qatar and the United Arab Emirates. Egypt placed 20 military industrial enterprises at its disposal, while the other three partners pledged to invest initial capital in an amount of $1.04 billion. Thus the Arab Organization for Industrialization was founded on a specific regional division of labor: Egypt presented its military-production base and working hands, and the oil-exporting countries invested their capital.

Inasmuch as Egyptian military industry did not have sufficient capabilities to independently organize production of modern weapons and military equipment and the Sadat regime was orienting itself more and more toward the West, the Arab Organization for Industrialization turned to military-industrial companies of capitalist states for assistance. The majority of contracts for licensed production were concluded by the late 1970's with companies of Western European countries with approximately an equal degree of participation of French and British firms. At that time American companies limited themselves to concluding a contract to produce jeep vehicles.

One of the principal characteristic features of contracts between the Arab Organization for Industrialization and its western partners was that they provided for creation of mixed companies in which the Arab side had the controlling block of shares, while the proportion of a particular Western European firm's participation was determined by the degree of its interest in developing a specific kind of production. In addition, the contracts included conditions stipulating the training of Egyptian engineering-technical personnel both in educational institutions of western countries and directly at ARE assembly enterprises. Thus necessary preconditions were created by the late 1970's for beginning the output of military products at Arab Organization for Industrialization enterprises.

But a real threat arose to the further existence of the Arab Organization for Industrialization with the conclusion of a separate Egyptian-Israeli "peace" treaty in March 1979 and the subsequent declaration of an economic boycott of Egypt by the majority of Arab countries. Just a month later (in April 1979) there was an announcement of its dissolution, the cessation of capital invest-ments, and the cancellation of all previously concluded contracts. The oil-exporting countries decided to remove all their capital investments from this organization's assets. Egypt for its part announced the creation of the Egyptian Organization for Industrialization on the basis of enterprises which were part of the Arab Organization for Industrialization. It was initially assumed that the Egyptian Organization for Industrialization would realize all contracts previously concluded within the framework of the Arab Organization for Industrialization, but because of a shortage of funds a number of projects (production of Lynx helicopters and Mirage F.1 fighters) had to be given up.

The Egyptian Organization for Industrialization[1] presently has nine enterprises specializing basically in the production of aircraft and missile equipment.

As already noted, the only Egyptian-American joint venture created within the framework of the Arab Organization for Industrialization is the **Arab American Vehicle (AAV)** company formed in 1977 together with American Motors with an overall capital of $35 million, but 51 percent of the shares belonged to the Arab side. At the present time the company's plants have 17,000 workers. It produces military jeep vehicles as well as light vehicles. The company's main enterprise is located in Heliopolis (Fig. 1 [figure not reproduced]).

In January 1978 Egypt signed a protocol with Great Britain organizing three joint ventures within the scope of the Arab Organization for Industrialization. The firm of **Arab British Dynamics (ABD)** with capital of $780 million was formed in accordance with this protocol; 70 percent of the shares were on the Arab side and 30 percent with British Aerospace. The company enterprise in Heliopolis (a Cairo suburb) produces Swingfire ATGM's under British license. A total of 50,000 missiles have been ordered. The annual rate of production was 500 units during 1982-1985, 1,127 in 1986 and 1,136 (estimate) in 1987.

The enterprise presently is mastering the output of TOW ATGM's. The previously adopted Sagger ATGM is being modernized; in particular, a new warhead section with greater armor-piercing capability is being developed.

Two other Egyptian-British joint ventures are the **Arab British Helicopter (ABH)** company, city of Helwan, with 30 percent of its shares belonging to the firm of Westland, and **Arab British Engine (ABE)**, whose plant is located in the same city, with 30 percent of the shares belonging to the British Rolls Royce corporation.

At the present time Arab British Helicopter is accomplishing licensed assembly of SA 341 Gazelle helicopters developed by the French firm of Aerospatiale, and the plant of the other Egyptian-British joint venture puts out engines for these helicopters. The first lot of 36 rotary-wing craft already has been assembled.

Two joint ventures with France also were established within the framework of the Arab Organization for Industrialization.

In November 1986 the first Alpha Jet combat trainer was assembled in the plant of the **Arab French Aircraft** company in Helwan (Fig. 2 [figure not reproduced]). The enterprise was created together with the French firm of Dassault-Breguet, but presently 100 percent of the shares belongs to the Arab Organization for Industrialization. In addition to assembling the Alpha Jet at a rate of two aircraft per month, the plant is producing the most basic spare parts for American F-16 Fighting Falcon and French Mirage-2000 tactical fighters.

An enterprise of the other joint Egyptian-French company, **Arab French Engineering**, is assembling Larzac 04 jet engines for the Alpha Jet in the city of Helwan, and in the near future it is proposed to organize assembly of engines for Mirage-2000 tactical fighters.

In addition to the six enterprises mentioned, the Egyptian Organization for Industrialization includes the aforementioned arms production plant (Sakr), the Kader Factory for Developed Industries enterprise, and an electronics plant.

The **Sakr Factory for Developed Industries** (Plant No 333) enterprise in Heliopolis specializes in producing artillery and missile systems of several types, including shoulder-fired antitank rocket launchers and rounds for them; the 122-mm Sakr-18, -30 and -80 multiple rocket launchers with a range of fire of 20, 30 and 80 km respectively, as well as rockets for them; Hossam antitank grenades; 23-mm twin antiaircraft guns; 80-mm air-to-surface rockets; and air defense systems with missiles having IR homing heads.

The plant of the firm of **Kader Factory for Developed Industries** (Plant No 72) in Heliopolis has been putting out the Fahd APC (4x4, Fig. 3 [figure not reproduced]), developed especially for the ARE Army by the West German firm of Thyssen-Henschel, since 1984. The APC uses a Daimler-Benz tracked chassis. In addition, this same plant performs licensed assembly of the Brazilian Tucano trainer aircraft (Fig. 4 [figure not reproduced]). The program for producing these aircraft calls for 120, 80 of which are being purchased by Iraq.

The **electronics plant** in Heliopolis produces field communication equipment, radars and on-board aircraft communication equipment.

Another association of enterprises of Egyptian military industry is the National Organization for Industrialization, subordinate to the Ministry of Military Production, which is headed by the minister of defense and military production. It includes 16 independent enterprises.

A plant of the **Abu-Zaabal Engineering Industries** company (Plant No 100) in Qalyubiyah Province is the only enterprise for producing automatic guns and artillery pieces with a caliber up to 203.2-mm. Series production began in 1983. The 23-mm self-propelled and towed air defense mounts, 122-mm towed gun-howitzers, 130-mm towed howitzer-guns, and tank guns for Soviet-produced T-55 and T-62 tanks which are being modernized are produced here at the present time. The company is involved in a program for creating self-propelled 122-mm artillery mounts.

A plant of the **Maadi Company for Engineering Industries** (Plant No 54) in Maadi (a Cairo suburb), built in 1954 with Sweden's help, produces automatic and semiautomatic rifles as well as machineguns and pistols. The product list of manufactured products includes the 7.62-mm Misr automatic rifle, the Hakim 7.92-mm semiautomatic rifle, the Aswan 7.62-mm heavy machinegun, the Suez 7.62-mm light machinegun, and the 9-mm Helwan automatic pistol (a license copy of the Italian Beretta Model 1951 pistol).

An enterprise of the **Helwan Company for Machine Tools** in the city of Helwan (Plant No 999) produces machineguns of calibers 60, 82 and 120 mm, sights for them, as well as rails for the 122-mm Sakr-18 and -30 multiple rocket launchers.

The **Helwan Company for Engineering Industries** enterprise (Plant No 99) also located there produces casings for artillery shells of calibers from 57 to 130 mm and rounds for mortars of calibers 60, 82 and 120 mm, aerial bombs of calibers 50-500 kg, warheads for missiles, mines including naval mines, fougasse, and grenades.

Two plants of the **Shubra Company for Engineering Industries** (Plant No 27) in Cairo and **Abu-Qir Engineering Industries** (No 10) in Alexandria produce small arms ammunition. In addition, the latter produces mortar rounds and hand grenades.

Production of artillery shells for up to 40-mm antiaircraft systems, antipersonnel mines, hand grenades, and fuzes for large-caliber artillery shells is concentrated in Cairo at an enterprise of the **El Mazarak Company for Engineering Industries** (Plant No 45), built in 1956.

The **Abu-Zaabal Company for Specialized Chemicals** (Plant No 18) in Cairo produces explosives and powders for all kinds of ammunition as well as missile solid propellant, and the **Kaha Company for Chemical Industries** (Plant No 270), also located there, produces detonators, smokepots and other pyrotechnic equipment.

Radio communication equipment is produced by a plant of the **Benha Company for Electronic Industries** (Plant No 144) in Cairo. It also produces mine detectors.

The only enterprise producing diesel engines for armored equipment is a plant of the **Helwan Company for Diesel Engines** (Plant No 909) created in 1964 and located in Helwan. It presently produces 8-150 hp diesel engines as well as 75-300 kw generators and pumps.

Optical and electro-optical instruments for the Egyptian Armed Forces are produced by a joint venture of the Egyptian Ministry of Defense **Arab International Optronics** (51 percent of shares) and the British United company (49 percent) in El Salaam. In particular, various night vision devices and laser rangefinders are produced here.

According to an assessment of foreign specialists, Egypt presently has the most developed military industry in the Near East after Israel, employing some 70,000 persons.

The ARE government places great emphasis on developing national military industry, considering the fact that combat equipment supplied by the Soviet Union at one time is out of date and physically obsolete, with the exception of certain kinds (MiG-21 fighters, T-55 and T-62 tanks, Mi-8 helicopters), and arms deliveries by western countries presently do not satisfy requirements of the Egyptian Armed Forces. But development of a national military industry is being delayed considerably by the absence of sufficient finances and lack of highly skilled scientific and engineering-technical cadres, as well as by the policy being followed by the United States. The latter is attempting to preserve and strengthen Egypt's dependence on the import of weapons and military equipment from the United States and countries of Western Europe by exercising control over the status and development of the ARE Armed Forces to prevent their superiority over the Israeli Army.

Footnotes

1. The press (including the JANE'S reference works) often continues to call this organization "Arab," i.e., the Arab Organization for Industrialization—Ed.

Forces and Assets of Civil Defense Radiological Reconnaissance and Dosimetric Monitoring in NATO Countries

18010800l Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 68-72

[Article by Col (Res) V. Yemelyanov]

[Text] Considering civil defense [CD] to be an inalienable part of military preparations, NATO's military-political leadership continues to improve this system overall and its individual elements. Within the scope of specific measures being taken to protect the populace against weapons of mass destruction in bloc member countries, great emphasis is placed on establishing and developing a radiological reconnaissance and dosimetric monitoring service. Western specialists believe that the need for organizing such a service in the CD system is dictated not only by the likelihood that large areas will be contaminated by radioactive fallout in case of nuclear war, but also by the possibility of such contamination in peacetime from accidents at enterprises where production processes involve fissionable materials, and at atomic electric power stations above all.

There is no single international radiological reconnaissance and dosimetric monitoring service in the North Atlantic Alliance. All measures relating to this are carried out on a national basis, coordinated by the NATO Civil Defense Committee, which is part of the NATO Main Civil Emergency Planning Committee. Meanwhile, close coordination has been arranged among a number of bloc states and information is being exchanged on the organization, conduct and results of radiological reconnaissance. Such cooperation is characteristic of the United States and Canada in particular as well as of Great Britain, France, the FRG, Belgium and the Netherlands. The western press repeatedly notes that the working capacity of national networks for evaluating the radiation situation is checked periodically during NATO exercises. Such services established in civil defense of the United States, Canada, the FRG, Great Britain, France, the Netherlands and Belgium as well as in Northern European countries are the most modern and developed.

The American press emphasizes that the primary purpose of radiological reconnaissance and dosimetric monitoring in the **United States** CD system is to prepare and carry out measures for antiradiation protection of the population. The service includes a far-flung network of ground radiological reconnaissance and dosimetric monitoring posts as well as equipment for conducting aerial radiological reconnaissance. Its basis consists of ground posts, which as a rule are set up in administrative-political centers, major populated points and near the most important road junctions.

Each ground reconnaissance post is equipped with a set of radiation monitoring devices including a radiometer, two wide-band roentgenometers, two dosimeters and necessary auxiliary gear. Local authorities and CD entities have the right to put out the posts. In accordance with requirements, posts must have reliable antiradiation protection and have communication equipment for uninterrupted data transmission to higher headquarters.

Some posts (around 20 percent) are located at federal establishments and directing agencies of states, but the majority are with the local administration, at industrial enterprises, at power supply, water supply and transportation system installations, as well as at police stations and fire brigades. The task of posts at federal agencies includes providing the country's government and CD leaders with information on the radiation situation in major cities and at important installations. With the beginning of nuclear war, these posts are to transmit reports on radiation levels in their areas to the data collection and processing center according to a prearranged timetable. Such information is to be transmitted every hour for 18-20 hours, inasmuch as it is in that time interval that radioactive fallout that has formed from one medium-yield nuclear burst will occur, according to views of American CD specialists. Subsequently it is planned to issue information from federal posts only on request.

According to American press data, there is a total of over 54,000 ground radiological reconnaissance and dosimetric monitoring posts on U.S. territory, and under emergency conditions it is planned to increase their number to 150,000.

In addition to stationary ground posts, it is also planned to establish mobile posts for conducting radiological reconnaissance. As a rule, the latter will be used in areas with low levels of radiation and will provide more detailed data on locations of radioactive fallout. Mobile post movement routes and stations for measuring radiation levels are planned in advance and adjusted in accordance with the existing situation.

It is planned to conduct airborne radiological reconnaissance in areas with high radiation levels and where ground posts have been put out of commission. It is believed that aerial reconnaissance aircraft can survey vast areas in short time periods, collecting data not only on radiation levels, but also on the overall situation in areas that have been subjected to radioactive contamination. It is proposed to monitor radioactive contamination of the atmosphere at high altitudes by Air Force assets and radioactive contamination of the terrain and air at low altitudes by CD assets. For this it is proposed to involve the owners of light aircraft who are part of the public organization known as the Civil Air Patrol. They already have experience in such operations and have taken an active part in assisting the populace in mopping up essentially all natural disasters and production accidents which have occurred in the United States since 1961. According to American press data, appropriate reserves have been established at state CD depots and at certain airfields for fitting out the aircraft with special devices for airborne radiological reconnaissance.

Dosimetric monitoring of radiation doses received by the population is to be accomplished using various radiation monitoring devices at the disposal of U.S. CD entities; such devices number over five million, including around 370,000 at stationary ground posts, almost 700,000 in shelters and refuges, 900,000 at state depots, 600,000 at the federal CD depot in Richmond, Virginia and over 400,000 in educational institutions. In addition, employees of state establishments and National Guard personnel have over two million individual dosimeters. Radiation monitoring devices are delivered by state governments in a centralized manner with federal funds. All radiation monitoring devices go to workshops present in each state and also are maintained with federal funds to ensure constant readiness of the radiological reconnaissance and dosimetric monitoring service. There the devices are checked, calibrated and repaired. Gear for radiological reconnaissance posts undergoes inspection and necessary repair at least once every two years, and devices in shelters and refuges or intended for distribution to protective structures are checked once every four years.

The U.S. CD leadership makes wide use of specialists at civilian research establishments to conduct necessary studies for making an optimum choice of locations for stationary ground posts and for building antiradiation shelters. For example, associates at a research laboratory in Oak Ridge evaluated the probable radioactive contamination of the country's territory, and this became the basis for compiling a diagram showing the location of areas with high radiation levels.

The American press reports that under a program for further improving U.S. CD over the next few years, it is planned to outfit formations with new dosimeters and to train some 7,000 instructors and up to 22,000 specialists of various profiles for performing radiological reconnaissance and dosimetric monitoring by the beginning of the 1990's.

In the opinion of western specialists, the geographic position of **Canada** and the proximity of its most densely populated southern areas to important U.S. military-industrial centers create an immediate threat of radioactive contamination of the territory even in case a nuclear strike is delivered only against its senior partner in the bloc. A Nuclear Detonation and Fallout Reporting System has been established and is functioning in the country. It includes posts for determining epicenters of nuclear bursts, radiological reconnaissance and dosimetric monitoring posts, data collection and processing centers (located at the federal government command post and in CD staffs of areas, districts, zones and municipalities), and intermediate report collection stations. It is planned to set up an exchange of information with army dosimetric monitoring posts for the period of an emergency situation.

Radiological reconnaissance and dosimetric monitoring posts in the most populous part of the country are situated up to 75 km from each other in a meridian direction and up to 25 km from each other in a latitudinal direction, with larger intervals in sparsely populated areas. Some are permanent and others are equipped with necessary devices and are to be used only in wartime. It is planned to deploy a total of up to 12,000 posts in an emergency situation.

Among Western European countries of the North Atlantic community civil defense of the **Federal Republic of Germany** has the most developed radiological reconnaissance and dosimetric monitoring service, which is part of the warning and notification system within the framework of national civil defense. The FRG territory is divided into ten warning districts (their boundaries coincide with Land boundaries), each of which includes 4-5 monitoring-measuring areas for evaluating the radiological, chemical and bacteriological situation.

Information from ground observation and monitoring posts goes to area monitoring-measuring stations, then to the national warning center report collection station, where it is processed, generalized and if necessary passed on the population with the help of various technical equipment at warning posts. There are 25-30 ground observation and monitoring posts situated 12-15 km from each other functioning in a monitoring-measuring area. According to western press data, a total of 1,565 stationary posts (including 1,000 fully automated ones) are deployed on FRG territory. In addition, 200 mobile observation and monitoring posts are ready for action.

To carry out functions assigned them, the personnel of these subunits are equipped with necessary devices and individual protective gear (Fig. 1 [figure not reproduced]). By the mid-1990's it is proposed to fully automate the process of transmitting data from observation and monitoring posts to report collection stations at the country's CD national warning center.

In **Great Britain's** CD system the radiological reconnaissance and dosimetric monitoring of terrain as well as collection of data on movement directions of radioactive clouds in fallout areas are assigned to the Royal Observer Corps (ROC), which is an integral part of the CD warning system. It numbers some 11,000 persons who man 873 ground observation and warning posts scattered across the country. Each such post is an underground reinforced concrete bunker with an area of around 15 m^2 and 3 m high built at a depth of 6 m.[1] They are manned in shifts of four persons and are outfitted with necessary equipment for collecting and transmitting data on the nature and yield of nuclear bursts and the radiation and weather situation. Three or four posts form a detachment, several detachments form a monitor team, and the latter are consolidated in observation and warning sectors.

The headquarters of the monitor teams and observation and warning operations centers are located in protective works designed for a lengthy stay by from 40 to 50 persons. Ventilation and emergency power sources are provided there. The observation and warning sector headquarters usually is located together with one of the monitor team headquarters included in a given sector. Information received by ROC posts through the monitor team headquarters (a total of 25) and observation and warning sector operations centers (a total of five) is transmitted to 250 monitoring warning stations, from which processed data on the radiation situation in specific parts of the country are made known to the populace through CD system warning stations (there are 22,000 of them).

In **France** the basis of CD radiological reconnaissance and dosimetric monitoring consists of stationary posts deployed across the country's entire territory at a distance of approximately 20 km from each other. They are established basically at police stations, fire depots, establishments, and enterprises primarily with an around-the-clock work regime. The French press reports that a sum total of 2,700 stationary posts have been deployed, each of which is to be manned by a team of 20 persons. In peacetime, however, their personnel and radiation monitoring gear is only at 20 percent strength. In addition to stationary posts, there are provisions for deploying mobile posts.

Along with a situation estimate based on data received from a far-flung network of posts in France, an automated system for forecasting radioactive fallout has been established in each of seven defense zones, which permits determining zones of probable radioactive contamination depending on the kind and yield of the nuclear burst and predominant movement directions of air currents.

Italy has set up 1,625 stationary radiation observation and dosimetric monitoring posts, judging from western press articles. When the situation becomes aggravated it is planned to establish an additional 440 mobile posts. Monitoring the atmosphere's radioactive contamination is the responsibility of weather stations, including 21 weather stations belonging to the Air Force.

Developed and well outfitted radiological reconnaissance and dosimetric monitoring services have been established and function within the framework of civil defense in Scandinavian countries of NATO. For example, **Norway** has trained technical personnel for deploying 400 stationary and mobile posts. Stationary posts are established under local CD entities, with long-distance assistance columns (mobile formations for reinforcing local CD forces and assets), and at the most important industrial enterprises and electric power stations. Posts in local CD formations and long-distance assistance columns can assign one radiological, chemical and bacteriological reconnaissance patrol. Information gathered is transmitted by communication equipment to CD warning system centers, which simultaneously make it known to CD leaders, the military command and the populace.

In **Denmark**, as in the majority of other bloc countries, data on the radiation situation in various parts of the country are to be collected by stationary and mobile radiological reconnaissance and dosimetric monitoring posts (Fig. 2 [figure not reproduced]). In cities it is planned to warn the population of the possibility of radioactive fallout in two phases: initially a preliminary signal is given by sirens about the threat of fallout, and then a signal about fallout is given. In a rural area it is planned to provide warning using sirens and church bells in one phase—only a preliminary signal is given about the threat of radioactive fallout. Subsequently information on the radiation situation is to be relayed by radio.

There are 150 stationary posts, organized basically in basement spaces of public buildings (town councils, schools, fire brigade barracks and so on), set up in **Belgium** to perform radiological, chemical and bacteriological reconnaissance and to perform dosimetric monitoring. They are manned by a team of 2-12 persons depending on the importance and location, but in the opinion of CD specialists the optimum makeup of the team, figuring its lengthy stay at the post, will not exceed four persons.

Posts are outfitted with communication equipment; necessary radiation monitoring devices, including gear for determining radiation levels without going to the surface; as well as indicators for determining the epicenters of nuclear bursts. Necessary stores of provisions, medicines and other life support means have been established at the posts. Each team member has an individual antichemical and antibacteriological protection set.

In addition to stationary posts, it is planned to use mobile radiological reconnaissance and dosimetric monitoring posts in Belgium which even in peacetime are fully supplied with necessary equipment and are at half-strength in trained personnel. Such posts are attached to certain industrial and power engineering enterprises where fissionable materials are being used. Information on the radiation situation is transmitted by posts to CD area (subarea) centers, then to provincial centers and from there to the national radiation situation evaluation center. The latter is linked with similar entities of the FRG, France, Great Britain, the Netherlands and Luxembourg.

In civil defense of the **Netherlands** companies and separate platoons have been formed as part of a service for protection against mass destruction weapons to perform radiological, chemical and bacteriological reconnaissance, conduct dosimetric monitoring, and perform chemical and radiological decontamination. Teams for stationary and mobile posts are formed from the personnel of these subunits. According to western press announcements, the Dutch CD system has a total of 300 stationary and 600 mobile radiological reconnaissance and dosimetric monitoring posts.

Although developed to a lesser extent than in other bloc member countries, nevertheless civil defense in Greece, Spain and Portugal also has forces and assets for conducting radiological reconnaissance and dosimetric monitoring. For example, in **Greece** these tasks are accomplished by civil defense in coordination with the armed forces, within which five stationary and several mobile posts have been established. There are provisions only for mobile posts in the CD system. Necessary gear for them has been purchased and is stored at depots. It is also planned to set up posts under town councils of the largest cities and in a number of ministries whose enterprises use fissionable materials in production processes.

In **Spain** collecting data and informing the population about the radiation situation is the responsibility of the National Guard, which has reconnaissance and dosimetric monitoring equipment. To this end some 2,000 posts outfitted with necessary radiation monitoring devices have been set up on the country's territory. The posts are located in major cities and populated points of the country.

The civil defense system of **Portugal** has only mobile posts for performing radiological reconnaissance and dosimetric monitoring.

In **Turkey** stationary posts are dispersed throughout the territory 8-16 km from each other. They are set up with weather stations above all. Centers for collecting and generalizing primary radiation situation data are located in two sectors (Eastern and Western) of the CD warning system. Close coordination has been established between them and the country's air defense sectors.

The foreign press notes that on the whole the majority of CD systems of NATO states include developed radiological reconnaissance and dosimetric monitoring services. They are developing and improving further basically within a national framework, but are being directed by the NATO Civil Defense Committee, which coordinates measures in this area in individual countries with the bloc's general military preparations.

Footnotes

1. For more details on the layout of observation posts see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 1, 1987, pp 93-94—Ed.

Point Mugu Pacific Missile Test Center

18010800m Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 73-76

[Article by Capt 3d Rank A. Stefanovich]

[Text] In carrying out broad programs to modernize existing models of missile weapons and develop new ones, the U.S. Navy command set up a number of research centers and range facilities for their comprehensive testing. One of them is the Pacific Missile Test Center, established on the south coast of California near Point Mugu in April 1975 from the unification of the Naval Missile Center and the Pacific Missile Test Range. The center presently includes coastal and island territory (the overall area is more than 110,000 km^2) as well as the main research and test area located 80 km northwest of Los Angeles (over 180 km^2, Fig. 1 [figure not reproduced]).

The actual use of the Point Mugu range facility for military purposes began back in 1946 when the United States began testing rockets with the help of specialists brought out of Germany (rockets created on the basis of models those specialists had developed). During the 1950's-1960's tests and evaluation of the Regulus-1 and -2, Sparrow and Sidewinder missiles and the Bullpup and Walleye aerial bombs were conducted at the range facility. In the 1970's specialists began testing such models of missile weapons as the Phoenix, Harpoon, Standard, Tomahawk and others. Just during comprehensive testing of Harpoon antiship missiles, completed in 1977, 30 monitored operational launches were made in the sea sector of the Pacific Missile Test Range, including 13 of the AGM-84A antiship missile from P-3 Orion aircraft, 9 of the PGM-84A antiship missile from surface combatants and 8 of the UGM-84A antiship missile from aboard submarines.

Presently the Pacific Missile Test Center is the main center in the U.S. Navy which conducts basic research, development and evaluation of new missile weapons coming into the naval inventory, checks the reliability of missile systems already in the inventory, and tests electronic countermeasures systems.

The center's measurement equipment and laboratory facility also are widely used for evaluating advanced weapon models for the Air Force and Army and in conducting practice firing under naval combat training plans. Each year some 12,000 tests take place on its territory.

Organizationally the Point Mugu Pacific Missile Test Center includes five directorates (range facility, for evaluating the reliability of modern weapons, for use of targets, electronic warfare, and logistic support) as well as the Point Mugu Naval Air Station and an air detachment and test range at Barking Sands (Hawaiian Islands). The center's overall numerical strength exceeds 8,000 persons.

The 305th Attack Squadron and 65th Patron Squadron of the Reserve, the 4th Test Squadron, 34th Tactical EW Squadron, 6th Antarctic Research Squadron and 5th Light Attack Helicopter Squadron as well as a subunit for servicing the Transit satellite navigation system and naval long-range communications, all located in the vicinity of Point Mugu, are used to accomplish certain missions in the Test Center's interests.

A sea test range with a water area taking in a 360x144 km sector between San Nicolas Island and Point Mugu (Fig. 2 [figure not reproduced]) is the basis of the center's test facility. In 1970 the largest number of missile tests was conducted near San Nicolas Island and Santa Barbara Strait, but the increased intensity of air traffic in the California coast zone led to difficulties and in a number of cases also to interruptions in range facility work. For this reason in the middle of the last decade the Navy command concluded a contract with General Dynamics for developing and placing the EATS (Expanded Area Test System) on the range, which would allow testing weapons in a broader area.

The EATS became operational in the early 1980's. It is used to accomplish such tasks as automatically tracking several ships and aircraft simultaneously in the test area, exchanging command and telemetry data between control stations (on San Nicolas Island and the coast) and controlled targets, providing VHF radiotelephone communications among forces taking part in the tests and shore control stations, registering test results, and relaying them to shore stations for subsequent processing and analysis.

The EATS uses three specially refitted P-3 Orion aircraft as airborne monitoring and measuring stations, which permits organizing the collection and relay of telemetry and other data from 100 different sources simultaneously. The foreign press reports that the use of airborne monitoring and measuring stations permitted conducting more complex tests at a distance of up to 450 km from the coast of San Nicolas Island.

Test results are transmitted over cable and radio communication lines to the central control station from monitoring and measuring stations. The central station is equipped with modern computer equipment, which allowed shortening the time for processing test results from 2-8 days to 4 hours.

EATS gear also supports the work of sea test ranges established for the period when missile training launches are conducted under Navy combat training plans. Such exercises using EATS gear are held four times a year, twice near Puerto Rico on the Atlantic coast and twice on the Pacific coast near San Diego. For example, EATS monitoring and measuring gear and QF-80 and QF-4 controlled airborne targets simulating the air adversary were used in practice not far from Puerto Rico with the Aegis multifunction weapon system installed on the cruiser "Ticonderoga."

The Point Mugu Test Center presently has some 200 airborne targets (Fig. 3 [figure not reproduced]), some of which are capable of flying at altitudes of from 9 m to 12,000 m at a speed of around 1,000 km/hr. Special rockets, towed and remotely controlled flying craft, and ships and vessels which have served their time act in this role. Individual targets are equipped with gear for creating diverse jamming, which permits simulating enemy air attack weapons with sufficient validity.

Towed airborne targets usually are used at altitudes of from 9,000 to 12,000 m in working naval combat training missions. Controlled target missiles (BQM-74C, BQM-34S, BQM-34E, AQM-37A) are launched from platforms situated on shore and fly at given altitudes at a distance of up to 450 km from San Nicolas Island, after which they return and land.

Pilot-controlled aircraft targets (QF-4B, QF-86H, QT-33A) fly out of Point Mugu and land on San Nicolas Island. After the pilot gets out, the aircraft target is started up and is initially controlled from a mobile control station located on the island, and then from an escort aircraft. After the aircraft target is taken to a given area, control is passed over to one of the ships taking part in the tests. The method of controlling the QF-86H aircraft target equipped with a television camera is somewhat different. The image from it is relayed to the television screen of an F-86 aircraft located in the vicinity of the center; the pilot controls the aircraft target by radio from the cockpit. The Motorola TSW-10 automated airborne target control system installed at the Point Mugu range facility in the late 1970's permits simultaneously controlling eight drones at a distance of up to 450 km from the control station.

In connection with the fact that characteristics of the above airborne targets do not fully meet requirements placed on them for testing advanced weapon models, the U.S. Navy command concluded a number of contracts for development and production of more advanced airborne targets. In particular, Martin Marietta created a supersonic controlled airborne target capable of simulating low-flying antiship missiles. It can fly at an altitude of around 9 m at a speed 2.3-3 times greater than the speed of sound to a distance of up to 90 km. The target is for testing ship antiaircraft weapon systems. It can be launched from P-3 Orion, A-6 Intruder and F/A-18 Hornet aircraft. Under the contract it is planned to deliver the first 15 targets during 1988-1989, with a total of approximately 1,000 to be purchased for the Navy.

Such firms as Northrop, Teledyne and Beech Aircraft are taking part in competitive development of targets. For example, Beech Aircraft plans to supply more than 200 AQM-37C airborne targets to the U.S. Navy (each one is 3.8 m long and has a payload weight of 23 kg). As reported in foreign military-technical literature, the target is capable of flying at an altitude of 300 m at Mach 0.87, and at an altitude of 24,000 m at Mach 3. It is to be used for testing and working on the Aegis shipboard multifunction system.

The underwater ordnance range facility at Barking Sands, which is part of the Pacific Missile Test Center, is used basically for testing antisubmarine weapons and practicing combat training missions by ships, submarines and naval aircraft. The range facility water area is more than 160 km^2. It is equipped with sonar gear and equipment for processing test results.

Research and tests carried out by the EW directorate hold an important place in the activity of the Point Mugu Test Center. The directorate (overall strength of around 380 personnel) includes three departments: electronic countermeasures development, electromagnetic systems development, and computer equipment development. The foreign press reports that under the program for developing advanced EW equipment, new airborne AN/ALQ-162, AN/ALQ-126B, AN/ALQ-136 and INEWS ECM stations are being modified at Point Mugu. Considerable attention is being given to creating and upgrading software for advanced equipment.

Foreign specialists believe that in the future the EW directorate will play an even greater role in supporting combat and day-to-day activities of the U.S. Navy. For example, in accordance with long-range EW plans of the Point Mugu Test Center it is envisaged that when ships or aircraft of a task force or task group detect new enemy electronic emissions, measured parameters of these electronics will be transmitted to this directorate in real time over satellite communication channels. Algorithms developed by its specialists for suppressing the new radio emissions will go over satellite communication channels to the ships and aircraft of the force or group and be input to software of the on-board EW equipment.

Foreign military specialists note that the diversity of factors determining the reliability of missile weapons and their systems does not permit obtaining calculated reliability indicators which would be sufficiently close to reality. In this regard the range facility and laboratories of the Point Mugu Test Center systematically conduct reliability tests of missile weapons aimed at identifying their design and production-technical deficiencies, timely remedying of which would permit improving their operating characteristics. Missiles are tested under various conditions for the effect of impact-vibration, climatic, radiation and other factors. An automated data bank has been established at Point Mugu to analyze and predict missile weapon failures, with failures in the course of missile weapon operation in all fleets of the U.S. Navy taken into account. The Test Center's work in the sphere of reliability permitted increasing the mean-time-between-failures for missiles of various types from 40-60 hours to 2,000 hours and improving the reliability of missile weapons by ten times compared with 1960.

On the whole, foreign military specialists believe that the level of the scientific and technical facility of the Pacific Missile Test Center at Point Mugu supports necessary tests for modernizing existing weapon systems and developing new ones.

Joint U.S.-French Naval Exercise 'Finia-89'

18010800n Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) p 78

[Article by Capt 2d Rank Yu. Kryukov]

[Text] In 1989 naval forces of NATO countries in the Southern European Theater stepped up operational and combat training activities. In the first half of February the following exercises were conducted in the western and central areas of the Mediterranean against a uniform operational background: Allied Naval Forces Southern Europe Exercise "Dogfish-89", U.S.-French Naval Exercise "Finia-89", and Italian Naval Exercise "Mare Aperto-89/1."

The largest both in makeup of participants and in scope of missions accomplished was exercise "Finia-89", which took place from 4 through 13 February. Its objective was to check and work out plans for joint employment of naval forces of the United States and France in the Mediterranean in operations of the initial period of war.

Up to 15,000 servicemen and over 30 combatant ships were brought in for the exercise, including the nuclear-powered multipurpose carrier Theodore Roosevelt, the amphibious assault ship Guadalcanal, and Marine subunits from the United States; and the multipurpose carriers Foch and Clemenceau and Army subunits which are part of the Rapid Action Force from France. In addition, active participation of aircraft and helicopters of land-based patrol aviation of the participating countries was noted.

Problems practiced in the exercise were the transition of forces from a peacetime to a wartime footing and the formation and operational deployment of two carrier striking forces (the nuclear-powered multipurpose carrier Theodore Roosevelt and the multipurpose carrier Clemenceau), two landing detachments (one French and one American), and striking forces, hunter-killer forces and minesweeping forces made up of two or three ships.

On completion of deployment of the ship forces to combat tasking areas, primary attention was focused on missions of winning sea and air supremacy as well as conducting an amphibious landing operation.

The operation to land an amphibious assault force over the beach on the island of Corsica (France) was conducted on 6 February by a combination method using assault landing craft and assault transport helicopters. Air preparation of the landing area as well as close air support during the landing was accomplished by deck-based aircraft from the carriers Theodore Roosevelt and Clemenceau. The carrier Foch was used in the landing variant and supported the landing of assault forces with the help of assault transport helicopters. During the operation 1,800 landing personnel were landed, including 700 U.S. Marines, 800 persons from the French Rapid Action Force and 300 from reconnaissance and raiding subunits. The hunting and "killing" of "enemy" surface combatants and submarines were assigned to ship striking forces and hunter-killer forces. Ship minesweeping forces swept approach routes to assault force landing points.

After seizing a beachhead, the first echelon of the landing forces began conducting combat operations ashore to support the landing of the main body and expand the landing beachhead. Combat operations ashore were practiced on completion of the main body's landing.

Special attention was given during the operation to problems of conducting reconnaissance and destroying antilanding defense targets on approaches to the landing points as well as ashore, organizing a logistic support system, and organizing the coordination of mixed forces while providing air and fire preparation and support.

Missions practiced during the U.S.-French joint naval exercise indicate that despite France's official announcement of withdrawal from the NATO bloc military organization, the views of its military-political leadership on employing its naval forces in the Mediterranean in case so-called crisis situations arise coincide with views adopted in Washington.

Article Not Translated from ZARUBEZHNOYE VOYENNOYE OBOZRENIYE No 4, April 1989

18010800o Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89) pp 1-2

Publication Data

18010800p Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 89 (signed to press 11 Apr 89)

[Text] English title: FOREIGN MILITARY REVIEW

Russian title: ZARUBEZHNOYE VOYENNOYE OBOZRENIYE

Editor: V. I. Kozhemyakin

Publishing house: Izdatelstvo "Krasnaya zvezda"

Place of publication: Moscow

Date of publication: April 1989

Signed to press: 11 April 1989