Scientific-Technical Progress and

The Revolution in Military Affairs

(A SOVIET VIEW)

COL. GEN. N. A. LOMOV, Editor

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American Editor's Comment on Scientific-Technical Progress and the Revolution in Military Affairs

Scientific-Technical Progress and the Revolution in Military Affairs is the third in a series of recent Soviet military writings to be translated and published under the auspices of the United States Air Force. The original Russian edition was sent to the printers on November 15, 1972, and published in the Spring of 1973 by the Military Publishing House of the Ministry of Defense of the USSR in 40,000 copies.

The book is identified as describing the present stage in the development of Soviet military theory and practice in relationship to scientific-technical progress. It tells how the "achievements of science and technology, the invention and introduction of nuclear missile weapons and other modern means of armed combat have brought about a revolution in military affairs". The book analyzes the qualitative changes in weapons and the technical outfitting of the Soviet army and navy, in the organization of the armed forces, the forms and methods of combat, in troop control, the methods of training and indoctrinating troops, and "the dialectics of the relationships of man and technology in modern war."

Scientific-Technical Progress and the Revolution in Military Affairs is part of the *Officer's Library* and, according to Soviet newspaper reports, is the seventeenth and final volume to be issued in the current series. The *Officer's Library* series of books was announced in December, 1964, by the Military Publishing House of the Ministry of Defense of the USSR. The stated purpose of the series is "to arm the reader with a knowledge of the fundamental changes which have taken place in recent years in military affairs." The book *Military Strategy*, edited by Marshal Sokolovskiy and published in three editions (1962, 1963 and 1968) is part of the *Officer's Library* series.

Scientific-Technical Progress and the Revolution in Military Affairs was written by a group of officers and generals who are recognized spokesmen of Soviet military affairs. Many of them, for example V. M. Bondarenko and Colonel Ye. I. Rybkin, are frequent contributors to the journal *Communist of the Armed Forces* and other prominent Soviet military publications. Colonel-General N. A. Lomov, editor of the book, was for-

merly assigned to the General Staff Academy. General-Major I. I. Anureyev was a contributor to the 1965 Frunze Prize winning *Dictionary of Basic Military Terms* which is also part of the *Officer's Library* series. General-Major M. I. Cherednichenko has written extensively on military affairs and is best known for his contributions to all three editions of *Military Strategy*.

NOTES

Use of the word "army" in Soviet military literature is frequently misunderstood in the West. The Soviet concept of "army" has several meanings: first, the Armed Forces in general; second, the Ground Forces as distinct from the other services, such as the Air Force and the Navy; third, the operational large unit of the Ground Forces, including corps, divisions and other units. Where no indication is given to the contrary, the concept "army" is usually used in the first meaning.

On page 250, the text references a Russian translation of General Maxwell Taylor's book, *The Uncertain Trumpet* (New York: Harper, 1960). When this book was published by the Military Publishing House in Moscow, the title was changed to *Nenadezhnaya Strategiya (Hopeless Strategy)*.

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Authorship

The book *Scientific-Technical Progress and the Revolution in Military Affairs* has been written by a group of officers and generals consisting of: Maj Gen I. I. Anureyev, doctor of military science and professor (Chapter II); V. M. Bondarenko, candidate of philosophical science and docent (Chapter I); Maj Gen V. V. Voznenko, candidate of military science and docent (§ 1 and 2 of Chapter IV, § 1 and 2 of Chapter V); Col M. I. Galkin, candidate of philosophical science and docent (Chapter VIII); Maj Gen K. V. Zababashkin, candidate of military science and docent (§ 3 of Chapter IV); Maj Gen A. K. Zaporozhchenko, candidate of military science and docent (§ 2 and 4 of Chapter VI); Col Gen N. A. Lomov, professor (Introduction and Conclusion); Maj Gen V. I. Matveyev, candidate of military science and docent (§ 3, 4, and 5 of Chapter V); Col V. I. Morozov, candidate of philosophical science and professor (§ 1 and 2 of Chapter VII); Col Ye. I. Rybkin, doctor of philosophical science and professor (Chapter X); Maj Gen N. M. Safronov, candidate of military science and docent (§ 4 of Chapter IV); Col K. V. Spirov, candidate of philosophical science and docent (Chapter IX); Maj Gen A. Ye. Tatarchenko, candidate of military science and docent (§ 1 and 3 of Chapter VI); Col S. A. Tyushkevich, doctor of philosophical science and professor (Chapter I); Lt Col N. F. Fedenko, doctor of psychological science and professor (§ 3 of Chapter VII); Maj Gen M. I. Cherednichenko, candidate of military science and docent (Chapter III).

The overall editorial supervision was by Col Gen N. A. Lomov, professor; Maj Gen I. I. Anureyev, doctor of military science and professor; and Col M. I. Galkin, candidate of philosophical science and docent.

The leader of the group of authors was Col *M. I. Galkin.*

Introduction to the Russian Edition

The scientific-technical revolution has determined the prospects for the development of modern military affairs, and has posed a large number of problems, the solution to which has raised Soviet military science to a new, higher level. The complexity of modern military affairs is generally recognized, the process of its improvement is continuing, and it would be hard to name any area which did not depend upon the overall development of production, science and technology.

However, in this multiplicity of military problems which are most closely linked with scientific and technical progress, it is possible to isolate a number of the most important ones, the solution to which would be a main prerequisite for fundamental changes in the content of combat missions and the methods for executing them. The achieved level of the economy and material production is the overall basis for these changes. The revolution in military affairs has gained a broad and profound scope in the economically most developed nations, that is, in the Soviet Union and the United States. However, the economy is not the only source of the military-technical revolution.

Political policy has also been a decisive factor which determined the direction in the development of military affairs. For the capitalist world, and primarily for the monopolistic bourgeoisie of the United States which is the main bulwark of international reaction, the policy of anti-communism and aggression has been the basis of military policy. In the military development of the imperialist nations, due to the particular features of each of them, the influence of scientific and technical progress has been reflected in different ways. However, the overall trend in the development of the armed forces, as determined by the coalition nature of wars, is directly dependent upon this policy. "The increased possibilities of production, science, and technology," pointed out the General Secretary of the CPSU Central Committee, Comrade L. I. Brezhnev, at the International Conference of Communist and Workers' Parties in Moscow in June 1969, have been used by the monopolies for their own egoistic purposes, that is, for intensifying the exploitation of the masses, for strengthening the apparatus

of coercion over them, as well as the machine of military aggression and adventures.[1]

For the Soviet Union as well as for the other nations of the socialist community, the decisive significance of policy in implementing the tasks of the revolutionary transformation of military affairs has been determined by the necessity of the military defense of socialism against imperialist aggression. "All that has been created by the people," commented the Accountability Report of the CPSU Central Committee to the 24th Party Congress, "should be reliably defended. To strengthen the Soviet state means to strengthen its Armed Forces, and to raise in every possible way the defense capability of our motherland. As long as we live in a troubled world, this task remains one of the main ones!" [2] The fundamental reorganization of the Soviet Armed Forces to meet the needs of the nation's defense commenced and is continuing with respect to implementing this most important task.

Modern warfare which combines the actions of man, weapons, and military equipment is characterized at present, due to the arming of the armed forces with nuclear weapons, radioelectronic and jet equipment as well as other means, by fundamentally new patterns. The questions of the relationship between man and military equipment hold a special place in it. A profound and correct understanding of these questions is of most important significance for the development of the Soviet Armed Forces.

Soviet military thought is confronted with the tasks of a further scientific generalization of the processes presently occurring in military affairs. As yet many new phenomena in military affairs require a proper theoretical study and the elaboration of valid views on various questions. The rapid introduction of modern technical achievements into the Armed Forces has required on the part of military science an equally rapid theoretical study of the ways and means for employing the new types of weapons and military equipment. Of course, in this instance modern military theory has not merely substantiated the practical achievements. In recent years, a great deal has been done in the development of military theoretical research, particularly in the areas directly related to the introduction and technical utilization of modern weapons. Along with fundamental scientific works, there are popular scientific works by theoreticians and practical workers in our Armed Forces available for a broad range of readers.

The authors of the book presented here are also making their humble contribution to this important and major undertaking. In this work, on the basis of describing the most recent means of conducting a war, an

[1] *Mezhdunarodnoye Soveshchaniye Kommunisticheskikh i Rabochikh Partiy. Dokumenty i Materialy. Moskva, 5–17 Iyunya 1969 g.* (International Conference of Communist and Workers' Parties. Documents and Materials. Moscow, 5–17 June 1969), Moscow, Politizdat, 1969, p 46.

[2] *Materialy XXIV S"yezda KPSS* (Materials of the 24th CPSU Congress), Moscow, Politizdat, 1971, p 81.

attempt has been made to show in a generalized form the new phenomena which have arisen as a result of the revolution in military affairs. The basic principle for examining these phenomena has been the demonstration of them in an interrelationship, and in light of those relations which have been created as a result of employing the most recent scientific and technical achievements in military development. For example, in dealing with the organizational structure of modern armed forces, the authors have judged its merits from the result which this organization could provide in carrying out various combat missions.

The role of nuclear weapons in creating troop combat organisms is expressed in the fact that precisely these weapons determine the character and content of the troops' actions under present-day conditions. As is known, the troops of the various services of the armed forces conduct combat operations in close coordination between themselves, and this is the main task in organizing combat and the operation on the basis of using the effect achieved by employing nuclear weapons for the purposes of the decisive defeat of the enemy.

The fundamental reorganization of the Soviet Armed Forces is one of the indicators of the revolution in military affairs. This reorganization is based upon equipping the services of the armed forces with the appropriate nuclear weapons and the creation of independent strategic missile troops which must carry out the chief missions of a nuclear war.

The methods for conducting combat operations are organically linked to the new structure of the Soviet Armed Forces. These methods operate not as abstract schemes, but rather as examples of the vital and enterprising creativity of the commanders and staffs. Weapons and military equipment can be employed in combat and an operation with varying degrees of success. For this reason, the question of the role of the commanders and the mastery of methods of the scientific leadership over the training and combat use of troops is in one of the first places.

The demands placed upon the commander have risen by many times. Control of modern weapons and troops, even with the use of automation and electronic computers, is a very complex matter. For this reason, the book has given great attention to the questions of training and indoctrinating the modern soldier, and above all the commander, who is the organizer of military operations in all levels of the Soviet Armed Forces.

In our nation, the revolution in military affairs has been carried out on the basis of progress in the development of the productive forces as well as scientific and technical achievements which have provided for the creation of such powerful weapons as nuclear weapons, as well as jet-propelled and radioelectronic military equipment. These weapons and equipment are created and controlled by a new Soviet man, a man of a socialist society. This comprises one of the main bases in forming the new methods for conducting military operations. In his speech at the 24th CPSU Congress, the USSR Minister of Defense, Mar SU A. A. Grechko, pointed out that our Armed Forces are being continuously equipped with diverse modern weapons and military equipment. Here he stressed that the strength of our Army and Navy is not only comprised of modern weapons. "The main thing," he said, "is the people in whose hands these weapons rest. Under present-day conditions, as before, victory to a no lesser degree depends upon the state of the combat morale of the warring armies. The men who have mastered the military equipment and who are strong in political morale terms will ultimately determine everything. Our army consists of such men." [3]

The revolution in military affairs encompasses all of its most important areas. Let us try to briefly take up at least several of these areas in order to bring out the qualitative indicators of modern armed combat.

The effectiveness of nuclear weapons rightly holds the first place. In the arsenal of these weapons which are now represented by a significant number of types of different nuclear devices, the strategic nuclear weapons play the main role. Precisely these weapons have fundamentally altered the nature, content, forms, and methods of conducting military actions. Their combat and technical capabilities, given basically in the second chapter of the book, make it possible to draw sufficiently complete and correct conclusions on the destructive force of nuclear weapons which in essence is completely beyond comparison with conventional weapons.

It must be stressed particularly that the basic purpose of strategic nuclear weapons is a simultaneous strike against the enemy strategic nuclear weapons and its military groupings, as well as against the military and economic centers and control centers. The effect of nuclear weapons on the enemy's military and economic potential, as well as defense against enemy nuclear strikes comprise the most important task of armed combat under present-day conditions.

Nuclear weapons are characterized by a great destructive and devastating result as a consequence of the effect of an entire complex of destructive factors including the shock wave, radiant energy, penetrating radiation, and fallout. The use of these weapons has fundamentally altered the nature of combat, the operation, and the entire war as a whole. The possibility of quickly achieving not only an operational result directly but also a strategic one comprises the main distinguishing feature of nuclear war.

The great range of nuclear weapons is the second very indicative factor which has had a decisive influence upon the nature of modern war. The virtually unlimited range of strategic missiles has caused the intercontinental scope of armed combat.

The great range, high speed, and power of a nuclear charge of the megaton class of a strategic missile make it possible in a short period of time to simultaneously hit installations located on enemy territory over

[3] *Pravda*, 3 April 1971.

the entire depth of the theater of military operations. Strategic bombers and atomic submarines which are also the carriers of large nuclear devices possess high combat capabilities. Ballistic and winged missiles, as well as tactical aviation, make it possible to deliver nuclear devices over significant distances and to hit enemy groupings located in the operational depth of defense. The ceiling of aircraft, and effectiveness and range of antiaircraft defenses in terms of altitude significantly surpass the capabilities of air defense weapons from the period of the last war.

Thus, the spatial boundaries of combat, an operation, and the war as a whole have undergone very substantial changes. This is also the result of military technical progress, and shows the new capabilities of nuclear war.

Time factors are the next indicator showing the new relationships in modern war. The speed of a missile or a projectile, as well as the speed of combat carriers of weapons such as aircraft, submarines, and surface vessels, tanks, armored personnel carriers, and auxiliary vehicles, are not only the time parameters for the rapid action of weapons, military equipment, subunits, units, and formations. These are simultaneously a new significant factor which determines the rate of combat and the operation as well as the character of interaction between the forces and means participating in them. And above all, this is a new criterion for the duration of a nuclear war, as a war which is essentially highly fluid.

A strategic intercontinental ballistic missile is capable of delivering a nuclear warhead to a target which is10,000-12,000 kilometers away from the launching area over a period of 25-30 minutes. Significantly less time is required for using nuclear devices against objectives which are located directly in the zone of the operation or the theater of military operations.

These time parameters determine the pace of combat operations and the measures to support them. Conforming to this pace are: the rate of fire of automatic weapons and the speed of communications; the mobility and maneuverability of tank troops and the speed of putting up bridges by the engineering troops; the rate of advance of land forces in the directions of nuclear strikes; the rate of rebuilding railways destroyed by the enemy, and so forth.

For this reason, it is quite natural that the unprecedentedly fast pace of military operations requires maximum automation of the control process carried out on the basis of introducing electronic computers and the principles of cybernetics into military affairs. The reaction to the quick actions of air attack weapons should be superquick. This applies particularly to the air defense weapons and bodies. The carrying out of this most important mission in a nuclear war is inconceivable without using modern systems of automated control over the active air defense weapons where time is measured in fractions of a second.

The destructive force and range of nuclear weapons and the speed of

military operations comprise that "minimum" of the basic qualitative features which characterize the new patterns of modern war.

Scientific and technical progress and the revolution in military affairs are organically related and interdependent phenomena. Modern military and technical problems are being elaborated on the basis of equipping the Soviet Armed Forces with up-to-date weapons and military materiel considering their continuous development. At present the main task is to further assimilate what has been provided by scientific and technical progress for improving military affairs.

However, it must be considered that the intensity of using achievements in scientific and technical progress for the purposes of military affairs is related to the international situation, and to its tension or relaxation. Recent events reflect the continuous growth of the anti-imperialist forces in the struggle for the ideals of peace and socialism. We are fighting to make a strong peace in the world, and for eliminating the threat of a new world war.

Being guided by the interests of universal peace, our party and state are solving the problems of Soviet-American relationships. The results of the Soviet-American summit talks held in May 1972 reflect the real situation in the world. The documents signed in Moscow as a result of the talks mark a new victory for the principles of peaceful coexistence, they are an indisputed success for Soviet foreign policy, and contribute to an improvement in the international situation and a strengthening of peace throughout the world. Also of particularly important significance is the temporary agreement on certain measures in the area of limiting strategic offensive weapons, as well as the treaty on limiting antimissile defense systems.

Certainly, our party and people are assessing the present-day situation in a sober and realistic manner, and foster no illusions concerning the antipopular essence of imperialism and its aggressive motives. The socialist nations, in conducting a policy of peaceful coexistence, combine it with a firm rebuff to the aggressive intrigues of imperialism and reaction, as well as decisive support for the just struggle of peoples for independence and social progress.

Military theory is confronted with the task of providing the most complete analysis of the relationship of the revolution in military affairs with the major social changes, economic development, and scientific and technical progress. For the theoreticians and practical workers in military affairs, this opens up broad prospects for studying the diverse processes to strengthen the defense capability of our motherland. If the work offered here helps the reader to add to his understanding of the new phenomena in military affairs, the authors will feel that the efforts expended by them will not have been in vain.

Chapter I. Scientific-Technical Progress and its Effect on the Development of Military Affairs

The present-day scientific-technical revolution has coincided in time with the transition of a number of nations and peoples from capitalism to socialism. This coincidence has not been accidental. It reflects the presence of profound international relationships between the fundamental transformation in production and in the social relationships of modern times.

The scientific-technical revolution has also had its effect on the structure of the productive forces primarily in the economically most developed nations. It has disclosed the historical limitations of capitalist production relationships, and has shown the indisputed advantages of socialist production relationships. The capitalist states have greatly encouraged scientific-technical progress, using it primarily for increasing profit.

Over the more than 50 years which have passed since the Great October Socialist Revolution, imperialism has lost a great deal. Its unchallenged reign over the people has ended. But this in no way means that the forces of imperialist reaction are not capable of new crimes. Mankind is now confronted with the fact of an intensification of the reactionary aggressiveness of imperialism headed by U.S. monopolies.

For this reason the socialist nations, in putting the scientific-technical revolution to work for social progress, have not forgotten for an instant the strengthening of their defenses. "In carrying out the will of the people," said L. I. Brezhnev in the Accountability Report of the CPSU Central Committee to the 24th Congress, "the Communist Party has been constantly concerned with strengthening the nation's defenses. . . . The Soviet people can rest assured that at any time of the day or night, our glorious Armed Forces are ready to repel an enemy attack, no matter from where it might come." [1] The might of the Soviet Union has been and remains the chief bulwark of peace in the world.

[1] *Materialy XXIV S"yezda KPSS*, p 81.

1. Characteristic Features of the Present Stage in the Development of Science and Technology

Science and technology develop constantly and continuously. This has been reflected in the concept of "scientific progress" and "technical progress," and under present-day conditions "scientific-technical progress" and "the scientific-technical revolution." The last two concepts are not equal or identical. A good deal of philosophical, sociological, and popular scientific literature has been devoted to explaining their content.

In the literature which has been published in the capitalist nations, views are widely found in which the progressive role of science is either exaggerated or underestimated. Some bourgeois ideologists have depicted the successes of science and the achievements caused by them in the area of technology as the beginning of a new era for the "flourishing of capitalism." Others feel that science embodies something demonic, while technology is an evil-fated implement.

There have also been many correct and objective views concerning the essence and consequences of scientific-technical progress. However, a consistently scientific interpretation of these concepts is possible only on the basis of Marxist-Leninist theory.

Scientific-Technical Progress and Its Basic Components

Scientific-technical progress is a process of the interaction of society with nature and the technical environment, and an organic unity of scientific-technical and social aspects. It manifests the ability of society not only to understand nature and its laws more and more profoundly, but also to use the results of this knowledge in developing production and changing social relationships.

Scientific-technical progress is the uninterrupted process of understanding and using the forces of nature for increasing the might of man and society. It characterizes the successiveness of social development and the growing might of society vis-a-vis nature, as well as an increase in the internal opportunities for changing and improving society itself.

If scientific-technical progress, which includes both the quantitative as well as the qualitative changes in science and technology, expresses an overall trend for a rise in their social role, the present-day scientific-technical revolution expresses a particular stage of scientific-technical progress, a particular form of a jump in the development of science and technology, and a particular period of transition from their old state to the new one. In this sense, the concepts of "scientific-technical progress" and "the scientific-technical revolution" are sometimes conditionally viewed as identical.

Scientific-technical progress reflects the dialectical unity of two relatively independent processes, that is, the development of science and the

development of technology under the effect of material production and social relationships. Material production acts as the starting point for the basis for the development of science and technology, while social relationships are the conditions of their development. But this determines merely the overall nature of the tie between science and technology and such a complex system as society. In actuality, the interaction of science and technology with society is much more complex and contradictory.

As is known, labor is the basic condition of human life. At one time F. Engels wrote that in a certain sense, labor created man himself. Labor and production activities on the part of people are their effect on nature. Initially in this process, the people used only their hands equipped with primitive implements. In the course of historical development, mankind created more and more complex technical devices which, in the expression of the founders of Marxism, supplemented, strengthened, and continued the natural organs of man.

The basic and key direction in the development of technology has been related primarily to production as the most important and vitally necessary sphere of human activity. Technology was born out of the immediate material needs of people. It not only arose in the process of production, but also is a most important component of production. People and technology, being the most important elements of the productive forces, in the production process do not exist in isolation from one another. They are interrelated in a definite manner. People are the chief element of the productive forces, while technology is their substantive, material basis.

In the rich relationship between mankind and nature and between man and man, there exists a process of creating material and spiritual resources which include most diversified technologies, that is, productive, scientific research, domestic affairs, etc. All technology is man-made organs which are created by people for more effectively performing the functions of man in different types of activities. Technology represents a system by which people act practically and carry out their dominance over nature.

Under the conditions of a war and in the preparations for it, the technical outfitting of the army and military equipment are of enormous significance in the life of society. The military equipment is a portion of technology understood in the broad sense of the word. The concepts of "technology" (in the broad sense) and "military technology" stand in relationship of the general and the particular. They have common features, and their purpose and essence, as artificial organs of man, coincide to a definite degree. At the same time, military technology possesses a number of particular features, and it develops considering the specific needs of modern warfare and military methods of coercion.

Along with technology, science is a most important component in scientific-technical progress. Science, as a separate form of social awareness, represents a development system of knowledge concerned with the

world about us, as well as laws for the development of nature and society. The essence of science and its basic content are expressed in discovering the laws of development for the objective world and their use in the interests of social practices.

Laws are the basic form for expressing knowledge in science. Science includes verified knowledge concerning the facts and phenomena of reality, that is, empirical material obtained by observation or in the course of special experimental research, as well as methods for examining facts and discovering laws. Finally, science includes various scientific propositions and hypotheses which are based on empirical material and already discovered laws. These propositions and hypotheses can be either substantiated or rejected. All of this culminates in general theoretical conclusions and a philosophical interpretation of laws, definitions, and theories. Consequently, science as a form of social awareness, is a definite system of laws, scientific concepts, and theories unified by ideas and a certain logic. This applies both to social as well as natural sciences.

Scientific-technical progress is characterized not merely by the successes of science and technology in and of themselves. In many ways it is determined by the nature of their relationship and interaction. Of course, it would be more correct to speak about the interdependency of science and production. However, in the given instance one can limit oneself to pointing to the presence of just one interaction between science and technology, since it corresponds to the basic historical stages in the development of science and production.

Basic Stages in the Relationship of Science and Technology (Science and Production)

The relationship between science and technology is an organic and natural one. Technology, in the well-known expression of K. Marx, is embodied knowledge. Its development is a process of the embodiment of human knowledge. In this process, three major stages can be differentiated.

The first stage encompasses the period from the appearance of scientific knowledge until the Industrial Revolution at the end of the 18th and the beginning of the 19th centuries. It is characterized by the fact that science and technology (and production as a whole) developed being only slightly interrelated. The clearly expressed relative independence in the development of science and technology led to the separating of science from production and to their actual complete divorcing.

This separation can be explained by many factors. In the first place by the fact that with the dividing of society into classes, the social division of labor into mental and physical was deepened. Mental labor more and more was separated from physical. Secondly, social production in this period was primitive. Production technology did not rise above the manufacturing of very simple tools by the forces of the immediate workers. Thirdly, the level of scientific development was extremely low. In essence, science had just arisen and was living through a period of development. F. Engels dates the origin of true science to the 18th century, when the results of past history were systematized, and human thought began to see the internal relationship and interdependency in the facts of reality.[2] The publishing of the immortal work of Copernicus *On the Revolutions of the Celestial Spheres* (1543) was a revolutionary act marking the beginning for the process of the development of true science. Fourthly, until the appearance of capitalism, there was no acute social need for the accelerated development of science and its joining with production. Until the appearance of the working class and industrial capital, there were no social forces which were able to begin solving this problem.

From what has been stated it in no way follows that science was completely alien to production, and did not participate in improving production technology. Certainly there were individual instances of a link between science and technology and the participation of scientists in the development of technology. The activities of the patriarch of Russian science, M. V. Lomonosov, who took an active part in the establishing and development of domestic industry would be an example of this.

However, there are not so many examples here, and they do not determine the overall nature of the tie between science and technology in that period. The Industrial Revolution itself, particularly in its first stages, was not the fruit of scientific development. The appearance of the first working machinery was related not to the activities of scientists, but rather to the work of talented and at times genial representatives of production.

The beginning of *the second stage* in the relationship between science and production dates to the appearance of machine production. The machine, K. Marx pointed out, is that material form for the existence of the means of labor which causes the replacement of human effort and practical procedures by the forces of nature due to the creative application of natural science. For this reason, the second stage is characterized by the fact that science begins to explain the operating principles of machines which have already been created and participate in production. Theoretically it establishes not only the technical arrangements and adaptations, but also scientifically analyzes the production processes. The most characteristic feature of this stage is the conversion of production from an empirically functioning one to a theoretically analyzed one.

The satisfying of the direct and very specifically expressed needs (orders) of production by science became the basic form for the relationship between science and production. At times such orders were very precisely formulated. Here an example would be the competition announced

[2] See K. Marx and F. Engels, *Soch.* (Works), Vol 1, p 599.

by Napoleon during the English naval blockade of France for creating an artificial dye which could replace indigo (a natural blue dye) necessary for the textile industry. In the given instance, the order of production was not only specific but formulated in an able and understandable manner.

The increased activity of science was also related to the growth of its maturity and to the complicating of social relationships. Already by the end of the 19th nad the beginning of the 20th centuries, the technical and applied sciences began to play a marked role in the production process. After them, fundamental theoretical sciences moved into industry. The electrical engineering and chemical industries owe their appearance precisely to these sciences. However, these examples still do not characterize the relationship of science and production as a whole. They are concerned with specific production processes, individual comparatively narrow sectors of production, and so forth.

More mature social conditions determined the organic combining of science and production. K. Marx wrote that "only capitalist production turns the material production process into the application of science in production." [3] This in no way should be understood as a recognition of the fact that science is the offspring of capital. On the contrary, capital recognizes science and subsidizes it as much as is advantageous, that is, allows the obtaining of greater profit. "Capital did not create science, but rather exploits it." [4]

In the present-day *third stage* the relationship between science and production is becoming qualitatively different both in terms of content and form. Scientific and technical progress has assumed the form of a scientific and technical revolution which marks a transition to scientifically organized production. A true unification of science and production, and a qualitative change in the place of man in the production process most fully express the creative character of the activity of the masses of people and the necessity of the dominance of advanced social relationships.

Science is organically included in production and becomes an immediate productive force. This relationship (or more accurately, interaction) between science and production has a permanent character, and reflects the degree of man's domination over natural and social forces; it expresses man's control over reality, and his freedom in terms of it. At the same time, the form of interaction between science and production is such that present-day scientific and technical progress has a clearly expressed accelerating rate. This rate is caused both by the internal logic of the development of science and production, as well as by the substantial shifts in social relationships.

[3] *Bol'shevik* (The Bolshevik), No 1–2, 1932, p 21.
[4] *Ibid.*

A most important feature of scientific-technical progress is the acceleration of its development rate. This, incidentally, is one of the reasons explaining why the present stage of scientific-technical progress has assumed the appearance of a scientific-technical revolution. To speak about an acceleration in the rate of scientific-technical progress means to describe primarily the state of science. Primarily science, in invading production, and in leading it, causes fundamental changes in it.

Modern science is living through a period of fundamental shattering of old scientific concepts. There is occurring an abrupt about-face in views, in the interpretation of facts, and in the theoretical explanation of observed phenomena. This profound change accelerates the course of scientific development, and makes it a more effective implement for man.

F. Engels, in his work *Essays on the Critique of Political Economy*, in characterizing the growth rate of natural science, wrote that "science is moving ahead proportionately to the mass of knowledge inherited by science from the preceding generation." [5] Subsequently, Engels returned repeatedly to this idea, and, in developing it, *formulated the law of the accelerated development of natural science*. In pointing out that the publication of the immortal work of Copernicus *On the Revolutions of the Celestial Spheres* was a turning point in the development of natural science, Engels stressed that "since this time science has developed at a gigantic pace, and this development has intensified, if it can be so expressed, proportionately to the square of the distance (in time) from its starting point. It was essential to show the world that from now on for the higher product of organic matter, for the human spirit, there was in force a law of movement, which was the inverse to the law of movement for inorganic matter." [6] All historic development of natural sciences has substantiated these ideas of F. Engels.

At present a number of Soviet and foreign authors (G. Dobrov, M. Karpov, V. Nalimov, N. Styazhkin, G. Bledutz, V. Kra, D. Price, P. Auger, and others) have used an exponential function $f(z) = e^z$ for describing the growth rate of certain indicators of science. The exponential function has been well studied in mathematics. It quantitavely characterizes monomolecular reactions, and the processes of the multiplication of biological formations (for example, bacteria, and certain zoological species such as rabbits, and so forth). In other words, the given function examines the quantitative aspect of such processes the growth rate of which depends (proportionately) upon the initial value of this changing amount.

The exponential growth of science is expressed by the following formula:

$$A = be^{kt},$$

[5] K. Marx and F. Engels, *Soch.*, Vol 1, p 568.
[6] *Ibid.*, Vol 20, p 347.

where e — the basis of the natural logarithm (the Neper number) ~ 2.7; b — the total of scientific knowledge; t — the time elapsed since the moment of the calculation; k — a coefficient changing under various historical conditions and reflecting the influence of the development level of the productive forces and other factors on the scientific growth rate.

Among the designated values, the b value or the total of scientific knowledge at the moment of the calculation, is the most difficult to determine quantitatively. In recent years, indicators have been defined which more or less correctly describe its value. These are:

The amount of scientific information, that is, the number of scientific journals, original printed works, and so forth;

The number of scientists;

The number of scientific research institutions;

The amount of allocations for scientific development and other characteristics.

The American scientist D. Price and his associates, on the basis of statistical data, for each of the indicated features, have constructed exponential graphs which in virtually no way differed from the calculated. They substantiated the exponential character for the growth of the designated scientific indicators considering the modern data. The doubling of the number of scientists occurs every 7 years in our nation, every 10 in the United States, and every 15 years in the European nations.

From this, some authors have concluded that, in the first place, the growth curve for the number of scientists will catch up with the growth curve of the population, that is, the entire population of the world will be engaged in natural sciences, and, secondly, the amount of scientific information will become so enormous that it will be impossible to use it. The necessity will appear not only of publishing abstract journals, but also abstract journals of abstract journals, and so forth. A paradoxical situation may arise where it will be easier to resolve one or another equation, to prove a new theorem, or to analyze the absence of a certain physical or chemical phenomenon than to find their solution in the enormous flow of scientific literature.

A number of bourgeois scientists have gone even farther. Without believing in the progress of human society, they feel that the exponential growth of science in the near future should lead to a slowdown of its development, and then to its "suppression" (these views have been called the "theory of saturation"). Of course, one cannot agree with such pessimistic views concerning scientific progress.

At the same time, the exponential growth of the quantitative indicators of science leads one to the conclusion that the organization of scientific research should undergo fundamental changes. At present, the basic results of science show a trend to double every 45 years. But its external indicators double significantly faster, every 7-15 years. In order to double the number of scientific results, at present it is essential to increase the

number of scientists by 16-fold, and to raise the level of allocations on scientific research and experimental designing by more than 30-fold.[7] Understandably, at a certain level of development, it will be more and more difficult to allocate the funds which fully satisfy the needs of science. At present there are various viewpoints concerning the optimum amounts of resources allocated for science. Thus, Academician N. N. Semenov feels that in the future, up to 50 percent of mankind will be engaged in scientific labor, for Professor D. Bernal the figure is 20 percent, and for Academician P. L. Kapitsa, 10-20 percent. However, it is perfectly obvious that in the immediate decades, science more and more should change from an extensive character of development to an intensive one.

The present level of science is characterized by an ever growing need to understand the patterns of scientific development. The self-awareness of science has become a necessity. At present, a new area of knowledge, the philosophy of science, has developed and this studies the development laws of science as an integrated system. The tasks of the philosophy of science are to elaborate the theoretical bases for organizing and planning scientific research, for forecasting the scientific and technical policy of a state, for optimizing scientific potential, and raising its effectiveness.[8]

The new organization of the activities of science and scientific research institutions and the planning of scientific development are an important aspect in the research of the philosophy of science. This aspect in scientific development shows a clearly expressed sociopolitical casuality. It is most fully disclosed under socialist conditions with an economy which develops proportionately and according to a plan, and a social interest in the greatest possible development of science and universal education for the members of society. Socialism creates exceptionally favorable opportunities to direct the entire diversity of scientific research according to a statewide plan. Science has become an immediate productive force.

Science—an Immediate Production Force of Society

In our literature, various opinions have been expressed about the process of converting science into an immediate productive force. The supporters of one of them understand this process in a literal sense, feeling that science is becoming a component element in the productive forces. According to the convictions of the followers of another viewpoint, science cannot become an element of the productive forces, since it is related not to material phenomena but to spiritual ones. They feel that the process

[7] See G. M. Dobrov, V. N. Klimenyuk, L. P. Smirnov, and A. A. Savel'yev, *Potentsial Nauki* (The Potential of Science), Izd-vo Naukova Dumka, Kiev, 1969, pp 22–23.

[8] See G. M. Dobrov, *Nauka o Nauke. Vvedeniye v Obshcheye Naukovendeniye* (The Philosophy of Science. The Introduction to General Philosophy of Science), 2d edition, Izd-vo Naukova Dumka, Kiev, 1970, p 8.

of converting science into a direct productive force must be understood as a fact of strengthening the interrelationship between science and production. The supporters of these viewpoints have an over-simplified notion of the process of converting science into an immediate productive force. They do not take into account the entire complexity and contradictoriness of both science and production.

Science is a form of social awareness, and it is a spiritual and theoretical activity. But science includes also scientific experience, and laboratory research which relies on an experimental basis. Finally, science is also a definite organization of people and the use of equipment. Consequently, modern science embodies both theoretical and practical activities. It fulfills the functions of understanding the laws of the world around us and the use of them in the interests of society. In turn, production itself is changed in a non-uniform manner. In the process of its development, there is a constant change in the relationship of the elements comprising it. Some of them which were previously in an embryonic state develop, grow stronger, and become the decisive ones, while the significance of others is reduced.

As is known, K. Marx and F. Engels, aside from the material elements of the productive forces, that is, the means of production and people, also pointed to the spiritual potentials which also have an effect on raising labor productivity. ". . . Along with the physical aspect of simple labor," emphasized F. Engels, there is "the spiritual element of inventiveness and thought," and "the spiritual element, of course, will belong among the elements of production and will find its place among production outlays in political economy." [9] K. Marx felt that "as large-scale industry develops, the creation of real wealth" will depend more and more "upon the general state of science and upon the degree of development of technology or upon the application of this science to production." [10]

Of course, this does not mean that the thoughts of a scientist or the abstract theoretical conclusions of science become elements of the productive forces. The well-known thesis of Marxism states that the idea becomes a material force when it is mastered by the masses. Not the presence of developed science and not the thoughts and ideas of the scientists in and of themselves but rather their realization and their practical application in production are the most important aspect of converting science into an immediate productive force of society. This leads to the appearance of fundamentally new forms of the relationship between science and production practices. While previously science solved only those problems which the development of industrial and agricultural production posed for it, at present the characteristic trend is for the more rapid development of science in terms of production. That is, science sets the pace for production. The might of science has grown so that at present

[9] K. Marx and F. Engels, *Soch.*, Vol 1, pp 554–555.
[10] *Bol'shevik*, No 11–12, 1939, p 61.

science has turned from the captive of nature which examined only what nature created into an active force which skillfully pointed out and rectified the "shortcomings" of science and its "miscalculations" and "oversimplifications." Academician M. V. Keldysh in one of his speeches said: ". . . The highest achievement of science is where science does not imitate nature but where it creates the possibility of transforming nature."

The outstripping of production practices by science at present is a pattern of historical development. In relying on social practice and possessing relative independence, science has matured to the point where it cannot follow blindly in the development of social production, but must go ahead and show the way for it. In turn, social production has achieved a level of maturity where it cannot develop further without science, and more and more is becoming science's technological application.

This in no way repudiates the fundamental thesis of Marxism on the determining role of production in social development.

In the first place, science itself is inconceivable without extensive experimental facilities which have become truly industrial ones. Such modern experimental equipment as elementary particle accelerators, radiotelescopes, and so forth, are, in essence, enormous industrial installations.

Secondly, all the results of scientific research, no matter how far they might seem at first glance from social production activities, ultimately are still destined for production. Social production and the development of productive forces are the goal of science and its result.

In the third place, the needs of production as before determine the development of science, but the form of this causality has changed. The general needs of social production are now manifested not in the need for any specific discoveries, but rather in the need for the predominant development of definite scientific directions on which the efforts of the scientific collectives and sufficient funds should be concentrated.

A vivid example of this would be the development in recent decades of those scientic sectors without which it would have been impossible to shift control functions from man to special automated devices. The creation of cybernetics has become possible not only as a result of the development of science itself, but also as a result of the development of practice which has required special machines adapted for performing logical operations at a faster rate than man.

The socioeconomic conditions are an important factor for converting science into an immediate productive force. In a capitalist society, this conversion has been used primarily by the monopolies which have endeavored to increase their profits as much as possible. Certainly, a certain share of the profit remains for all of society, but a larger portion of it is appropriated by the exploiters. The social conditions of capitalism have a negative effect on the development of science itself, in giving rise to such phenomena as its militarization, reduced interest in theoretical, fundamental research, a patent war between the monopolies, and so forth.

In a socialist society, the status of science is fundamentally different. Here the process of converting science into a direct productive force is used for the good of all the people. Science becomes a powerful means for the rule of man over surrounding reality. "Scientific-technical progress," said L. I. Brezhnev at the 24th CPSU Congress, "is the main lever for creating the material and technical basis of communism. This is why on such an important question as the development of science and technology, we should be perfectly clear of the prospects and consider them in our practical work." [11]

It must be emphasized that not only the natural and technical sciences are turned into a direct productive force, but also the social and humanitarian sciences. In terms of their social function, social sciences have shown themselves to be a force capable of transforming all aspects of society's life.

In the course of communist construction, leadership more and more is moving into the area of controlling things and production processes. For this reason, the social sciences, without losing their relative independence, in an alliance with natural and technical sciences, have a direct effect on the entire production process and its regulation, particularly through the organization and distribution of labor, and control. Under socialist conditions both the natural and the social sciences are changed into a single social force.

The essence of converting science into a direct productive force consists in the embodiment of scientific knowledge in the implements of production, in technology, organization and productive methods, and in the mastery of this knowledge by the participants in the production process. "Nature," wrote K. Marx, "does not build machines, locomotives, railways, electric telegraphs, self-acting mules, and so forth. All these are the products of human activity, these are a natural material which has been converted into the organs for the control of human will over nature or into organs for exercising this will in nature. *All of this is the organs of human brain created by human hands;* it is the embodied force of knowledge." [12]

The materialization of scientific knowledge is carried out above all in the decisive sphere of production, that is, *in the manufacturing of the implements of labor*. Step by step, in discovering the causal ties and relationships and in examining the patterns of nature from the simplest to the more complex, science has helped man to create those implements of labor which make it possible to successfully conquer nature. All modern technology, and in particular automated technology, is materialized science.

Along with the creation of technology, *science has disclosed for man the secrets of obtaining and utilizing various types of energy*. While

[11] *Materialy XXIV S"yezda KPSS*, p 57.

[12] *Bol'shevik*, No 11–12, 1939, p 63.

mechanical energy could be used and for a long time was used without virtually any scientific knowledge, electrical and nuclear energy has been mastered by man exclusively with the aid of science. Also related to science have been man's subsequent efforts directed in obtaining enormous quantities of energy and using it for raising the efficiency of production and satisfying the material and spiritual needs of society.

A very effective way for converting science into a direct productive force is through *the organization of production and its technological methods*. Machine production made it possible for science to first give birth to the electrical engineering and chemical industries, and then to atomic engineering, the production of electronic computers, and so forth. Due to science many production processes have become continuous, and man does not control them directly but rather through special instruments and devices. Modern industry and agriculture are becoming more and more the technical application of science.

But the conversion of science into a productive force has occurred not only by changing the material aspect of the productive forces. It is also carried out through the immediate participants of production. Initially engineers and technicians were the carriers of science in production, and now scientists. Modern production more and more requires the creative application of scientific knowledge. For this reason scientists not only indirectly but also directly are involved in the production process, and take a personal part in the development of industry and agriculture, while workers and kolkhoz members, as the direct producers of material goods, are being raised to a level of the conscious application of science.

This means that practical knowledge, labor skills and science merge more and more as the tasks of communist construction are solved. This is the most important "mechanism" for turning science into a direct productive force. But it does not operate in a pure form. In the course of socialist and communist construction, this "mechanism" is manifested in all the practical social activities of people, and above all in creating the material and technical basis of society. The particular features of the present-day period of the scientific-technical revolution are organically linked to it.

The Particular Features of the Present-Day Scientific-Technical Revolution

The converting of science into a direct productive force is the most important but not the only particular feature of the present-day scientific-technical revolution. The scientific-technical revolution is also characterized by fundamental shifts in all the components of the process accompanying it, that is, both in science, in technology, and in the forms of the relationship between them. In their aggregate, they express the

fundamental changes in the production sphere. But what production element, or what aspect of production is changing the most?

K. Marx and F. Engels, in studying the Industrial Revolution at the turning point of the 18th and 19th centuries, pointed out that the history of the development of the means of labor and the production activity of man are inseparably interrelated. The means of production and the people who use these means comprise a single mechanism of labor. A change in one of the component elements from this single mechanism is most closely related to the development of another. Here the means of labor play the leading role.

The creation of artificial organs which are capable to an ever greater degree of performing the functions of natural organs not only eases the labor of man, but above all significantly raises his efficiency, and increases the possibilities of social production. For this reason, the overall trend in the development of production has been characterized by the historical process of creating technical devices which to an ever growing degree were capable of fulfilling human functions in the production process.

The continuous change in the relationship between the material (technical) and personal (human) factors in production activities toward a broadening of the functional capabilities of the former and a constant alternation and complication of the functions of the latter is, thus, a most important characteristic in production development, and, ultimately, in all of society.

In the process of production activities, man performs an infinite number of functions. However, these can be reduced to five basic ones, that is, the source of energy, the engine, the transmission mechanism, the direct effect on the subject of labor, and control of technology and production. Initially man fulfilled all these functions himself, using only his physical and mental capabilities. But in the course of historical development, he created artificial attachments or used objects created by nature for performing individual functions. The change in the relationship between technical and human factors has occurred unevenly. If the implements of labor are created which are able completely or significantly to form one of the basic production functions of man, then an abrupt change occurs in production.

Precisely such an abrupt change which was called the Industrial Revolution occurred at the end of the 18th and the beginning of the 19th centuries. The essence of this abrupt change was in transferring the functions involved in the direct processing of the subject of labor from man who fulfilled this function with his own hands equipped with tools to a machine which worked under the control of man. This led to a decline in manufacturing and to the appearance and rapid development of factory-plant production.

The appearance of machines was one of the stages in the development of the implements of production. Later on automatic devices appeared in

which man did not take a direct part. Automatic equipment makes it possible to turn over to special devices a certain portion of the functions relating to production control. In this manner it opens up a broad path to the automation of all production, that is, from the production processes to accounting and inspection.

Automation is a qualitative jump in the development of technology and it has changed the place of man in production and the character of his labor. It has had a determining effect on the development of social production. Automation is the natural consequence of the entire preceding history of technical development, and is an important aspect in the essence of modern scientific-technical progress. *Automation and science which organically interact with one another have caused a fundamental change in production, and in the course of this change, man has turned over the functions of production control to special automatic devices and attachments, and thereby has provided a sharp rise in the production process. This is the essence of the present-day scientific-technical revolution.* It determines the particular features of technical progress as a relatively independent process of the scientific-technical revolution.

Inherent to modern technical progress is such an important feature as the exceptionally rapid development of technology and the appearance of new devices, mechanisms, inventions, and discoveries. At present it has become the rule that after a scientific discovery, the discovery is materialized. For example, the theory of electric welding developed by Soviet scientists headed by Ye. O. Paton made it possible for it to be not only the most economic method for joining metal, but also in many ways determined the path for industrializing construction. Automatic electric welding increases labor productivity by 10-12 fold, and reduces the consumption of electric power by 200 percent.

The simultaneous development of theory and the creation of technology lie at the basis of increasing the productivity of single mechanisms and units and increasing their capacity. Recently turbines of 150,000-200,000 kilowatts were installed at GES [hydroelectric plants], but now the issue has been raised of installing turbines of more than 1 million kilowatts. At present, areas of mathematics which were considered too abstruse have turned out to be very important for practical application in cybernetics and missile engineering, and include mathematical logic, game theory, and so forth.

Due to the enormous advances of physics, chemistry, mathematics, radioelectronics, and other sciences, technology is now developing on a broad front and in great leaps. And this has caused fundamental revolutionary changes in production. One has merely to introduce a certain discovery or improvement, and it immediately causes changes in the production process, and leads to the creation of new models of technology.

The improvement and introduction of technology are like a chain reaction. This is why it has become possible to produce a large number of most complex instruments and mechanisms which are so essential for missile engineering, and the automation of control as well as their mass application.

Technical progress not only depends upon the development level and rate of science, but is itself a unique catalyst for science. In modern technology used by Soviet people for rapidly raising productive forces, many questions have been posed, and the answers to them can be supplied only by science. Technology, as realized science, in being between man and nature, itself begins to pose certain problems for science, simultaneously being a definite basis for solving these problems. Thus, in the process of mechanization and automation, certain types of human activities are replaced by the functioning of special devices, for example, cybernetic ones. Here man becomes more and more, in the expression of Marx, "the supervisor and regulator of production," and is freed from direct involvement in the production cycle.

In this regard, such questions have arisen as the pattern of reducing the share of live labor in the direct production of a product, the possibilities of cybernetic devices in performing the processes of human mental activity, and the overall question of the relationship of the machine and the human brain. These and similar questions can be answered only with the aid of economic science, mathematics, physiology, theoretical cybernetics, and, of course, Marxist-Leninist philosophy. In solving the questions posed by technology, science becomes enriched, it hones and perfects its methods, and thereby accelerates the rate of its further development.

The consequences of technical progress under the conditions of the full-scale construction of communism are exceptionally humane. The development of new technology is used for the fundamental improvement and easing of human labor activities, for reducing the working day, for providing everyday amenities, for eliminating heavy physical labor, and then all sorts of unskilled labor. This means that the use and application of machinery coincide with its natural purpose, and the machinery is converted into an implement for the constant development and improvement of the production workers. Scientific-technical progress is the basis for a continuous rise in the technical and cultural level of the workers in our nation. The 24th CPSU Congress posed a task of historical importance: *"To organically link the achievements of the scientific-technical revolution with the advantages of the socialist economic system,* and to more widely develop the forms inherent to socialism for combining science with production." [13]

[13] *Materialy XXIV S"yezda KPSS*, p 57.

The present-day scientific-technical revolution is developing *according to those basic directions which correspond to the following production factors: the implements of labor, the sources of energy, and the subjects of labor.*

Full production automation is the general direction in the development of the scientific-technical revolution. In this instance man does not take a direct part in production. He designs the machines, he composes the programs for their work, and adjusts and tends the automatic devices. The auotmated plant is the fullest expression of full automation. The development of mathematics, its penetration into economic sciences, and the rapid development of cybernetics and electronic computers, automation and communications have made it possible to solve the problem of developing automated operational control systems for the national economy on significantly larger scales, right up to the nationwide scale. These prospects entail enormous benefits for our socialist economy.

"The improvement of the national economic planning and management system," said A. N. Kosygin in his speech at the 24th CPSU Congress, "under present-day conditions requires the extensive use of mathematical economics methods and the use of electronic computers, office equipment, and technically advanced communications. The use of *electronic computers* will make it possible to accelerate the obtaining and processing of information, the elaboration of different plan variations, and the finding of optimum plan solutions. Due to the advantages of the socialist economic system which makes it possible to control economic and social processes on a nationwide scale, the wide use of electronic computers will help to strengthen the soundness of our plans as well as to find the optimum solution for them." [14]

In the new five-year plan, at least 1,600 automated control systems for enterprises and organizations will be put into use. Work will be continued on developing a statewide automated system for collecting and processing information used for accounting, planning, and management of the national economy on a basis of the state system of computer centers and the unified automated network of national communications. Such a task is within the scope of only a socialist society.

Full production automation involves not only the management area, but also causes a multiplicity of technical shifts which transform the structure of modern industry and change the role and place of its individual sectors. Power engineering is one such sector.

The most important direction of the present-day scientific-technical revolution is the greatest possible development of power engineering. This has been caused by the requirements of production and the needs of

[14] *Ibid.*, p 174.

domestic services for the public. Electricity holds a particularly important place among all types of energy. The 24th CPSU Congress in its decisions emphasized the necessity of providing the more rapid development of power engineering in relationship to the other national economic sectors.

In the development of modern power engineering, three major interrelated and reciprocally caused directions are distinguished. The main one is an increase in the amount of produced and consumed energy. The two other directions, that is, the search for new ways for obtaining energy and the use of energy generated with a thermonuclear reaction, are subordinate to this.

The search for new types of energy is an important direction in the development of modern power engineering. As is known, at present up to 95 percent of all energy is obtained from unreplenishable types of fuel (coal, oil, gas, and so forth), and only around 5 percent from replenishable sources (rivers, sea tides, solar energy, and so forth). The discovery of atomic energy has been a major feat in modern science. Mankind has obtained enormous power sources. In surmounting the scientific and technical difficulties, many nations are already building hundreds of reactors and atomic power plants, although their role in power engineering in the immediate future still is limited.

The use of energy generated with a synthesis reaction, that is, a thermonuclear reaction, has great prospects. This is truly an inexhaustible source of energy for mankind. However, as yet only the first steps are being taken in solving this problem. Soviet scientists have achieved the most substantial success. They were not only the first to propose the principle of a magnetic trap for holding the plasma, but were also the first to successfully carry this out experimentally. This was a major and promising success for Soviet science.

A word must also be said about the task of raising the efficiency of power units which operate on conventional fuels. The efficiency of modern power plants is only 30–35 percent, and this means that two-thirds of the coal and oil are burned without benefit in the furnaces.

At present, work is underway on magnetohydrodynamic [MHD] generators, the efficiency of which is significantly higher than the presently existing power installations. The solution to the technical problems related to their creation will entail an enormous shift in the quantity of energy obtained. This shift can be carried out in a significantly shorter time and with fewer capital investments than if it were done on the basis of modern atomic power plants. Thus, if it were possible to raise the efficiency of all Soviet thermal plants to the level of the MHD generators, then in the future this would provide an increase in capacity equal to one-half the capacity of the USSR power plants now in operation.

The greatest possible development of chemistry is a most important direction of technical progress. The introduction of chemistry is an exceptionally vivid indicator of the growing role of science in creating the material and technical basis of communism. V. I. Lenin wrote: "A rise in labor productivity requires, above all, providing a material basis for large-scale industry. This is: the development of the production of fuel, iron, machine building, and the chemical industry." [15] The creation of a powerful chemical industry is a shock front of communist construction.

At present, science and technology have achieved a level where the role of chemistry in the devolpment of the productive forces has become truly revolutionizing. At present, the solution to fundamental problems of raising industry and agriculture, increasing the material prosperity, and strengthening the defense capability of the nation is related precisely to chemistry.

In communist construction, the social role of chemistry becomes truly enormous. It opens up for society prospects of an unprecedented rise in the standard of living, it provides a revolution in the implements of labor and the methods of manufacturing them, and makes it possible to have an unlimited quantity of any materials. Chemistry broadens the raw material base, and provides new materials for the processing industry, and the most effective means for raising agriculture, for increasing the output and improving the quality of consumer goods.

World practices indicate that at present chemistry is providing for the ever increasing use of products and materials produced by the chemical industry enterprises. The scientific laboratories have developed approximately 3 million different substances, a significant portion of which does not exist at all on the earth under natural conditions. Each year an average of around 14,000 new chemical compounds are synthesized.

The introduction of automated devices into production, the more rapid development of power engineering, and the use of chemistry in industry not only make it possible to raise production possibilities for producing products, but fundamentally change the very production process.

Here a special role is played by science. The effect of science on technical progress is carried out by a continuous improvement in production methods. During the period of building the material and technical basis of communism, production more and more becomes the technological application of modern science. It embodies the data not only of the natural sciences but also the technical and social sciences. The new ideas and principles proposed by physics, chemistry, and biology are realized in production by the technical sciences through an improvement or fundamental change in production methods.

[15] V. I. Lenin, *Poln. Sobr. Soch.* (Complete Collected Works), Vol 36, p 188.

This opens up exceptionally great opportunities for raising labor productivity. The further electrification and use of chemistry in the national economy rest on production methods and the production level. If the new mechanisms and automated devices are tied to old technology, this will not provide the proper results. Great capital investments will not bring about a significant increase in labor productivity, while costs can rise instead of declining.

Thus, electrification, the use of chemistry, and automation in the aggregate with the new industrial and agricultural production methods, as the chief directions of technical progress lead not merely to an improvement in production, or to a quantitative change in the productive forces of society, but rather to a qualitative change in them. The situation of man in production becomes a qualitatively new one. His creative function rises sharply. "The fact that man is able to make machines better," wrote the outstanding English physicist J. Bernal, "is, undoubtedly, a most interesting and pleasant fact. Machines can imitate, but man can create." [16]

2. The Effect of Scientific-Technical Progress on the Development of Military Affairs

Scientific-technical progress affects all aspects of society's life, including the development of military affairs. Military affairs have always been one of the areas of social life where modern scientific and technical achievements were employed more quickly and in greater quantity than in others. And this is understandable since the implementing of the interests of the ruling classes depended upon the development level of military affairs and upon the quantity and quality of the army's weapons.

Precisely military affairs and the requirements of the war being prepared or the needs of the front stimulated the development of the individual sectors of science and the creation of certain technical devices, without which it would be presently impossible to imagine either production or social life generally.

An example of this would be research in the area of ballistics, probability theory, radar, certain automated systems, and the development of such sectors of modern production and new areas of science as aircraft construction, aerodynamics, missile building, and so forth.

However, from this it in no way follows that military affairs are the motivating force of scientific-technical progress. Wars and military production ultimately impede and retard the development of the productive forces and the progress of many scientific and technical sectors.

[16] J. Bernal, *Mir bez Voyny* (World Without War), Izd-vo Inostrannoy Literatury, Moscow, 1960, p 88.

The interaction of science, technology, and military affairs is complex and contradictory. This interaction is socially caused, and depends upon the state of science and military affairs. No matter how developed science and technology might be, their use is determined by social and class interests. The decisive role is played by the interests of the ruling classes in the individual nations, and in the international scene, by the economically, politically, and militarily strongest states.

In the capitalistic states, the use of scientific and technical achievements in military affairs is determined primarily by the narrow class, antipopular interests of monopolistic capital and by the policy of the aggressive circles of imperialism. For this reason, all science in the capitalist world has become militarized. Thus, in the opinion of competent foreign experts, military, space, and a portion of atomic expenditures in the United States are more than 80 percent of the federal allocations and more than 60 percent of all expenditures on scientific research and development.[17] In the United States, 54 dollars go for scientific research for every 100 dollars of purchased military products. In other sectors of production, only 7.5 dollars of capital investments out of every 100 go for scientific research.[18] As for the Soviet Union and the other socialist nations, their use of science for military affairs is caused exclusively by the needs of defending peace, democracy, and socialism. They are forced to resort to this measure in order to provide the necessary conditions for carrying out the programs of socialist and communist construction.

Thus, the intensified use of science in military affairs is an expression of an acute class struggle on the world scene, and a manifestation of the basic contradiction, that is, the contradiction between capitalism and socialism.

Under these conditions, the problem of providing scientific-technical and military-technical superiority has moved to the forefront. For this reason, in order that military affairs (and above all their material and technical base) in the USSR and the other socialist nations did not lag behind their development in the capitalist states, it has been essential not only to consider the most recent achievements of fundamental and applied sciences most carefully and effectively, but also to judge their possible application in terms of strengthening the defense might of the entire socialist community.

A relatively high development level of modern science and its rapid

[17] See *Politika SShA v Oblasti Nauki* (U.S. Policy in the Area of Science), Izd-vo Progress, Moscow, 1971, p 34.

[18] See *UNESCO Courier*, November 1970, p 11.

pace can be noted in all areas of military affairs and particularly in military equipment. This is explained by the following circumstances.

In the first place, modern weapons and all the basic equipment of the services of the armed forces and branches of arms, in terms of their design and the laws of nature embodied in them, cannot be created and controlled without the application of the most recent scientific achievements, and not only in terms of the sectors of science but for a whole number of scientific disciplines. An example of this would be the nuclear devices and missiles the development of which has become possible as a result of the use of many areas of knowledge. While in terms of production, science is becoming a direct productive force, in terms of military affairs, it is gradually becoming their most important component.

Secondly, the development of modern natural scientific knowledge has outstripped the advancement of military affairs. As was already pointed out, nuclear missiles in the full sense of the word were born on the basis of development in nuclear physics. The idea of using the intranuclear forces as a means of direct destruction of the enemy could arise only when the enormous destructive force of them had been theoretically and practically discovered.

At present, the more rapid development of science in regard to the development of military technology has become even more apparent and indisputable. This applies not only to the creation and improvement of new weapons, but also a rise in the efficiency and an improvement in the tactical and technical performance of traditional weapons based upon the use of conventional explosives.

Thirdly, there has been a fundamental change not only in the sphere of applying sciences to military problems, but also in the very volume and character of these sciences. Prior to World War II, as a rule, the applied and technical sciences had an influence on the development of military affairs. The time gap between discoveries in the fundamental and theoretical sciences and their application in technology was so great that in actual terms these discoveries did not have a direct and immediate effect upon military affairs. In our times, this gap has been reduced to a minimum.

Fourthly, the rise in the role of science in military affairs has occurred not only by the active involvement of such fundamental sciences as physics, mathematics, and chemistry, but also by broadening the sphere of sciences the research results of which could be involved in creating new military equipment and improving the old. At present it would be impossible with complete conviction to mention any area of natural science which would be neutral or unnecessary for the development of military affairs. Any sector of natural science either already participates or potentially can be used in it.

For example, the sector of zoology which studies the structure and functions of the organs of individual animals can be used in designing

technical devices which perform similar functions. Recently this has developed into an independent science called bionics and which studies the mechanisms existing in nature for self-regulation and adaptation for the purpose of using them in technology.

Abroad, the data of many sciences are used concerning human higher nervous activity for developing psychochemical toxins, which paralyze a person's will, which induce panic, hallucinations, and so forth.

Fifthly, modern military equipment is so complex that its creation and production, daily operation and control require the active and immediate participation of science. This leads to a situation where not only scientists are involved in the work relating to military problems, but also many officers and generals become scientists in their particular activity.

Sixthly, the greatest possible use of science is required in such aspects of military affairs as troop organization and troop command, as well as the training and indoctrination of the personnel. The quantitative and qualitative change in the material and technical base has caused substantial changes in the character of military work, and these changes have required a consistently scientific approach.

Scientific Potential and Its Significance for Strengthening the Military Might of a State

The ever growing role of science in strengthening the military might of a state is now a clearly expressed pattern. Without considering this pattern, it is impossible to examine with sufficient profundity and completeness the state and prospects for strengthening the military might of a state, as well as its correlative possibilities with the armies of the developed imperialistic nations. Proceeding from this, in the postwar period, the concept of "scientific potential" has been proposed in Soviet military literature.

By scientific potential one understands a certain level and rate of development of all sciences as well as their ability to solve the fundamental problems concerning the development of society and science itself.

Scientific potential includes all sciences concerned with nature and society in its structure.

It must be kept in mind that "potential" (economic, morale, scientific, military, and so forth) is a relative concept. It has a specific practical value not only for itself, but also in comparison with the same potential of other nations, particularly those which can be viewed as possible enemies. In order to compare the scientific potentials of various nations, both quantitative and qualitative characteristics are essential.

It is not possible to provide a quantitative evaluation for many aspects of human scientific activity and the state of science such as creativity, the talent of scientists and their philosophical position, the spiritual

atmosphere in the scientific milieu, the ability to organize oneself for carrying out the most urgent problem, and so forth. In a way they express an internal state, and a readiness to solve certain problems.

For determining the potentialities of science generally and in the area of strengthening the nation's defense capability in particular, such indicators as the availability of scientific personnel, scientific information, and scientific facilities are of important significance. As was already pointed out, these scientific indicators develop exponentially. In knowing the mathematical expression for such growth of scinece, it is possible not only to compare the present quantitative level of science in the various nations, but also to predict with a sufficiently high degree the probability of its future development.

The factors which express the degree of scientific organization are of important significance for describing scientific potential. These are the presence of a statewide plan of scientific development, its fulfillment, the conformity of this plan to the highest level of world science, and the focusing of this plan on solving the fundamental problems confronting the nation's scientific forces.

The level of scientific potential is determined by the development of the leading sectors of modern science in the area of studying both social life and nature. The development rate of all sciences depends upon the experimental facilities for theoretical research, upon the presence of sufficient financing and, of course, upon the number of scientific research personnel, the nature of their training, and the organization of education as a whole.

The scientific community plays a major role in the development of science. It includes, above all, that collective in which the scientist works. The present state of science is such that the success of a scientific discovery is inseparably linked to the activity of not only one scientist but also an entire collective. This is of particularly important significance for the development of military science. Its content has changed significantly, and the area of military-technical, pedagogical, and other knowledge has broadened in it. The further elaboration of the fundamental theses of military science will be possible only under the condition of close collaboration between the scientists and specialists from various areas of knowledge.

With the present-day level and character of the productive forces and the degree of maturity in social relationships, the growth rate of scientific potential depends upon the possibility of uniting the efforts of scientists on a statewide scale. An enormous advantage for the socialist states in this regard is the fact that they can develop scientific research according to a unified plan on a nationwide scale, and for individual directions on the scale of the entire world socialist system.

An obligatory condition for the successful development of science and for the growth of scientific potential in our nation is the more and more

profound mastery of Marxist-Leninist ideology and the dialectical materialistic method by Soviet scientists. At present the solving of fundamental scientific problems is inconceivable without the conscious application of dialectical materialism to science. "In the age of the rapid development of science," states the CPSU Program, "the elaboration of the philosophical problems of modern natural science on the basis of dialectical materialism, as the sole scientific method of cognition, is assuming ever greater urgency." [19]

The higher the achieved level of scientific potential and the more significant its growth rate, the more science acts as "the historically driving, revolutionary force." [20] The effect of this force on military affairs is not uniform. It depends both on the nature of science itself as well as on the particular features of the various aspects of military affairs. At least three decisive directions are known by which science influences the development of military affairs. These are:

The influence of science and technology on the development of the means for waging war;

The influence of science on all problems related to the preparation of man for actions in modern combat;

The influence of science on improving the ways and methods for conducting armed combat.

Let us examine each of these directions.

The Influence of Science and Technology on the Development of the Means for Waging War

Scientific-technical progress has a definite influence on the development of all types of military technology. The concept of "military technology" encompasses all the technical means with which an army is armed. Certainly, not all types of this technology are of equal significance for military operations. Combat weapons play the determining role. Precisely combat weapons reflect fully the specifics of military technology, its particular features and distinction from production technology.

What should one understand as combat weapons? In the narrow sense, this is only a technical means which directly neutralizes the enemy in military operations. However, this definition is incomplete. In the broad sense, by combat weapons one should understand the entire technical system which in a certain manner combines the necessary elements and serves as a means for a direct effect on the enemy and his installations. The schematic structure of compat weapons can be represented as consisting of three basic elements: *the means of destruction, the means of*

[19] *Programma KPSS* (Program of the CPSU), Moscow, Politizdat, 1967, p 127.

[20] K. Marx and F. Engels, *Soch.*, Vol 19, p 351.

delivery, and the means of control. Each of these elements is related in its own way to modern scientific-technical progress.

The theoretical prerequisites for harnessing atomic energy were created by science in the 1930's. Mankind was able to use the colossal energy sources residing within the atom. However, the imperialist states, and above all the United States, endeavored to use atomic energy chiefly for military purposes.

The United States was ahead of the Soviet Union in developing atomic weapons, and hurried to use them. World War II was drawing to its close. The main attack force of imperialist Japan, the more than 1 million strong Kwantung Army, had been defeated by Soviet troops and taken prisoner. On 2 September 1945, the Japanese militarists signed an act of unconditional surrender. Thus World War II ended. Literally at the very end of this war, on 6 and 9 August, American aviation, upon the order of the then President Truman, dropped two atomic bombs on the Japanese cities of Hiroshima and Nagaski.

This barbarian act had not been caused by any military necessity. The U.S. ruling circles endeavored to lessen the importance of the Soviet Union's entry into the war of Japan, to intimidate the Soviet Union, and put pressure on it in solving the postwar problems. Secretary of State Byrnes at that time put it this way: "The bomb is necessary to make Russia obedient in Europe." However, the U.S. monopoly of atomic bombs did not exist for long.

Even in 1947, in the Soviet Union it was announced that the secret of the atomic bomb did not exist. In August 1949, the first atomic explosion occurred in the USSR. The Soviet scientists created a hydrogen bomb even sooner, and in fact earlier than the American scientists.

In the United States a hydrogen device was detonated in 1954. This was not yet a bomb, but namely a device, and a very heavy and combersome one. No aircraft of those times could have carried it. In the Soviet Union, the testing of the first thermonuclear bomb occurred in 1953, and we, thus, were ahead of the Americans in developing the most powerful and advanced type of modern weapon. Incidentally, the Americans themselves were forced to recognize this fact.

The outstanding successes of the Soviet scientists and scientific research, of course, were not accidental. The entire development of science and the productive forces in our state during the prewar years prepared the grounds for splitting the atomic nucleus. The prominent Soviet scientist, Academician V. I. Vernadskiy, even in 1922 had predicted:

"We are approaching a great turning point in the life of mankind, and this cannot be compared with anything that it has previously experienced. The time is not far off when man will possess atomic energy, a source of strength which will allow them to organize his life as he wishes . . ." [21]

[21] *Pravda*, 12 March 1963.

This was a very daring statement full of confidence in the strength and creative capacities of Soviet science. Incidentally, the American physicist E. Rutherford who split a nitrogen atom in 1919, by the end of his life, in 1937, stated publicly that mankind would never be able to release the energy within the atom.

In the Soviet Union, an entire galaxy of outstanding physicists developed, and they made their contribution to solving the problem of the atomic nucleus. We might mention just a few of them: A. F. Ioffe, S. I. Vasilov, N. N. Semenov, I. Ye. Tamm, P. L. Kapitsa, L. D. Landau, and others. The activities of the great Soviet scientist I. V. Kurchatov were of major significance for the development of Soviet nuclear physics.

The Great Patriotic War of the Soviet Union against Nazism required an enormous effort by all the forces of our state. The problem of harnessing the energy of the atomic nucleus for some time retreated into the background. As soon as the well-known turning point in the course of the war was reached, the Soviet government again created the necessary conditions for the scientists to work on using atomic energy for peaceful purposes and for defending the nation. This work was headed by Academician I. V. Kurchatov. The socialist economic system made it possible for our nation even during the difficult war years to mobilize sufficient means and to create an atomic industry in a limited time.

Thus, the successes of the Soviet Union in solving the nuclear problem were quite natural. They were prepared for by the rapid scientific and technical progress which followed the industrialization of the nation. And it is very important to point out that defense was not the only direction of nuclear research by our scientists. The Soviet Union from the very outset began to widely use atomic energy for peaceful purposes. We were forced to create nuclear weapons only due to existing circumstances which required a further strengthening of the nation's defenses.

The Soviet Union also made major advances in the development of missiles. Our scientists had long focused attention on missiles as the only means for penetrating space and achieving cosmic velocities.

The development of missiles is linked with the name of a great scientist and the creator of modern cosmonautics, K. E. Tsiolkovskiy. In his work *Research of World Expanses by Jet Instruments*, he elaborated a theory of missile flight and the basic principles of missile design. The theoretical ideas of Tsiolkovskiy maintain their importance even now. An important contribution of missile flight theory was also made by the Russian scientist I. V. Meshcherskiy who, along with Tsiolkovskiy, studied the question of the flight of various mass bodies.

Soviet science holds advanced positions also in the development of the jet engine. The theoretical bases of this direction in the development of technology were elaborated by N. Ye. Zhukovskiy. This work was completed by Zhukovskiy's student and subsequently academician, B. S.

Stechkin, who published the fundamental work *The Theory of the Air Jet Engine*.

Special institutions and laboratories concerned with missiles were set up in our nation. In 1928, there arose the Laboratory for Gas Dynamic Research which began to work on the problem of using liquid fuel. The Jet Engine Study Group (GIRD) became another research organization in the area of missile building.

In 1930, under the leadership of Tsiolkovskiy's student, the talented engineer F. A. Tsander, the first liquid-fuel jet engine was built and tested. Three years later the first liquid-fuel missile was launched in the USSR. It was designed by F. A. Tsander and built by a group in which S. P. Korolev began his work. S. P. Korolev subsequently became the major specialist on missiles.

In 1933, the basic work of missile building was transferred to the specially created Jet Scientific Research Institute. The use of missiles for military purposes was also studied. In particular, solid fuel air-to-air missiles were developed for aircraft. These missiles showed their best in the battles on the Khalkhin-Gol River. Multiple rocket launchers were developed for the land forces and the navy. The result of this was the appearance in the summer of 1941 on the Soviet-German Front of the famous "katyushas" which caused great losses for the Nazi troops.

Thus, in our nation, solid experience had been acquired in the area of missile building and the practical application of missile technology by the time the nuclear weapon was developed. For this reason, it is not surprising that the Soviet Union, immediately after the end of World War II, began the production of various powerful missiles, including multistage ones. A major role in the development of Soviet missile building was played by the prominent scientist S. P. Korolev.

The development of aerodynamics, gas and hypersonic dynamics and the aerodynamics of greatly rarefied gases assumed extremely important significance for the further improvement of the modern means of delivery, aviation, and missiles.

The development of science led to a real revolution in the means of control. Here the development of cybernetics was of decisive significance. The principles of cybernetics were stated for the first time by the American scientist N. Wiener in his book *Cybernetics or Control and Communication in Animal and Machine*. The works of C. Shannon and J. Neumann were also of important significance for formulating these principles. The work of the outstanding Soviet mathematician A. N. Komogorov also played a prominent role in the development of cybernetics. In many ways his work was parallel to that of N. Wiener, but in the area of forecasting, he proposed and substantiated the most important ideas before Wiener.

To a certain degree cybernetics arose from the needs of military practice, and above all from the needs of the air defense troops which even at the outset of World War II, due to the increased speed of aircraft, encountered the ineffectiveness of using conventional fire control means. The solution was found by using electromechanical PUAZO [anti-aircraft fire control equipment] which solved the problem of antiaircraft battery fire control without the immediate participation of man. Curiously, precisely in working on such problems, N. Wiener formulated the important ideas which marked the beginning to cybernetics.

The development of cybernetics has led to the creation of automatic systems which are capable of completely solving control problems for individual types of military equipment or performing a number of control operations, significantly easing the work of labor and making it more efficient. The development of such systems marked a qualitatively new stage in the control both over the means of combat as well as the military operations of the troops. It was a stage of complete automation of control.

At present, not only have systems been created capable of automating control of one object or a small amount of military technology, but also so-called large systems which are capable of automating control over enormous troop collectives, and sometimes a whole type of armed forces. Among the latter are the systems of the Sage type (the U.S. Air Defense Command), Armydata (command of an army group), and others.

One of the most important problems in modern military development is the organization of scientific research in the area of developing military technology. Probably the most important question here is the combining of theoretical (exploratory) work with the practical (technical) embodiment of scientific achievements. The theoretical elaborations should antedate military practices. This is a general pattern characteristic for the relationship of science with all social practices. Academician M. V. Keldysh has said: "We should know much more about nature and its essence than we are able to use at the given moment." [22]

However, theoretical research cannot lie idle for a long time, particularly in military affairs. The emphasis must be on bringing the theoretical conclusions to a technical realization so they can lead to fundamental changes and to a sharp rise in the effectiveness of combat technology. This is dictated, on the one hand, by the increased rate of scientific-technical progress which has significantly reduced the path from the theoretical to the technical embodiment, and on the other, by the urgent necessity for nations of the socialist community to maintain constant military and technical superiority over the forces of imperialism.

The objective necessity which has arisen in recent decades for the closest tie between science and practice and for the quickest introduction of the achievements of scientific-technical progress into production has fully maintained its significance in terms of military affairs and the task of maintaining the combat equipment and weapons on the level of the growing needs of a modern army.

[22] *Vestnik Akademii Nauk SSSR* (Herald of the USSR Academy of Sciences), No 11, 1963, p 57.

Modern science, like military technology, has a determining influence upon the training of army personnel. Soviet military personnel are profoundly aware that all modern military technology, and particularly nuclear weapons and automatic devices, is the embodiment of scientific ideas and production achievements as well as that materialized science serves as a dependable shield for the motherland.

The time has passed when it was possible to have a purely practical and empirical approach to weapons and military technology, while maintenance of them came down to using physical force and simple tools such as a wrench and screwdriver. Modern military technology requires a skilled and truly scientific attitude. Only under such conditions is it possible to neutralize the enemy target with the first missile, and to carry out practice missile launches with evaluations of "excellent" and "good."

In their predominant majority, Soviet military personnel show an aware attitude toward scientific and technical achievements and to advanced experience. The depth of the military, technical, and professional knowledge and skills is a most important indicator for the military and technical level of soldiers and sailors, sergeants, petty officers, ensigns, warrant officers, and officers of the Soviet Armed Forces.

High military technical efficiency and the underlying scientific knowledge provide the high combat capability and constant combat readiness of the Armed Forces. This is an indispensable condition for the rapid mastering of weapons and military technology, for raising class skills, for mastering related specialties, for meeting daytime standards at night, for extending periods of equipment operation between repairs, and so forth. The level of military and technical efficiency is a sort of indicator of military labor productivity.

Scientific-technical progress in military affairs also influences the combat morale of the troops as well as their morale and psychological forces. Modern bourgeois military theoreticians cannot help but recognize this. They have advanced the opinion that morale is something greater than confidence in weapons, and that it cannot be compensated for by technical achievements.

The possibility of a surprise attack by the aggressor on our nation places increased demands upon the military and morale qualities of Soviet military personnel. "For achieving victory over a strong enemy," wrote the Minister of Defense, Mar SU A. A. Grechko, "it is essential that each Soviet soldier represents the strongest fusion of political morale conditioning, military skill, physical endurance, courage, and heroism. This demand assumes particular significance under the conditions of a nuclear war." [23] The fate of our motherland and the cause of peace

[23] A. A. Grechko, *Na Strazhe Mira i Stroitel'stva Kommunizma* (On Guard for Peace and the Construction of Communism), Moscow, Voyenizdat, 1971, p 68.

throughout the world, and the progress of mankind generally to a significant degree depend upon the ideological conviction, the political awareness, the constant vigilance, and the entire aggregate of military morale qualities of the troops at each given moment.

At present we cannot longer hope that shortcomings in the training and indoctrination of personnel can be eliminated in the course of the war. Training and indoctrination of the troops, in accord with the nature of modern war, should be such that the decisive results are achieved at the very outset of the war.

The revolution in military affairs has brought to light new forms of personnel training and indoctrination. It is generally recognized that at present, it is possible to lead the troops, to teach and indoctrinate the personnel solely on a scientific basis, in relying on the most recent achievements of all sciences. The harder military affairs develop, the more significant will be the role of science in troop training and indoctrination and in the practical activities of military personnel.

Science and the Methods of Waging War

The establishing of the ways and methods for conducting armed combat as well as the organizational structure of the army is an important direction in the effect of science on modern military affairs. If the development level of natural and technical sciences is determining for military technology, and social sciences are crucial for the elaboration of scientific methods of troop indoctrination and training, the development level of military science is of decisive significance for improving the ways and methods of conducting armed combat.

Military science is most closely tied to the entire complex of social and technical sciences. It must be said that the active penetration of natural sciences into military theory to a significant degree is a characteristic trait of our times.

The penetration of not only physics and chemistry but also mathematics into military theory is very significant. The introduction of quantitative analysis methods into it, the use of modeling methods, and the possibility of using modern computers make it possible to approach research on the methods and means of conducting modern war not empirically but rather on a scientifically sound basis, with an accurate prediction of the future. This means that military science itself is significantly more dependent on other sciences than was the case previously.

Chapter II. Characteristics of New Means for Waging War

Among the means for waging war are various weapons systems and diverse military technology designed for conducting and supporting combat operations by various services of the armed forces and branches of arms.

The use of outstanding achievements of science and technology has led to a fundamental change in weapons and, as a consequence, to revolutionary changes in the area of military art.

The present-day revolution in military affairs has been related primarily to the creation of nuclear weapons, ballistic missiles, and atomic missile submarines, guided antiaircraft missiles, and other new types of weapons and combat equipment. The introduction of automated control systems also has had an enormous effect upon a further rise in the combat efficiency of the means for waging war.

Particularly characteristic for our times is the comprehensiveness in the development of the means for waging war and the closest relationship of their individual elements. The improvement of any one of the elements, for example, the warheads, has made it necessary to improve the other elements as well, that is, the carriers of the warheads, and the means of support and control.

Below we will examine the most important characteristics of the new means for waging war as taken from material published in the press.

1. Nuclear Weapons

Nuclear weapons at present are the basic means of destruction, and are used in the weapons systems of various services of the armed forces.

The discovery of a method for deriving nuclear energy has marked a turning point in modern science. There are virtually unlimited opportunities for using it for peaceful purposes in the world. For example, 1 kilogram of uranium 235, with complete fission, makes it possible to obtain as much energy as is generated in burning 2,000 tons of coal. The known reserves of uranium and thorium in the earth's crust are 26 million tons.

One kilogram of deuterium (the heavy isotope of hydrogen) is equivalent, in terms of the content of thermal energy, to 10,000 tons of coal. One liter of ordinary water contains a quantity of deuterium equivalent to the amount of heat given off in burning 400 kilograms of oil.

As is known, this outstanding scientific discovery of our age has been used by the imperialist circles primarily for military purposes.

At present, nuclear weapons have become the basic strategic means for waging war. It must be remembered that conventional weapons used during World War II possessed a power of no more than 5 tons of TNT. It has been estimated that during all the wars which have occurred on the earth up to the present, ammunition with a total power of 10 megatons has been used. But the power of just one modern device is the equivalent of the total power of all ammunition used in previous wars (beginning with the invention of gunpowder). It also must be considered that conventional weapons do not possess such powerful destructive factors which the nuclear weapons have such as penetrating radiation, radioactive contamination of the terrain, and radiant energy.

Characteristics of Certain Properties of Nuclear Weapons

There are two basic types of nuclear weapons, atomic and thermonuclear. *Atomic* weapons are based upon the use of the fission reaction in which several of the heavier nuclei (nuclei having a high atomic number) participate.

Among the fissionable elements are uranium 235 and plutonium 239. Uranium 235 is a natural fissionable element found in nature. Fissionable plutonium is not encountered in nature, but rather its fissionable isotope plutonium 239 is obtained artificially. Plutonium 239 is produced in fast neutron atomic reactors from natural uranium. A large quantity of electric power is required for producing plutonium 239.

Thermonuclear weapons are based upon the use of fusion reaction whereby two light nuclei are combined and form the nucleus of a heavier atom.

At present, in the fusion reaction, hydrogen isotopes are used, that is, deuterium and tritium or their combinations with lithium (lithium deuteride). With the fusion of all the nuclei contained in 1 kilogram of deuterium, as much energy would be released as would be produced in exploding 57,000 tons of TNT.

A temperature of scores of millions of degrees is required for achieving a thermonuclear reaction. This is why an atomic device serves as the detonator of a thermonuclear weapon. Here the explosion includes two phases: the explosion of the atomic device (the first phase) and the sub-

sequent explosion of the thermonuclear substance (the second phase). For this reason, a nuclear device can be called a double-phase weapon. But if the thermonuclear device is surrounded by a shell of uranium 238, then the explosion of such a device now has three phases, that is, the explosion of the atomic device (first phase), the explosion of the thermonuclear substance (second phase), and the explosion of uranium 238 under the effect of the high-energy neutrons (third phase). Such a device can be called three-phase weapons. Three-phase weapons are capable of creating heavy radioactive contamination of the terrain.

With the complete fission of 1 kilogram of uranium or plutonium, energy is released equivalent to the energy of exploding 20,000 tons of TNT. This means that in detonating a nuclear device of 20 kilotons (20,000 tons) 1 kilogram of fissionable material is subject to fission. But the actual quantity of uranium or plutonium in the device exceeds 1 kilogram. The ratio of the actually fissionable nuclear substance to the total quantity of nuclear substance can be called the efficiency of the nuclear device.

Basic Destructive Factors of Nuclear Weapons

The distribution of the explosion's energy in terms of destructive factors depends upon the type of device and mainly upon the type of explosion (on the ground, in the air, and under water). The approximate distribution of energy with the airborne explosion of a nuclear device is given in the following table.

Types of energy	Shock wave	Radiant energy	Penetrating radiation	Radioactive contamination
Percentage	50	35	5	10

At high altitudes, where the atmospheric density is less, the share of energy caused by the shock wave is insignificant, while the share of energy of the radiant energy becomes greater.

The shock wave which is formed as a result of the great compression of the surrounding medium (air, water, or ground) spreads in all directions from the fireball. After 10 seconds from the explosion of a 1 megaton nuclear device, when the fireball has a diameter of 2 kilometers, the front of the shock wave is 4.8 kilometers away from the surface of the ball.[1] Fifty seconds later, the fireball becomes invisible; over this time the shock wave has spread 19 kilometers. Then the shock wave travels at approximately 350 meters per second, that is, somewhat more than the speed of sound under stationary conditions (340 meters per second).

[1] See *Deystviye Yadernogo Oruzhiya* (The Effect of Nuclear Weapons), Moscow, Voyenizdat, 1965, p 34.

In colliding with the surface of the earth, the shock wave is reflected back, forming a reflected wave which is capable of causing destruction just like the direct wave. Aside from the excessive pressure which arises as a consequence of the shock wave, with its passing, very strong wind currents of air (velocity head) are formed. For example, in detonating a 1 megaton device, even at a distance of 10 kilometers from the center of the explosion, the air velocity is more than 110 kilometers per hour. Clearly such heavy flows of air are capable of significantly increasing the damage which is caused by the excessive pressure of the shock wave.

Below a table is given which shows the calculated radii for the destruction of municipal structures by devices of the megaton class.

Power of nuclear device, megatons	1	5	10	20	30
Radius of destruction to municipal structures, km	8	13.6	17.2	21.8	24.8

Penetrating radiation is a flux of gamma rays and neutrons which occurs for several seconds after the nuclear explosion and causes the ionization of atoms in the surrounding medium. As a result of the ionization of atoms in the human organism, the processes of the vital activities of its cells and organs are disrupted.

Radiant energy is a major destructive factor in a nuclear explosion. At altitudes of less than 15 kilometers, it is produced in the form of two pulses. The first, rather short pulse carries around 1 percent of the total radiant energy. The second pulse is longer, and carries a large amount of energy. The total duration of radiant energy increases with a rise in the power of the nuclear device. For example, the duration of the radiant energy in exploding a 1 kiloton device is 0.3 seconds, and with a 10 megaton explosion, around 30 seconds. It can be estimated roughly that with an airborne nuclear explosion around one-third of all the energy is produced in the form of radiant energy. This means that for every kiloton of released energy, one-third of a kiloton, or $3.3 \cdot 10^{11}$ calories, is represented by radiant energy. This quantity of energy is the equivalent of 400,000 kilowatt-hours of energy.

Radiant energy causes the igniting of combustible materials, the development of fires in buildings, forests, and so forth. Moreover, the radiant energy can cause burns and damage to the organs of vision. Megaton nuclear devices are capable of causing fires over great distances. Thus, a 10 megaton nuclear device can cause forest fires in a radius of up to 35 kilometers and fires in cities (with wooden structures) in a radius of up to 30 kilometers.

Thus, in terms of radiant energy as well, nuclear weapons are a weapon of mass destruction, capable of leading to devastaion over enormous territory.

The radioactive contamination of the terrain is a fundamentally new destructive factor which distinguishes nuclear weapons from conventional ones. The use of powerful nuclear devices in thickly settled areas entails enormous casualties among the unprotected population. As a consequence of this, nuclear weapons in the true sense of the word have become weapons of mass destruction.

Radioactive contamination is caused by the spread of an enormous quantity of nuclear reaction products, the decay of which is accompanied by the formation of gamma rays, alpha and beta particles which are harmful for living organisms.

As is known, fission products represent a complex mixture consisting of more than 200 isotopes of 36 elements. For each kiloton of explosive power, 57 grams of fission products are formed (or 57 kilograms per megaton). After 1 minute from the time of the nuclear explosion, the gamma activity of the 57 kilograms of fission products formed with a 1 megaton nuclear explosion can be compared with the gamma activity of 30 million tons of radium. By the end of the day, the radioactivity is reduced by more than 3,000-fold, however, with strong ground-level explosions, it can be even greater.

The following rule of thumb can provide a certain notion of the rate of the radiation level's drop over time. Each seven-fold increase in time after explosion leads to a reduction in the radiation level of 10-fold. For example, after 7·7·7 = 343 hours (approximately after 2 weeks), the radiation level will decline by 10·10·10 = 1,000 times.

If we take the radiation level 1 hour after the explosion as 100 percent, then the relative value of the radiation level in other later moments of time can be roughly judged from the table given below.

Time after explosion, hours	Relative radiation level, %	Time after explosion, hours	Relative radiation level, %
1	100	20	1.5
2	44	48	1.0
3	23	72	0.06
6	10	200	0.02
10	6	400	0.01

The biological effect of radioactive contamination can be judged from the radiation dose which is the product of the average radiation level multiplied by the time of irradiation. If complete radioactive fallout has occurred in the zone within a small time interval and if it is assumed that the population does not have any means of defense, then the total radiation dose can be tentatively determined by multiplying the radiation level by the corresponding coefficient which depends upon the time one remains in the zone.

Below, in the table, the values of this coefficient are given.

Time remaining in zone, days	1	2	3	4	5
Dose coefficient	9	12	13.5	15	16

For example, if the radiation level in the zone after the end of the fallout (approximately after 6 hours) is 10 rads per hour, then the total radiation dose which the unprotected population can receive is: 90 rads after 24 hours, 150 rads after 4 days, and 160 rads after 5 days.

In a real situation, the radiation dose will be less, since any form of shelter weakens the effect of radiation. Moreover, under the effect of wind and other meteorological factors, the fallout is usually dispersed in some areas and concentrated in others. The distribution of radioactive substances on the terrain depends upon the power of the explosion and the meteorological conditions, particularly the speed and direction of the wind at the various altitudes.

Let us briefly take up the danger which the testing of nuclear weapons in the atmosphere represents for mankind. In the period of 1945–1958 alone, as a result of the basic nuclear test explosions, the atmosphere received a quantity of radioactive particles which is the equivalent of the total radioactive fallout with the explosion of around 100 megaton capacity.

The smallest particles of the radioactive cloud which fall in the upper layers of the troposphere settle very slowly, sometimes over a month. The particles which fall into the stratosphere drop to the ground even over several years. Being in the atmosphere for a long time, the radioactive particles are moved around the earth by the winds, basically in an easterly direction. A large portion of the radioactive products falls in a rather narrow (approximately 30 degrees) longitudinal belt around the earth. A stratospheric radioactive cloud which forms in either hemisphere, as a rule, settles in the same hemisphere.

Strontium 90 is the basic radioisotope which falls with nuclear explosions in the upper layers of the atmosphere and which causes radioactive contamination. The half-life of strontium 90 is 27.7 years, and for this reason it is not subject to any significant decay before settling to the earth.

Calculations and experimental data indicate that as a result of explosions over land, an average of 50 percent of all the strontium 90 is retained in the atmosphere and then settles; as a result of explosions over water, the figure is 70 percent. The maximum accumulation of strontium 90 on the earth occurred in the summer of 1961.

The next radioisotope in terms of its biological effect is cesium 137 with a half-life of 30.5 years. With a nuclear explosion, 80 percent more cesium 137 fission products are formed than for strontium. Since these two isotopes have almost the same half-life, it can be considered that

the activeness of cesium-137 on the surface of the earth can be determined with sufficient accuracy by multiplying the corresponding values of strontium 90 by 1.8.

Thus, aside from the radioactive contamination of the terrain as a result of the fallout from the radioactive cloud, with massed nuclear explosions, there may be the falling of strontium 90 and cesium 137 which lasts for many years, with the concomitant contamination of the earth and water. This will have a harmful biological effect on living organisms.

If nuclear weapons testing were to be continued on the earth, this, undoubtedly, would lead to a dangerous saturation of the atmosphere with strontium and cesium products. This, in turn, would lead to dangerous genetic consequences. For this reason, the initiative of the Soviet government which ended with the successful conclusion of a treaty concerning a ban on nuclear weapons testing in the atmosphere, outer space, and under water in 1963 was a humanitarian act having significance for all mankind.

2. Nuclear Weapons Delivery Systems

Aerodynamic Flying Vehicles

Aerodynamic flying vehicles can fly in sufficiently dense layers of the atmosphere. These include bombers, and ground-to-ground and air-to-ground winged missiles.

Bombers are the carriers of nuclear weapons which can be used in the form of nuclear bombs or air-to-ground winged missiles.

American military specialists feel that mobile and small strategic objects which have relatively weak air defenses are the main targets for strategic bombers armed with nuclear weapons. Moreover, it is felt that after the first strike with ballistic missiles, the possibility of the penetration of the deep rear by the strategic bombers will increase as a consequence of a weakening of enemy air defense effectiveness.

Ground-to-ground winged missiles are unmanned single-use aerodynamic devices. These devices carry nuclear ammunition to the target and are then destroyed with the explosion of the ammunition. The range of a winged missile equals its technical flight range. The flight to the target is carried out using an autonomous control system.

The air-to-ground winged missiles are unmanned single-use aerodynamic devices which are launched from carrier aircraft. Strategic bombers which have been specially equipped for the combat use of missiles are employed as the carrier aircraft.

The use of air-to-ground winged missiles makes it possible to widen the combat capabilities of even bombers with poor flight performance, since they do not have to enter the zones where the air defenses are good.

American specialists feel that it is possible to use their obsolete B-52 strategic bombers, in suspending two Hound Dog missiles under each aircraft.

Rocket gliders are flying vehicles which combine aerodynamic and ballistic flight principles. In dense atmospheric layers, they fly like airplanes, but in entering an orbit, they become artificial satellites.

The American military have studied the possibility of rocket gliders (the Dyna-Soar project) as the carriers of nuclear weapons.

Maximum speed, service ceiling, and flight range are the most important tactical specifications of aerodynamic flying vehicles. Other characteristics are also of exceptionally important significance for evaluating the effectiveness of a flying vehicle, and these include such as the quality of weapons, the control system (particularly for unmanned devices), maneuvering capabilities, airfield performance, dependability, and so forth. Here we will take up an analysis of only the three above-listed characteristics.

Maximum speed is the greatest speed of horizontal flight achieved with full thrust of the engine. The speed of aerodynamic flying vehicles is often expressed by the relative M number which is the ratio of their flight speed to the speed of sound. According to maximum flight speed, modern aerodynamic flying vehicles are divided into subsonic, supersonic, and hypersonic.

Subsonic aerodynamic vehicles possess a speed that is less than the speed of sound. Such vehicles have a straight wing or a slightly swept-back wing. Their power unit is a piston engine with flight speeds of 600–700 kilometers per hour, a turboprop engine with speeds of 700–900 kilometers per hour, and a turbojet engine in instances when the maximum speed exceeds 900 kilometers per hour.

Supersonic aerodynamic vehicles possess a speed which is higher than that of the speed of sound. These vehicles have a swept-back wing, the sweep angle of which is greater than the maximum flight speed, a thin wing profile, and a greatly elongated fuselage. The power unit of modern supersonic aerodynamic vehicles is, as a rule, a turbojet engine (engines) with all the designed features for supersonic flight.

The advanced turbojet engines make it possible even in the atmosphere to reach flight speeds corresponding to an M number of 4–5. A further increase in flight speed is possible by using ramjets (up to M = 7–8) and rocket engines.

Hypersonic aerodynamic flying vehicles possess a speed which exceeds the M number by 400–500 percent. It has turned out that at very high supersonic speeds, the flow of air over the walls of the flying vehicle undergoes qualitative changes.

In the boundary layer which is directly next to the walls of the vehicle, there is no "sticking" of the particles (the local afflux velocity in the instance of "sticking" equals zero), as occurs with speeds of approxi-

mately up to M = 5–6, but rather there occurs a "slipping" (the local afflux velocity does not equal zero). As a consequence of this, the formulas for supersonic aerodynamics cannot be fully applied to analyzing motion with very high speeds.

At present, a number of American scientists are working steadily on a new branch of aerodynamics, that is, hypersonic aerodynamics, which will make it possible to carry out the calculations and all necessary bases for creating hypersonic aerodynamic vehicles. It must be pointed out that not only the "slipping" at the base of the boundary layer is a particular feature of hypersonic aerodynamics, but also chemical as well as magnetic phenomena which arise in the boundary layer as a consequence of the high local temperatures. At very high flight speeds, a plasma arises in the boundary layer. This phenomenon requires consideration of the patterns obtained in nuclear physics for hypersonic aerodynamics.

Hypersonic aircraft have approximately the same shape as supersonic aircraft, only thinner stub wings, most often of a triangular shape in the plan view. The propulsion units for hypersonic aerodynamic vehicles can be the hypersonic ramjets or liquid-fuel rocket engines.

An aerodynamic vehicle, particularly a heavy one, cannot develop maximum speed at low altitudes due to the great heating up of the skin. The kinetic heating which arises as a consequence of the retardation of the air along the walls of the flying vehicle becomes very significant at high speeds. The maximum possible temperature of the vehicle which is called the total temperature is given in the table for several M numbers in the stratosphere, where the temperature of the surrounding air equals —56.5°C.

M	1	2	3	4	5
Total temperature, °C	—13	117	335	637	1027

The actual temperature of the walls of the aerodynamic vehicle will be lower than that given in the table. However, heat-resistant materials are essential for achieving high flight speeds, since the duraluminum alloys show a deterioration of their strength properties beginning at a temperature of 180°C.

It must be pointed out that at high altitudes, the kinetic heating lessens, and at approximate altitudes of over 100 kilometers and more becomes virtually unnoticeable.

Thus, aerodynamic vehicles can carry out horizontal flight at a certain altitude at a speed which is limited by the minimal and at a speed permitted considering the kinetic heating.

For the aerodynamic vehicles there is a certain maximum speed for which there is no need of wings. This the so-called first cosmic velocity equal to 8 kilometers per second. With the flight of an aerodynamic

vehicle at such a speed, it becomes an artificial satellite, and circles around the earth in orbit.

At an altitude of 40 kilometers, the horizontal flight of an aerodynamic vehicle is possible at a speed no less than 3 kilometers per second and not more than 6 kilometers per second. Beginning at an altitude of 60 kilometers, the influence of kinetic heating sharply lessens. At a speed of 8 kilometers per second, the aerodynamic vehicle no longer requires bearing services, and it may fly as a space vehicle.

The service ceiling of an aerodynamic vehicle is the highest flight altitude at which its vertical speed equals 0.5 meter per second. This means that a further increase in altitude under the established conditions is impossible.

In order to reach a greater height, the aerodynamic vehicle must be brought up to maximum speed at a height somewhat less than the service ceiling. After this, the aerodynamic vehicle is brought sharply into a steep ascent and held there until a loss of speed. Due to the significant kinetic energy, the vehicle achieves an altitude called the zoom ceiling where it cannot "hold on" and begins to slip downward.

The zoom ceiling is substantially higher than the service one for high-speed aerodynamic vehicles. The service ceiling of an aerodynamic vehicle is the higher the greater its thrust-to-weight ratio and the better its supporting power (the greater the lift coefficient).

The service ceiling of supersonic aerodynamic vehicles is 20–25 kilometers. As is felt abroad, the service ceiling of aerodynamic vehicles in the future will reach 80–100 kilometers.

Flight range is an extremely impossible characteristic of aerodynamic vehicles, particularly for strategic ones. It depends on the aerodynamic quality, and the specific consumption and reserve of fuel.

The range of ammunition delivery is increased with the use of air-to-ground winged missiles. In the long run, as foreign specialists feel, atomic power units can be used on aerodynamic vehicles, and this will once and for all solve the problem of the range of flying vehicles.

At present, the basic performance specifications of the aircraft in use by the U.S. Air Force are the following (see the table):

Name of aircraft	F-4 (Phantom)	B-52	B-58	FB-111
Purpose	fighter-bomber	strategic bomber	strategic bomber	strategic bomber
Maximum speed, km/h	2,350	1,050	2,200	2,600
Service ceiling, m	18,500	18,000	21,000	18,000
Flight range, km	4,000	18,000	6,000	8,000
Maximum bomb load, tons	6.8	31	9	17

Ballistic missiles at present are the most effective carriers of strategic nuclear weapons. They are viewed by foreign specialists as the decisive

means for achieving success in a future war. A military ballistic missile consists of the following basic parts: the ammunition (warhead), control system, rocket engine, and fuel supply.

The rocket engine is one of the basic parts of the vehicle and determines its very purpose, that is, a missile.

Rocket engines are divided according to the type of fuel used in them into liquid fuel and solid fuel.

For the liquid-fuel engines, a liquid fuel is used consisting ordinarily of two components: the fuel and the oxidant. In a majority of the foreign missiles, as a fuel they use alcohols, hydrocarbon fuels (of the kerosene type), hydrasine, and others. Abroad, borane compounds and liquid hydrogen are considered to be promising liquid fuels. As oxidants they use liquid oxygen or substances rich in oxygen such as nitric acid, hydrogen peroxide, and nitrogen oxides.

In the solid-fuel engines, the fuel and the oxidant are together in the form of a monopropellant charge. The basic advantage of solid fuels is in the increased combat readiness of the missiles fueled with them and in their convenience of operation and storage. At present foreign scientists are endeavoring to create solid fuels with performance close to that of liquid ones. For this, various mixed fuels are being created with metal additives such as aluminum, magnesium, beryllium, lithium, and others.

The basic parameters of a missile engine are thrust, specific thrust, and thrust power.

The thrust of an engine is created by the release of gases from the nozzle. An increase in the engine's thrust is possible by increasing the fuel consumption per second (and this leads to an increase in the size and weight of the engine) as well as by increasing the exhaust gas velocity which depends both upon the calorific value of the fuel as well as upon the thermal efficiency of the combustion chamber.

For this reason, the higher the calorific value of the fuel and the more advanced the combustion chamber (the higher the thermal efficiency), the higher the exhaust gas velocity. Since the engine combustion chambers have basically achieved their maximum, science and technology are now looking for fuels with a high calorific value.

The specific thrust of an engine is the name given to the thrust per kilogram per second of expended fuel. It is not difficult to see that the specific thrust of an engine numerically will equal approximately one-tenth of the exhaust velocity. The higher the specific thrust and the better the fuel used, the less weight and consumption of fuel an engine will have with the set thrust value.

The thrust power of a rocket engine is the product of multiplying the thrust by the speed of the missile (at the given moment of time). The thrust power of rocket engines is a value which is constantly changing with the engine in work, and is not a characteristic parameter for it. However, for comparison with the known engines, it is legitimate to speak

about the power of a rocket engine. For example, with an engine thrust of 50 tons and a speed of 3,000 meters per second for the missile, the thrust power equals:

$$N = \frac{50{,}000 \times 3{,}000}{75} = 2{,}000{,}000 \text{ horsepower.}$$

As we can see, rocket engines are capable of developing colossal power of several million horsepower. Such powers cannot be developed by any other power units. The most powerful ship propulsion units develop a power of up to 280,000 horsepower, the engines of supersonic aircraft develop somewhat less power, while the largest hydroelectric plants produce 2–5 million horsepower.

However, a comparison of the thrust power of rocket engines with the powers of other propulsion units should not lead us to incorrect conclusions. In practice, any power unit is required to produce a set power for a definite period of time. The power multiplied by the time duration is the work or energy. Although a missile engine develops enormous power, it produces it in a short period of time, in just several minutes.

The trajectory of a ballistic missile can be divided into the following legs: launching leg, missile positioning leg, free flight leg, and stabilization leg.

The launching leg is the leg of the missile's movement from the launching position. A majority of ballistic missiles at first move vertically. One of the reasons for this is the desire to bring the missile as quickly as possible through the dense lower atmospheric layer, and to overcome its resistance with minimum losses. There is another reason for the vertical launching of a missile. This is that for a majority of missiles, inclined launching would require long and cumbersome guides. Inclined launching is used often only for short-range missiles.

For vertical launching, it is essential that the engine thrust be greater than the weight. The ratio of the engine's thrust to the weight of the missile is called the missile's thrust-to-weight ratio. The greater the thrust-to-weight ratio, the greater the acceleration of the missile and the sooner it gains velocity. It may turn out that a missile will have a high speed even in the dense layers of the atmosphere. In this instance, the missile's thrust to a significant degree will be consumed on overcoming the resistance of the atmosphere.

Consequently, very high thrust-to-weight ratios are not advantageous. Moreover, a high thrust-to-weight ratio causes significant overloads in launching, and this requires an increase in the structural strength. In turn, this leads to an increase in the missile's weight. On the other hand, a low thrust-to-weight ratio causes poor acceleration, and the missile travels upward for a longer time. Here, as a consequence of the force of gravity, the missile loses a portion of the speed equal to the product of the acceleration of the force of gravity by the lift time. The greater

the lift time, the greater the speed losses. For this reason, low thrust-to-weight ratios are unacceptable.

Abroad, modern missiles have optimum launch thrust-to-weight ratios within the limits of 1.6–1.8. For multistage missiles, lower thrust-to-weight ratios are used.

The missile positioning leg is the leg of the trajectory on which the missile's axis gradually turns toward the target. At the end of this leg, the engine ceases firing. The missile gains the parameters calculated for the given range, that is, the velocity, the angle of arrival of the velocity vector to the horizon (the pitch angle), and the azimuth. These complex functions are performed by the control system.

The entire leg, beginning from the launch and ending with the point where the engine cuts off is called the active leg of the trajectory. The length of the active leg ordinarily does not exceed 5–10 percent of the length of the entire missile trajectory.[2] Since it is easiest to organize control on the active leg of the trajectory, the dispersion is determined by the degree of accuracy of positioning the target for the calculated point, that is, the end of the active leg, with definite values for velocity, pitch angle, and azimuth.

The free flight leg is the portion of the arc of the trajectory from the point where the engine cuts off to the entry of the missile into the dense layers of the atmosphere at an altitude of several score kilometers. On the free flight leg, the missile moves under the effect of the force of gravity (the air drag at great altitudes can be overlooked) and the reserve of missile kinetic energy.

Movement under the effect of the force of gravity occurs along an ellipse, one of the focuses of which is in the center of the earth. The free flight leg of the trajectory can be calculated with a high degree of precision using the formulas of theoretical mechanics.

The stabilization leg begins from the point the missile enters the dense layers of the atmosphere until the moment of explosion (the hit). On this leg, the missile assumes the direction of stable flight with the aid of stabilizers.

The maximum altitude of the trajectory (the apogee) and the flight time are also important parameters of the missile's movement.

It is often pointed out that the high altitude of a ballistic missile is a very important advantage for it making it difficult to neutralize the missile. But the traveling of a missile to a great height makes it possible to detect it at a significant distance, and this increases the time for organizing antimissile defenses. The great trajectory height is inevitable, since the missile travels along an ellipse, and for the given range, this altitude is of definite significance.

[2] See A. Ye. Tatarchenko, *Ballisticheskaya Raketa* (The Ballistic Missile), Moscow, Voyenizdat, 1961, p 56.

The basic advantage of ballistic missiles is their enormous speed making it difficult to counter them. The short flight time is also one of the most important factors which create conditions for a surprise attack. The surprise factor which has always played a substantial role in a future war can be of a decisive influence on its outcome. The flight time of ballistic missiles even over enormous distances is short, and even in launching them to other continents the flight time is just around 30 minutes.

Below a table has been given showing the dependency of the maximum range, altitude, and flight time of ballistic missiles upon their maximum flight speed.

Speed, km/sec	Range, km	Maximum altitude, km	Flight time, minutes	Optimum angle, degrees
1.0	100	50	2.6	44.8
2.0	500	160	7.0	44.3
3.0	1,000	300	9.2	42.6
4.0	1,800	400	11.5	41.0
5.0	3,200	495	15.9	38.5
6.0	6,000	880	21.8	33.5
6.8	8,000	1,270	29.9	28.0
7.0	9,000	1,310	32.0	26.0
7.2	9,600	1,320	32.5	23.0
7.6	12,800	1,230	37.4	18.0
7.7	15,000	1,200	36.5	15.2
8.0	satellite	fixed	depends on perigee	

The guidance system is an important part of a ballistic missile. The so-called inertial guidance systems have been most widely used. An inertial guidance system includes the following basic elements: accelerometers, integrators, gyroscope-stabilized platform, the servos and the missile vanes.

The accelerometers are used for measuring missile acceleration. From the measured accelerations, it is possible to determine the missile's speed at any moment of time. This problem is continuously solved by the acceleration integrator. The integrator generates an electric current the voltage of which is proportional to the flight speed. Since it is impossible to know ahead of time in what direction the missile can receive disturbing acceleration, three accelerometers are used for three mutually perpendicular axes so that the acceleration is measured for all directions. Such a unit is the basis for any inertial guidance system.

The gyroscope-stabilized platform is used for installing the accelerometer unit on it. It maintains a constant position in space, regardless of the missile's rotation. The gyroscope-stabilized platform makes it possible to judge not only the direction of the missile's speed, but also the position of the missile body in space.

The vanes are used for guiding the missile in space in accord with com-

mands generated by the inertial system. The gas vanes proposed by Tsiolkovskiy have gained the widest use. These vanes are turning surfaces located in the gas jet emerging from the engine nozzle. With the flowing of gas over the vanes, a force arises, the amount and direction of which depend upon the angle of the vane's deflection. The high speed and high temperatures of the exhaust gases place great demands upon the heat resistance of the vane material. A variation of the gas vanes is the jet deflectors, that is, attachments in the form of deflectors around the engine jet nozzle, making it possible to change the direction of the exhaust jet.

On the active leg, the missile can be guided by changing the direction of the thrust of the engine which in these instances is suspended on joints, as well as by engines which have been called vernier engines. These are small jet engines which are used for the "precision adjustment" of the missile's position. They can operate on the same fuel as the main engines, but they can also operate when the main engines have stopped working. This makes it possible to correct small deviations in the missile's flight even during the free flight leg of the trajectory.

The precision of the missile's hitting the target is of important significance. The dispersion of missiles occurs according to a definite law, namely: the area of target impact is an ellipse, the center of which coincides with the impact point. One-half the width of the strip in which 50 percent of the launched missiles falls is called the probable deviation. The probable deviations are set in terms of range and lateral direction. If the probable deviations are equal, then the dispersion is called circular. The significance of the probable deviation depends upon the type of missile, the guidance system, and the range. For example, the probable deviation of a Titan-II missile is 0.02 percent of the firing range.

The table gives the basic technical data of strategic ballistic missiles in use in the United States (the values of the maximum missile speed, the height of the trajectory, and flight time are derivative and have been obtained by interpolation).

Type of missile	Maximum range, Km	Maximum speed, Km/sec	Maximum trajectory altitude, Km	Flight time, minutes	Launching weight, tons	TNT Equivalent of nuclear charge, megatons
Titan II	11,600	7.3	1300	33.5	140	10
Minuteman III	13,000	7.6	1300	37.0	36	2
Polaris A-3	4,600	5.7	600	20.0	15	1

3. Space Weapons

The forces of imperialism, in preparing for war against the Soviet Union and the other nations of the socialist community, are wagering

chiefly on nuclear weapons and other new means of waging war. Among the latter are primarily space weapons. Foreign military specialists view airspace and outer space as a strategically inseparable medium above the earth's surface, where military actions will be of important significance for armed combat as a whole. According to the views of the U.S. military leaders, outer space will be a unique theater of military actions in which the same fierce combat may develop as in the air in the past.

The United States has worked out a 15-year program (beginning in 1962) for the military use of outer space. This program consists of three stages, and envisages the solution to the following military problems. In the first stage (1962–1970) space systems were to be developed and created for supporting the military operations of the existing types of armed forces. In the second stage (1970–1975), it was proposed to work out and to put into operation space attack systems as well as an antispace defense system. The third stage (after 1975) is related to the more distant future. At this stage, space research was to be focused on developing space control systems, military orbiting stations, as well as research on the military use of the moon and other planets.

The scope of research on the military use of space in the United States can be judged from the allocations which have been given for these purposes. In the past, these funds amounted to 6–7% of the total Federal budget. According to foreign sources research in the realm of military use of space still continues.

It is also possible to judge the scope of work from the number of launches of various types of satellites. Prior to 1 January 1964, the United States had launched more than 200 earth satellites and space rockets. In the period from 1965 through 1980, there were to be more than 500 launches of various types of space devices. The basic directions in the area of using space in the United States are related to the elaboration and creation of space equipment and systems for military purposes.

Due to the efforts of the Soviet Union, in January 1967, a treaty was signed on the principles for the activity of states in the area of research and use of outer space, including the moon and other celestial bodies. This treaty has been signed by the governments of the USSR, the United States, and Great Britain. It is open for signature by any other states. According to the treaty, it is prohibited to put objects with nuclear weapons into orbit around the earth.

All the space weapons being developed in the United States can be divided into three groups:

Space systems for supporting military operations of the services of the armed forces;

Space weapons for making attacks from outer space;

Antispace defense weapons.

Space weapons for supporting military operations of the services of the armed forces include the following systems: reconnaissance, early warning

of missile launching, monitoring of nuclear attacks, global communications, navigation, topogeodesic support, and weather support. These space systems are considered by the American specialists to be primary, and many of them are in service or in the stage of introduction. Space weapons for making attacks from space are viewed as prospective and the need for them may arise in the instance that ballistic missiles become less effective due to the development of antimissile defenses. Particular attention is given to developing facilities for detecting, identifying, and destroying satellites in space. Below we will examine the basic results and directions of research being conducted in the United States in the area of the military use of space.

The Space Reconnaissance Mission

The space reconnaissance system, in the opinion of American specialists, will be an important type of reconnaissance in a global nuclear war. It can provide the necessary data on the enemy for all types of armed forces, and above all the aerospace forces, in a brief period of time and on a worldwide scale. With the aid of space reconnaissance, as American specialists feel, it is possible to obtain the coordinates for the major stationary and mobile objectives, to renew this information periodically, and to map enemy territory.

At present, the U.S. reconnaissance space devices are represented by the Samos, Discoverer, and Ferret satellites. These satellites are designed for strategic reconnaissance from outer space by photographing military and industrial installations, and in particular, missile bases and airfields, as well as for conducting radio intelligence. With the aid of six-nine Samos satellites and a complex of ground facilities, an operational space reconnaissance system has been created. The Samos satellites are put into polar orbits with an altitude of 300 kilometers and a circling time of 90 minutes using the Atlas-Agena satellite-launching missile.

The heavy satellites (1,860 kilograms) are equipped with high-resolution photographic equipment, and are used to obtain more detailed photographs of important enemy strategic objects. Lighter-weight satellites are designed for conducting scanning reconnaissance. The Samos satellites carry two photographic cameras, one of which, upon command from the earth, photographs the designated region in a zone 112 kilometers wide, while the second, at the same time, photographs the sky making it possible to determine with sufficient accuracy the coordinates of the objects photographed by the first camera.

Aside from photographic equipment, the Samos satellites carry infrared devices, as well as electronic reconnaissance equipment. This version of the satellite equipped with integrated reconnaissance equipment has been named the Ferret. As American specialists assume, with a Ferret

satellite, it is possible to detect certain missile bases from the work of ground radar stations, as well as from intercepted signals being transmitted over the communications system.

The life of Samos satellites in polar orbits at an altitude of 300 kilometers can be approximately 4–5 months. However, the duration of the active functioning is limited by the onboard supply of film. It must be pointed out that the Americans are endeavoring to use phototelevision equipment on the Samos satellites, and this would make it possible to immediately transmit the information to the ground collection points using communications satellites.

The well-known American Discoverer satellites, which are considered to be for research purposes, in actuality have a direct military purpose. These satellites are used for developing methods to drop reconnaissance photographic containers to the earth's surface.

Approximately in the second half of the 1970's, the Americans plan to use for reconnaissance stationary satellites in equatorial orbits 36,000 kilometers high. In a system comprised of such satellites, there are to be three space vehicles located at an angle of 120 degrees to one another.

Early Warning Satellites

For detecting the launching of enemy ballistic missiles, the United States has developed and put into use the Midas satellites which are equipped with infrared devices. With this equipment, as the American specialists feel, it is possible to detect missiles on the active leg of the trajectory using infrared radiation of the engines. The satellites make it possible to spot a missile after it leaves the troposphere 1–1.5 minutes after launching. This provides an opportunity to detect intercontinental missiles approximately 15 minutes earlier than with the superlong-range warning radars. The Americans feel that the system of Midas satellites will provide the prompt plotting of the nuclear strike, the scrambling of aircraft, as well as the carrying out of the primary measures along the civil defense line.

A Midas satellite is a cylindrical container with a cross section area of 2.4 square meters and a length of 6 meters. Solar batteries are used as power sources. The missiles are detected using infrared detectors. The area of infrared radiation used for detecting missiles is within the wavelength limits of from 1 to 5 microns. This is 1,000–10,000 times shorter than the waves used for these same purposes in radar equipment.

As is known, any object the temperature of which is above absolute zero is a source of infrared radiation. Consequently, practically all physical bodies produce radiation in the infrared area of the spectrum. The strong jet of hot gases and the high nozzle temperature (1,000–2000°C) of modern ballistic missile engines create a clearly expressed

infrared radiation pattern. The missile radiation distribution area in the spectrum scale of electromagnetic waves is determined by the absolute temperature of the radiation source. The higher the temperature of the gases coming out of the engine nozzle, the shorter the emitted wave.

For example, an object with an emission temperature of 300°C has a maximum of radiation intensity on a wave of around 5 microns. If the temperature of the object equals 100°C, then the radiation intensity maximum corresponds to a wavelength of 7.8 microns. The intensity maximum of infrared radiation coming from the exhaust gases of missile engines corresponds to a wavelength on the order of 2.5–3 microns. The intensity of the thermal radiation is proportional to the fourth degree of absolute temperature, while the intensity of infrared radiation on the wavelength corresponding to the radiation maximum rises approximately proportionate to the fifth degree of absolute temperature.

However, the capability of any body to produce infrared radiation has, at the same time, been a serious obstacle for using infrared equipment for the purpose of detecting missile launching. The so-called problem of the "interfering" background radiation has arisen, and this includes, for example, the infrared radiation of the sun, the moon, the reflected radiation from clouds, and so forth. This problem is solved by using special measures in designing the infrared equipment.

The fact that various bodies possess different infrared radiation spectra, and the radiation maximum is on different wavelengths which depend upon the temperature of the object, provides an opportunity to distinguish the detected missile from other objects. Proceeding from this, American specialists have concluded that the developed and launched Midas satellites equipped with sensitive infrared devices are capable of detecting ballistic missiles, beginning from an altitude of 10–15 kilometers and up to the end of the active leg.

In the future, American specialists feel it possible, in combination with a ground antimissile system or antimissile missiles placed on the satellite itself, to intercept ballistic missiles the launching of which has been detected by a Midas satellite. Thus, the early warning system based on Midas satellites in the long run is also designed for antimissile defenses. For global inspection and early warning of missile launching, American specialists feel it necessary to have a Midas satellite system consisting of 20 units circling in polar orbits up to 3,000 kilometers in altitude.

Satellites for Detecting Nuclear Explosions

American specialists consider the detection and monitoring of nuclear explosions to be an important task for supporting the military operations of aerospace forces. An experimental military satellite called the Vela Hotel has already been developed. Its primary purpose is to detect nuclear

explosions in outer space. The weight of the of the experimental satellite is 220 kilograms, with a cross section of 1.5 square meters. The satellite carries equipment consisting of 10 X-ray radiation detectors, six gamma ray detectors, and one double neutron detector.

With the X-ray detectors, it is possible to detect high-altitude nuclear explosions up to 160 million kilometers away from the satellite. The gamma ray detectors make it possible to detect nuclear explosions at a distance of up to 80 million kilometers, and the neutron detector at a distance of up to 1.6 million kilometers. According to the statement of the designers, this equipment makes it possible to distinguish the ionizing effect caused by sunbursts from the ionizing effect of a nuclear explosion. The Vela Hotel satellites are equipped with onboard solid-fuel rocket engines and are placed in intermediate elliptical orbits with an apogee of 100,000 kilometers. At the apogee, the missile engines are activated and these increase the speed up to the amount required for holding the satellite in a circular orbit at an altitude of 100,000 kilometers. The amount of circular velocity corresponding to this altitude is 1.93 kilometers per second.

Since the engine of the first satellite operates on the first loop of an elliptical orbit, and that of the second satellite on the second loop, on the general circular orbit, these satellites are spaced approximately 140 degrees apart. Such a reciprocal positioning of the satellites in orbit makes it possible to detect nuclear explosions over the entire surface of the earth. The first pair of Vela Hotel satellites was launched by an Atlas-Agena on 16 October 1963, and the satellites went into orbits close to the calculated

The program envisages the launching of a series of experimental satellites, and then, after positive results, it has been proposed to create a permanent space system of Vela Hotel satellites.

Global Communications Satellites

Extensive work is also being done on the use of outer space for creating global communications. As American specialists feel, under the conditions of a nuclear war, conventional communications can be seriously disrupted, and particularly the wire and radio relay communications lines. A space communications system is viewed as an important means of military command under the conditions of waging a global nuclear war. Military communications satellites are being developed for passive relaying as well as for active relaying of radio signals.

In 1960, the Echo-I passive retransmitter was put into orbit. This satellite was an inflated balloon 30 meters in diameter and weighing 60 kilograms. Its shell was made from polyester film 0.013 millimeters thick

with a very thin aluminum coat which provided a reflection coefficient of 0.98 for radio waves with a frequency up to 20,000 megacycles.

At the beginning of 1964, the more advanced Echo-II satellite with a diameter of 41 meters and weighing 350 kilograms was put into orbit.

The existing plans for conquering outer space do not envisage further launches of satellites for passive retransmitting, and the basic efforts are to be concentrated on developing satellites for the active retransmission of radio signals. Such satellites are considered to be very promising for developing military space communications. Extensive work is being done under the Relay, Syncom, Telstar, Atlas Score, and Courier projects. The Relay satellites are designed for relaying TV broadcasts on one channel as well as for providing two-way radiotelephone communications on 12 channels. The weight of the satellite is 78 kilograms, the length 81 centimeters, and the maximum diameter 73 centimeters. The satellites have been put into elliptical orbits with an apogee of 7,400 kilometers, and an inclination of 46–47 degrees to the equator. For conducting experiments on the use of the Relay satellites, ground communications stations located in the United States, Brazil, Japan, and certain Western European nations are being used.

The Syncom satellites are designed for two-way radiotelephone communications over two channels, as well as for transmitting television images. The satellite weighs 68 kilograms, it is 39 centimeters long, and 71 centimeters in diameter. A particular feature of this satellite is the fact that it has been put into a so-called synchronous orbit. If the satellite is put into an equatorial orbit and it attains the first cosmic velocity in the same direction as the earth turns, and the appropriate orbital elevation is selected, then it will rotate with the earth as a single whole. The period of its rotation will equal 24 hours. Such a satellite is called stationary. The height of the stationary orbit equals 35,800 kilometers.

A stationary satellite will remain constantly over the same point of the earth. If the satellite is put into an orbit 35,800 kilometers high, but not on the same plane as the equator, but rather with a certain inclination, then it will "inscribe" a small figure eight in the sky. Three stationary satellites placed 120 degrees apart will provide communications between any points on the earth, aside from points above 80 degrees north and south latitudes. The Syncom satellites have been put into synchronous orbits with an inclination of 33 degrees. They have been equipped with solid-fuel engines for moving from an intermediate elliptical orbit to a high (35,800 kilometers) circular orbit, as well as directional jet nozzles for reaching the synchronous orbit and remaining there.

The Telstar satellite is designed for relaying television broadcasts on one channel or for two-way radiotelephone communications over 60 channels. Two satellites have been put into orbit, one in 1962 and one in 1963. The first satellite was put into an elliptical orbit with an apogee of 6,000 kilometers and an inclination of 45 degrees; the second in an

orbit with an apogee of 10,700 kilometers and an inclination of 43 degrees. The U.S. Defense Department has developed the Atlas Score and Courier satellites for active signal retransmission, but the experiments with them are felt to be little promising.

In the opinion of a number of specialists, the development of a separate space system for military communications is inadvisable. These specialists feel that the U.S. Defense Department can use commercial space communications which the Comsat Corporation (a joint stock company specially created upon a decision of the U.S. government) plans to create. The Comsat Corporation envisages two systems of space communications. One of them should include satellites circling in polar orbits 10,000–20,000 kilometers high. According to the calculations, with the arbitrary placement of the satellites in the orbits, this system should consist of 18 satellites, and with fixed positioning, not less than 12 satellites.

Another system of space communications should use approximately six satellites circling in a stationary orbit. Each satellite provides two-way communications with a channel width of 4 kilocycles, with plans to have 1,200 channels. Solar batteries are to be used for powering the satellite equipment. On the satellites, a passive thermoregulation system will basically be used. Atlas-Agena, Thor-Delta or Thor-Agena launching rockets will be used for putting the communications satellites into orbit.

Extensive work is also being done on other space communications programs. Up to the present a great deal has been done under the West Ford program which is being carried out for military purposes. According to this program, a large number of dipoles is to be put into orbit, and these dipoles will form a belt circling around the earth. This belt should serve as a relay in the system of space radio communications. Two attempts for creating such a belt have already been made, one of which is considered successful. On 9 May 1963, at an altitude of 3,700 kilometers, a container was orbited (weighing 34 kilograms) and containing more than 400 million dipoles, and approximately one-half of them went into separate orbits. By 18 June 1963, these dipoles formed a complete belt up to 56 kilometers thick. Such a belt can provide multichannel radioteletype communications, but is not suited for radiotelephone communications.

For radiotelephone communications, a belt with a higher concentration of dipoles is required. The life of this belt, as experience has shown, is approximately 3 years. It should be pointed out that heavy satellites in orbits of 3,700 kilometers in height will exist for virtually unlimited time. The comparatively short life of the belt is explained by the fact that the light dipoles, under the effect of light pressure constantly descend, they enter the dense layers of the atmosphere and burn up. The creation of still another experimental belt is planned by orbiting 1 ton of dipoles. The altitudes of the new belt above the earth should be greater than in the 1963 experiment.

In the opinion of American specialists, space communications which use a dipole belt have definite advantages in comparison with a space system based on communications satellites. These advantages are felt to be:

The lower cost, since only two belts needed be created for providing local communications: one in a polar orbit and the other in an equatorial orbit;

The great dependability and durability;

The significant resistance to communications jamming.

Among the drawbacks of a space system using a dipole belt, the American specialists consider the significant losses and unsuitability for relaying television broadcasts, as well as the possibility that the enemy could use such belts. In the opinion of many American specialists, a communications satellite based upon dipole belts will not replace but merely supplement a space communications system using satellites for the active relaying of radio signals.

It must be pointed out that the belts of dipole fibers greatly impede optical and radioastronomical observations, and they also create difficulties for spaceflights, particularly manned ones. For this reason, all progressive scientists have sharply protested the formation of the dipole belt. A scientifically valid protest has also been made by the USSR Academy of Sciences.

Navigational Satellites

The American military are giving very great attention to the construction of atomic submarines which can carry the Polaris ballistic missiles. The Polaris A-3 missile has a maximum range of 4,600 kilometers, and can carry a thermonuclear device with a TNT equivalent of up to 1 megaton. An atomic submarine is capable of carrying 16 missiles which can be launched from under water at a depth of 30 meters at a speed of not more than 2 knots. For raising the precision of the missile launching, the location of the sub in the ocean must be determined. American military specialists have proposed solving this problem using navigational satellites which form a space navigation system along with the ground facilities. This system is to be used not only for raising the precision of the Polaris missile launching, but also for navigation purposes for submarines, surface vessels, and strategic aviation, as well as for the effective use of nuclear weapons from mobile carriers, and in the long run, for the navigation of space vehicles.

The U.S. Defense Department has completed the development of a space navigation system which uses Transit satellites. This system includes four Transit satellites which circle in polar orbits, four satellite tracking and command ground stations, a computer center, and two stations for

controlling the flight of the launcher missiles in the leg of positioning the satellites in orbit. The onboard equipment of the Transit satellite is designed for 5 years of work. The satellites are equipped with radioisotope power sources and gravitational stabilization and orientation systems.

The operating principle of a space navigating system consists in the following. The Transit satellites every 1–2 minutes transmit data on the current coordinates of their trajectory, as well as time signals. The submarines which are equipped with special gear receive the signals and at the same time from the Doppler shift of the frequency, determine the distance to the satellite. The sub coordinates are calculated on the basis of these data. The satellite transmitters are hooked up to an onboard memory. The program fed into this device is periodically corrected on the basis of the data of satellite observations. The correction is calculated by the computer center, and fed into the onboard memory from the commands of the tracking station.

American specialists feel that with the aid of a space navigation system, it is possible to raise the precision of the Polaris missile launchings by approximately 200 percent in comparison with autonomous missile launching from the sub, when the sub determines its own position by its own means. A space navigation system, as the Americans feel, sharply raises the combat effectiveness of the missile-carrying subs, providing an opportunity to launch the missiles from any area of the ocean and regardless of weather conditions.

Topogeodetic Satellites

Topogeodetic satellites also have a direct military purpose. The United States is giving great attention to their development. Their task is to clarify the shape of the earth, to provide the precise positioning of the continents, and to clarify the coordinates of various objects. It is not difficult to note that all these measures have important significance for the military application of strategic means of attack, and above all for planning nuclear missile strikes. Moreover, the topogeodetic satellites can be used for studying the effect of gravitational forces on satellite orbits as well as for determining the accuracy of the optical, electronic, and radar systems used in trajectory changes. In conducting geodetic work, the satellite should serve as the "control point" for triangulation measurements. With the aid of the topogeodetic satellites, as American specialists feel, it is possible to reduce the error in determining the distance between any two points on the earth to 10–15 meters.

In the United States, two types of topogeodetic satellites have been developed, the Anna and the Secor. In 1964, both of them were put into orbit. The Geos satellite is also being developed.

In the United States, the special Tiros satellite has been created for meteorological support of the armed forces, and above all the nuclear ones. The periodicity of Tiros launches is determined by the necessity of having at least one satellite with functioning equipment in orbit. The satellite's equipment is designed to work for 3 months, although according to American data, it works significantly longer (up to 14 months). Each of the satellites in 1 day scans just 10–15 percent of the earth's surface. This is explained by the small inclination of the orbit (47 degrees), as well as by the design shortcomings of the satellites. In the future, they plan to put into polar orbit a Tiros satellite with a more advanced design of television cameras.

At the same time, the more advanced Nimbus weather satellites are being developed. The experimental Nimbus satellites should weigh 270 kilograms, be around 3 meters high and have a maximum cross section of 1.5 meters. Two types of TV cameras should be placed on them: one for recording the image on board and a camera with the immediate transmission of the cloud cover picture. They are also studying the possibility and advisability of developing the Aeros weather satellites designed to be put into a synchronous orbit.

4. Missile and Space Defense Weapons

In U.S. military plans, a significant place has been given to the problem of missile and space defense. The U.S. President Nixon has upheld the decision to deploy an ABM system approved by the preceding administration.

In September 1967, the creation of a limited Sentinel ABM system was announced. In the spring of 1969, it was decided to create the Safeguard system which should defend first of all missile bases and Washington, and for this 12 antimissile complexes were to be built.

On the basis of the treaty between the USSR and the United States on limiting the missile defense systems (May 1972), the parties pledged to limit the missile defense (ABM) systems, and to take other measures in accord with the provisions of the treaty.

In the American scientific research, the following technical principles for missile defense have been studied: interception of the missile on the active, middle, and terminal legs of the trajectory. The Bambi Project examined the intercepting of the missile on the active leg. According to it, the detection, the identification of the warheads against the background of decoys, and the launching of antimissile missiles should be carried out from artificial satellites. The calculations of U.S. scientists indicate

that for the effective functioning of such a system, thousands of satellites would be required, while the operating expenditures would be tens of millions of dollars a year. For this reason, work on the Bambi Project was stopped. However, it is felt that if a sharp reduction can be achieved in the cost of putting the payload into space, the development of a missile defense which intercepts the missile on the active leg will be more advisable. The destruction of the missile on the middle leg of the trajectory is possible approximately with the same principles as the interception of the satellite in orbit with the missile defense weapons.

The question of intercepting the missile on the terminal leg of the trajectory has been worked on most. In this instance, it is a matter of distinguishing the warheads among the decoys. The latter can be recognized due to atmospheric filtration at altitudes of 70–100 kilometers. If an antimissile missile is launched at the moment of identifying the warhead (at an altitude of approximately 100 kilometers), and its interception will be effected at an altitude of more than 50 kilometers (for providing the safety of the defended object against a high-altitude nuclear explosion), then the speed of the antimissile missile should be greater than the speed of the warhead. From this it follows that the identification of the warhead should occur in the middle leg of the trajectory. The dependency of the required speed of the antimissile missile on the range of warhead identification (the velocity of entering the atmosphere for the warhead of an ICBM is considered equal to 7 kilometers per second) is given in the table.

Range of identification, km	400	800	1,200	1,600	2,000
Speed of antimissile missile, km/sec	6.5	3.8	2.5	2.0	1.8

As is known, the American Nike-Zeus antimissile missiles had a speed of 2 kilometers per second. At such a speed, the missile warhead should be identified at a distance of 1,600 kilometers from the radar station.

American specialists classify the ABM system depending upon the nature of the defended objectives. For defending medium-sized cities (a diameter of 8–18 kilometers), a zonal missile defense is required which can intercept the warheads of the ICBM at the end of the middle leg of the trajectory. For defending small objectives (command posts, missile launching positions, and so forth), an objective missile defense is required which can intercept at the terminal leg of the trajectory. Americans feel that both types of targets can be defended by elements of an ABM system which consists of PAR radar stations and the Spartan antimissile missiles for long-range interception and the MSR radars and the Sprint antimissile missiles for close-range interception.

At present, the United States has a missile early warning system (BMEWS) consisting of early detection and identification radars. This consists of three radar centers located in Alaska (Clear), in Greenland (Thule), and in Scotland. The maximum detection range of the station is 5,000 kilometers with an effective reflecting surface of the missile warhead of 1 square meter, and 3,800 kilometers with a reflecting surface of 0.5 square meter. The view sector of a complex of four stations in a horizontal plane is 120–150 degrees. According to the estimate of American specialists, the existing early warning system does not create a solid radar field, and possesses limited possibilities in terms of predicting the warhead impact points and the missile launching areas. The BMEWS system provides a 15-minute warning with low-energy trajectories (the greatest trajectory altitude of approximately 1,300 kilometers), and can predict the impact point of a limited number of warheads with an accuracy of 370 kilometers and 90 kilometers in the longitudinal and lateral directions, respectively.

In the future, the ABM system should use PAR early warning radars and MSR antimissile missile guidance radars. The PAR radar for over-the-horizon detection possesses a multimegawatt power and can provide superlong-range detection of the target, its identification, and the target designations for the MSR guidance radar. In addition, the PAR radar can provide guidance of the Spartan long-range interception antimissile missile. The radar antenna is located in a concrete building with dimensions of 100x100x43 meters. Each PAR radar occupies an area of 110x1,100 meters. The operating ranges of the radar are 400–500 megacycles (a wavelength of 60–75 centimeters). The general trend in using the radar station bands is in developing the higher frequencies for protection against "blinding" by a nuclear explosion. However, the opposite tendency can also be noted, that is, the return to the meter wave band. In particular, this is seen from the data on the operating frequencies of the PAR radar.

All the radars designed for missile defense operate with phased antenna arrays which provide high-speed scanning. The requirements of greater range, quick responses, and high resolution have made it necessary to widely use electronic computers. The radars coupled to an electronic computer automatically perform the following tasks:

Scan for a target within the sector of view for each facet of the antenna array;

Target identification by comparison of the back signal from the warhead (the signature) with the radar signatures;

Tracking the target by periodically determining its coordinates;

Optimization of the operating conditions for the radar transmitters and receivers;

Exchange of information between different stations;

Sorting and assessing data to be displayed;

Monitoring and assessment of the proper functioning of the system, and modeling the situation for training antimissile complex crews.

The first universal computer designed for performing the listed functions possesses a speed of 325,000 operations per second. An improved version of this machine will have a speed of 4 million operations per second.

In addition to the PAR, more advanced radars are being developed. At the end of 1968, the U.S. Air Force received the powerful AN/FPS–85 station. It is used in the air defense center, and already transmits a large amount of information from earth satellites. Aside from detecting space objects, the station can detect and track intercontinental missiles launched from a southerly direction. As American specialists feel, the station could be located in Antarctica for detecting orbital missiles. With its present location (Eglin Air Force Base in Florida), the station detects not less than 90 percent of all objects in near-earth orbits. It is linked with the ABM duty complexes on Johnston and Kwajalein Islands.

The new SLBMDW radar system is being put into use. This is designed for detecting ballistic missiles launched from submarines. It will consist of several posts located on the coasts of the Atlantic and Pacific oceans and the Gulf of Mexico. Its range is 1,600 kilometers.

The new radar network will broaden the effective zone of the existing BMEWS system, providing for the detection of missiles flying in from different directions at a distance of several thousand kilometers.

A warning system is also being tested based upon the use of over-the-horizon radars which detect the missile soon after its launching. The Teepee and Madre radars have been designed on this principle. It has been announced that a nuclear explosion in the Southern Pacific was spotted by the first example of the Teepee station at a range of 12,800 kilometers.

There are also data on the work of the AN/FRS–93 over-the-horizon radar complex. It consists of several direct scattering transmitters located in the Far East and Western Europe. Radars are being developed on the over-the-horizon principle which should detect submarine-launched ballistic missiles and strategic bombers.

In the United States, work has been done on developing a missile early warning space system consisting of artificial satellites equipped with optical and infrared sensors. It was to consist of one-two satellites in peacetime and two-three in a period of a tense international situation. Multipurpose satellites weighing 900–1,350 kilograms and equipped with gravitational stabilization should be put into extended elliptical orbits by the Titan III-D launcher missile. The orbit apogee should coincide with the passage of the satellite over enemy territory, and this would make it possible to observe the areas of missile bases for an extended time.

It was felt that two or three satellites could detect not only the fact of the launching of missiles, but also the direction of their flight. Each year six such satellites were to be put into orbit. It is assumed that the satellite put into an elliptical orbit with an apogee of 30,400 kilometers in August 1968 comprises part of the ICBM launching early warning system. Initially the research on the possibilities of detecting missile launches from space was done with the aid of Midas satellites equipped with infrared sensors and placed in polar orbits with an altitude of 3,000 kilometers.

Research has also been done on determining the possibilities of detecting missile launchings from satellites equipped with radar equipment. The radar sensors designed for detecting the flares of launched missiles were placed on the Vela Hotel satellites launched for detecting nuclear explosions in space.

In the United States, there is also the SPADATS system for monitoring outer space. This receives data on the orbits of space objects. The SPADATS system includes a large number of radar, electronic, and optical stations.

Weapons for Destroying Missiles and Space Vehicles

Antimissile missiles are weapons used for destroying missile warheads. They are devices consisting of two-three stages, and equipped with rocket engines, a navigation system, and a warhead.

The U.S. ABM system has envisaged the use of the Spartan and Sprint antimissile missiles. The first has three stages and operates on solid fuel. It weighs 15.5 tons, is 16.76 meters long, and has a maximum diameter of 1.1 meters. The range of interception is 640–960 kilometers. The antimissile missile is launched from a silo. The maximum speed corresponds to an M number = 4, and an interception at a range of 100 kilometers can be made in 15 seconds. The power of the warhead is 1 megaton.

In line with the appearance of maneuvering and separating warheads, U.S. military specialists have also worked on a further improvement in the antimissile missile. For this, a three-stage, variable-thrust engine was developed, making it possible to reduce the speed of the antimissile missile on the midcourse, to increase the time for selecting the target and guiding with higher accuracy, as well as to carry out the intercept at a significantly greater speed.

In line with the new tasks which the Spartan antimissile missile should carry out, its cost was not 1.2–1.3 million dollars, but rather 3 million dollars.

The Sprint antimissile missile has two stages and operates on solid fuel. It weighs 3.4 tons, it is 8.23 meters long, and has a maximum diameter of 1.37 meters. The interception range equals 40 kilometers, and the height of the interception is 25 kilometers. The power of the warhead is 1 kiloton.

The antimissile missile is launched from a silo with the aid of a gas generator stage, and the engine of the first stage fires only after the missile has entered the air. The maximum speed of the antimissile missile is 1.6 kilometers per second. It was tested in 1967 and 1968. Here also they worked on the possibility of intercepting maneuvering and multiple warheads of ICBM. American specialists feel that one of the possible ways for maneuvering the last stage of the antimissile missile can be the injection of rapidly burning fuel into the flow of air passing over the antimissile missile.

In developing missile defenses, the Americans have considered the development of a new effective weapon, the so-called spectral bomb, to be a most important problem. In contrast to conventional nuclear explosions of the antimissile missiles which affect the warhead of the missiles with the shock wave and thermal radiation, a spectral bomb emits pulses of a broad range of X-rays from small to very great energies. The greater the energy of these rays, the deeper they penetrate into the warhead, and, in creating heat, cause the melting of the wires and the deactivating of the mechanism for detonating the payload. The antimissile missiles with a spectral warhead could make it possible to develop zonal defenses at least against an attack by small forces. It has been proposed that for the Spartan missile, a payload be developed equivalent to the power of 1 megaton, and this would explode at a distance of 1.5 kilometers from the ICBM warhead. Aside from the effect of X-rays, they also studied another damaging factor, neutron radiation. Neutrons, in penetrating the warhead, could cause the premature detonation of the nuclear charge. The nonprofit Rand Corporation for several years has been working on the development of such a weapon which has been called "clean" or "neutron." American specialists feel that scientific and technical achievements in the next 10 years will make it possible to shift the operation of deactivating the ICBM to outer space.

In the United States research has been done on estimating the technical possibilities of using powerful lasers for destroying missile warheads. The research on the new weapon is based upon the advances made in developing gas lasers which operate on the basis of carbon monoxide. American specialists consider that at least 10 years are needed for obtaining the necessary laser power and developing the means for controlling the laser beams. At the same time scientific research is being carried out on developing an antimissile missile which has a multiple warhead.

The final composition of the ABM system should be determined on the basis of testing an experimental complex on Kwajalein Island. According to the plans, in developing missile defenses, they have proposed using 175 Minuteman, Atlas, and Polaris ballistic missiles as targets. These were to be launched from Vandenberg Air Force Base and from mobile oceangoing platforms.

U.S. military specialists are giving attention to the questions of assessing the effectiveness of the ABM system being developed. Here they have used the method of comparing various methods for limiting losses from enemy nuclear missile strikes in the population and in industry. The ABM cost factor is the expression of this. This factor is the ratio of expenditures on the ABM system (development, production, and operation) to the enemy's expenditures on creating the offensive weapons to be used by him.

In determining the possibilities of making a nuclear missile strike, American specialists have also considered the "weapons delivery factor." Below we have given a table for determining the "weapons delivery factor" for the U.S. ICBM.

Factors reducing number of missiles reaching targets	Reduction factor
Presence of missiles	0.90
Combat readiness	0.90
Reliability of missiles in flight	0.90
Reliability of launch	0.90
Total	0.66
Missiles remaining after first enemy strike	0.75
Total	0.49
Missiles crossing prospective enemy missile defenses	0.75
Weapons delivery factor	0.37

The efficiency of the missile defense system is also judged on the basis of the forecast "threat model." These models are drawn up proceeding from the supposition that the opposite side possesses the same capabilities for making a nuclear missile strike as the United States does. The method of determining the equivalent power of the U.S. ICBM payloads is given in the following table.

Type of missile	Number of missiles	Power of payload of one missile, megatons	Total equivalent power, megatons
Minuteman-I	500	1	500
Minuteman-II	500	2	790
Polaris	656	0.7	520
Titan	54	5	160
Equivalent power of all rocket warheads			1970

By the equivalent power of several of the same payloads, one understands the product obtained by multiplying the number of payloads by the power of one payload by a factor of two-thirds (according to the law of similarity, the power of a payload by a factor of two-thirds is proportional to the area of destruction of the shock wave).

The calculations of the U.S. military specialists have shown that if over the next 10 years 10–15 billion dollars will be spent on the upkeep and improvement of missile defense, then according to the cost criterion, it satisfies the requirements. As the Americans feel, multiple warheads with independent targeting are a serious threat for missile defense. Aside from increasing the probability of crossing the missile defenses, such warheads significantly raise the destructive effect on the objects. Thus, the effectiveness of a nose with 10 warheads, with a power of 50 kilotons each, in hitting a large city equals the effectiveness of a nose with one 10-megaton warhead.

American specialists feel that since the Spartan antimissile missile will cost 1–2 million dollars, the cost of delivering the multiple warheads to the targets will be less than the expenditures necessary for intercepting them.

According to the U.S. Air Force program, a satellite interception system is being developed based on the thrust-accelerated Thor carrier rocket (TAT). This system should be located on Johnston Island in the Pacific. As the American specialists feel, the locating of the satellite interception equipment close to the equator will make it possible to carry out the task with all orbital inclinations with the expenditure of a minimum amount of energy on the correction related to a change in the orbital plane of the interceptor satellite. It is felt that by using the TAT carrier missile, the interceptor satellite with a nuclear warhead of around 1 megaton can be put into an orbit with an altitude of 400 miles (760 kilometers).

The TAT antisatellite complex has made, according to American data, at least two successful intercepts. The Transit navigation satellites have been used as targets. In the course of this testing, the TAT carrier missiles have been launched in straight lift and interception trajectories, and have carried dummy nuclear warheads. The distance-measuring equipment located on the target satellite has made it possible to conclude that a nuclear explosion could destroy the satellite. Work is being done to improve the homing system of the TAT carrier missile in order to reduce missile dispersion in intercepting the satellite.

In the United States, work has also been done on developing space vehicles for identifying and destroying target satellites under the name of Saint. However, due to technical difficulties, this work has been halted, and a decision was taken to carry out preliminary testing on the manned Gemini satellites. The modified Gemini satellites designed for space defense purposes have been named Blue-Gemini.

Gemini satellites are two-man, and are used for studying a protracted (up to 14-day) manned spaceflight, and for experiments on the rendezvousing of manned and unmanned satellites in orbit. The weight of a Gemini satellite is 3,085 kilograms, the length is 5.8 meters, the maximum diameter is 3 meters, and the volume of the cabin is 2.26 cubic meters. For conducting experiments on orbital rendezvousing, the

Gemini satellite is equipped with a radar providing guidance to the target satellite. The maneuvers in orbit are carried out by onboard engines. The spacecraft of the Apollo system with astronauts on board have landed on the moon and returned to the earth.

On the satellites designed for conducting experiments on orbital rendezvousing, additional fuel tanks will be installed for the satellite engines, and as a result of this the weight of the satellite will increase to 3,540 kilograms. The Blue-Gemini satellites will be used in experiments related to studying problems involved in creating antisatellites for space defense.

The Soviet Union, in carrying out a program of space research for peaceful purposes, has made outstanding advances. Thus, in particular, at the end of 1970, the Soviet Luna-16 and Luna-17 space stations for the first time achieved the automatic delivery of lunar soil to the earth and examined the surface of the moon with the automatic moonwalker controlled from the earth. At the beginning of 1972, there was the flight of the Luna-20 station, as a result of which soil from an inaccessible region of the moon was also delivered to the territory of the Soviet Union. The flights of the Mars-2 and Mars-3 automatic stations which became satellites of the "red planet" were also outstanding achievements of our science and technology. They brought to Mars an instrument capsule and made it possible to learn much that was new about it. The manned orbital Salyut scientific station has been developed, and this is the pioneer of a future space laboratory for extended research on the earth and outer space. The Venera-8 automatic interplanetary station, after 4 months of travel, reached Venus, and its equipment made a soft landing on the surface of the planet. The accuracy of the ballistic calculations was amazing. It has been estimated that the space "sharpshooters" had to hit the set point of a 10-kopeck coin traveling at a distance of 80 meters.

The development of means for waging war occurs on the basis of the achievements of productive forces and scientific-technical progress. The discovery of nuclear energy, and the advances in mathematics, aerodynamics, rocket dynamics, cosmonautics, cybernetics, radioelectronics, and other areas of knowledge have made it possible to develop new weapons such as nuclear weapons, the modern carriers of nuclear weapons, aerospace defense weapons, and automatic control devices.

In the future, there will be a continuous process of improving and raising the efficiency of these weapons. At the same time, on the basis of scientific research, even more advanced weapons and military technology will be developed, and these will lead directly to revolutionary changes in military affairs.

This is why forecasting the development of science and technology and determining promising scientific directions are of urgent significance for developing the armed forces and the advancement of military theory.

Chapter 3. Conventional Weapons and the Prospects of Their Development

At the present stage in the development of military affairs, along with nuclear missile weapons as the chief means for waging a world war, conventional weapons are also continuing to be improved. By conventional weapons, one usually understands the weapons and military equipment based upon the use of nonnuclear ammunition. Below we examine the state and prospects for the development of conventional means for conducting combat operations using the materials published in the Soviet and foreign press.

The maintaining of armies in the major capitalist nations and the further development of conventional weapons can be explained by a number of factors, the chief ones being:

The possibility of the occurrence of a nuclear war is not excluded; however, the danger of mass destruction and the fear of inevitable retaliation awaiting the aggressor have forced the imperialists to put more and more stress on limited and local wars which up to now have been waged with conventional weapons;

According to universal recognition, a nuclear war can be a quick one. But there is also the viewpoint that after the exchange of massed nuclear strikes and the exhaustion of nuclear stockpiles, a war will not end but enter a new stage, and can be continued with conventional weapons;

Military leaders abroad feel that a world nuclear war may not be manifested with equal intensity in all areas. In the main theaters of military actions, the basic missions of the war will be carried out with nuclear missile weapons. As for the other theaters, here, quite probably, the proportional amount of conventional weapons will be significantly increased;

It cannot be imagined that in a nuclear war, even in the main theaters of military actions, all the missions will be carried out with just nuclear missile weapons. It is advisable and advantageous to carry out a whole series of missions with conventional weapons (for example, neutralizing many military targets on the battlefield, capturing enemy territory, and so forth).

All of these and other factors have caused the continuous development of conventional weapons and the retention of significant amounts of them in the armies of the major nations of the world. Scientific-technical progress in the postwar years has had a significant influence on the equipping of all types of armed forces not only with nuclear missile weapons, but also with conventional weapons which possess higher combat efficiency in comparison with the period of World War II. This has entailed changes in the structure of the armed forces and the methods for conducting military operations.

1. Basic Directions in the Development of Conventional Weapons in the Postwar Period

By conventional weapons, one should understand a definite system of weapons comprising:

The means of destruction such as explosives, ammunition, and other means of destruction;

The means of delivering ammunition (the means of destruction) to the target such as artillery, missiles, tanks, aircraft, surface vessels, submarines, and so forth;

Means of support such as reconnaissance, detection, engineering, camouflage, rear, medical support, and so forth;

The means of control and communications.

Conventional weapons are given to the land forces, the air defense troops, the air force, and the navy. Each of these services is designed for carrying out completely specific tasks. This causes the unique outfitting of them with conventional weapons. This applies first of all to the means of destruction (ammunition) and to the means for delivering them to the target. There are also certain distinctions in the means of support and control. For this reason, the conventional weapons systems are better examined in terms of the services of the armed forces.

However, it must be stipulated that there is no strict line between nuclear missile weapons and conventional weapons. Of course, the means of destruction, that is, the nuclear ammunition and conventional ammunition, differ fundamentally. As for the carriers of the ammunition, a significant portion of them can deliver both conventional and nuclear ammunition to the target. This applies to missiles, aviation, surface vessels, and other carriers. For this reason, by conventional weapons, one understands first of all conventional ammunition and the corresponding carriers of this ammunition.

In order to more fully determine the combat capabilities and development prospects of modern conventional weapons, it is essential to briefly examine the development trends of these weapons in the postwar period. By the end of World War II, conventional weapons in many armies had

achieved an unprecedented level of development. Immediately upon the end of the war, measures were taken to further improve these weapons, along with creating nuclear ones.

The development of weapons in the postwar period can be divided into three stages.

The first postwar stage (1945-1953) was characterized by the rapid development of aviation caused by the introduction of the jet engine. By the end of the 1940's, tactical aviation had received light jet bombers and jet fighters with perisonic and somewhat later supersonic speeds. Long-range aviation was particularly developed. By the middle of the 1950's, long-range bombers (turboprop and jet) had been developed and put into service. In terms of fighting qualities, these were up to the American strategic medium and heavy bombers.

Great attention was paid to the development of air defense weapons. The National Air Defense Troops were rearmed with jet fighter aviation. Automatic antiaircraft guns were also received.

Our army possessed the world's best tanks and self-propelled assault guns which played a major role in the years of the Great Patriotic War. But they also were subject to major modernization. The armor was improved, the maneuverability and effectiveness of fire were raised, and the stabilizing of tank weapons began to be used. New amphibious tanks appeared.

Rocket artillery which proved effective in the war underwent significant improvement. New types of heavy artillery and mortars, as well as recoilless guns and hollow charge rocket launchers, and the proportional amount of automatic small arms were increased. The Land Forces began to be armed with armored personnel carriers and cross-country vehicles.

Measures were taken to accelerate the development of the navy, to replace obsolete ships and weapons, and to build new submarines and surface vessels. New types of electronic equipment appeared, and calculators and new means of communications, in particular, radio relay, began to be introduced.

As a whole, by the end of the first stage, our Armed Forces, along with atomic weapons, had received very effective conventional weapons for those times, in quality terms being models of advanced military equipment. This markedly altered the appearance of the Soviet Armed Forces, and greatly raised their combat might in comparison with the last year of the Great Patriotic War.

The second stage was from 1954 through 1959. This was characterized by the further rapid development and stockpiling of nuclear weapons, and by the development of diverse missile weapons, particularly strategic ones. This caused the rapid growth of our nation's military might and the beginning to a complete revolution in military affairs. Along with ICBM and medium-range missiles, tactical missiles, air-to-ground, air-

to-ship, and air-to-air missiles, as well as antiaircraft and antitank missiles began to be received on a mass scale.

During these years, the Ground Forces received tactical missiles, modernized medium and heavy tanks, armored personnel carriers, tractors, self-propelled antiaircraft guns, and other types of weapons.

The Air Force was armed with new long-range and strategic bombers, fighter-bombers, and fighters, as well as helicopters and new transports.

The National Air Defense Troops were equipped with every effective antiaircraft missiles as well as new jet interceptors. In the Navy, new types of surface vessels and submarines with modern propulsion units continued to be developed and built.

The third postwar stage which one can date to the 1960's has been characterized by the mass introduction of strategic nuclear missile weapons. At this time, new intercontinental and medium-range missiles appeared, and the tactical missiles, the naval missiles (ballistic and winged), the air-to-ground, air-to-ship, air-to-air, and antitank missiles were developed and improved. Other types of weapons and military equipment were also further developed. New more effective tanks were created, and two-plane stabilization of tank weapons was introduced. New wheeled and tracked armored personnel carriers with increased cross-country capability appeared. The fighting qualities of small arms, including rocket launchers, were improved. The multibarrel rocket units became more advanced. Conventional naval weapons were also further developed.

The third stage was characterized by the rapid development and broad introduction of electronic equipment into the Armed Forces including: electronic computers, calculators, radar and navigation equipment, guidance and target designation equipment, and means of communication. This equipment has been used for detecting targets, for launching and guiding missiles, aircraft, projectiles, torpedoes, for aircraft and ship navigation, as well as for raising the reliability and operability of control over all forces and means.

Thus, in the 1960's, a new qualitative change occurred in the development of weaponry. This applied not only to the fundamentally new weapons, that is, the nuclear missile ones, but also to conventional weapons. In comparison with the period of World War II, conventional weapons changed substantially, and they acquired new fighting qualities. Their destructive effect, maneuverability, stability, and controllability in the course of combat operations were improved. This entailed fundamental changes in the methods of their combat application.

2. Means of Destruction in Capitalist Armies

Modern means of destruction (explosives, powder, ammunition) have been marked by higher effectiveness in comparison with the past. This

has been achieved by improving the explosives and powders, as well as by developing new types of ammunition and their standardization.

Explosives have become more powerful, as well as less sensitive to shocks and friction, and excel in increased density and stability. Propellant powders have been further developed. There has been an increase in the gravimetric density, the calorific value and evenness of burning have been increased. This has made it possible to sharply raise the power of the destructive effect of the projectile on the target. For example, spherical powder possesses greater power (due to the use of nitroglycerine instead of pyroxylin), an even rate of burning, and a lower burning temperature, and as a consequence of this, the durability of the barrels has been increased.

In the armed forces of the NATO nations, in the 1950's, a standard cartridge was adopted for small arms, and this was called the "7.62-millimeter NATO cartridge."

In the foreign press, it has been pointed out that in the armies of the Western nations, various types of projectiles have been constantly improved. Arrow-shaped bullets and miniature rockets have appeared.

Various types of armor-piercing shells have been widely developed, particularly the subcaliber designed for firing from antitank guns or from field artillery weapons. In the new armor-piercing shell, the housing has an armor-piercing core from a solid alloy and a charge of an explosive which is fired by the core upon encountering the target, and pierces the armor. A shell is being developed for firing at tanks with spaced armor. A rocket-assisted projectile has also appeared in which the head is made up of an explosive shell, while the tail is a rocket engine. The use of such shells makes it possible to sharply reduce the weight of the weapon and increase the firing range. Supercaliber projectiles are also being developed for recoilless artillery, as well as cluster projectiles for field artillery.

Hollow charges have been widely developed and these possess high armor-piercing capability, in addition to plastic explosions with a high rate of detonation. In the experiments conducted in Canada for gun antiaircraft firing, along with conventional powder, they used a gas charge (a mixture of oxygen, hydrogen, and helium). Powder charges (propellants) have been particularly developed for rocket artillery and missiles, and monopropellant charges and highly effective rocket fuels such as solid, long-storable liquid and hybrid ones are being developed.

3. Conventional Weapons Systems of the Land Forces

Among the conventional weapons of the land forces are small arms, antitank weapons, artillery and mortars, armor, air force elements, antiaircraft weapons, engineer equipment, infrared equipment, control equipment, and so forth.

The firearms in use by the armies of many nations have been almost completely replaced, and possess high combat qualities. They differ from the small arms of the World War II period in the smaller number of type and weight of the weapons, increased firepower, a high rate of fire, universality of application, simplicity in use, and dependability of action under various conditions. The small arms include: the individual weapon of the infantryman, machine guns, submachine guns, grenade launchers, and antitank rocket launchers.

The individual weapon of the infantryman is the carbine (normal and sawn-off, and with automatic firing) and the rifle (self-loading and automatic) with a caliber of 7.5–7.62 millimeters. Their technical specifications as an average come down to the following: length 760–1,055 millimeters, weight 2.5–4.2 kilograms, muzzle velocity of around 850 meters per second, gun range up to 1,000 meters, magazine capacity up to 20 cartridges, and rate of automatic fire up to 700–800 rounds per minute. A dagger-type bayonet can be fastened to the carbines.

In 1964, the United States adopted a 5.56-millimeter rifle, the bullet of which, in hitting the tissue of an organism, "tumbles," causing severe wounds to it. The Hague Declaration of 29 July 1899 banned the use of such bullets. Such rifles are being issued in the NATO armies. The modern rifle can be used as an antitank weapon, and for this a grenade launcher is put on the rifle's muzzle. The launcher is a small metal tube, and the firing is with a hollow charge grenade at a range of 80–90 meters. In some rifles, a special grenade discharger is fastened under the rifle barrel, and can be used to fire antitank or fragmentation grenades at a range of 50–400 meters.

Also among the individual weapons of the infantryman are the submachine gun or automatic used in the armies of many nations. Submachine guns usually have a larger caliber than a rifle (9 millimeters and more), and this is caused by the greater "stopping action" (the time from the impact of the bullet to the occurrence of the shock; this declines with an increase in the caliber). The range of fire of this weapon is up to 800 meters, the gun range is 100–300 meters, the magazine capacity is 20–40 cartridges, and the rate of fire is 460–700 rounds per minute. Some submachine guns have a bayonet. The Kalashnikov automatic, in terms of its fighting qualities, is considered one of the best in the world.

The machine gun is a more powerful small arm. Previously there were two types of machine guns, light and medium. At present ordinarily a standard machine gun is created with a caliber of 7.62 millimeters with a gun range of up to 1,800 meters. It can be fired from a support, in a standing position, or from the hip. The medium version is designed for firing from a tripod at ground targets, while the antiaircraft version is used for firing at airborne targets from a special stand. In a number of nations, the 12.7-millimeter machine gun is still in use.

Antitank rocket launchers have been widely introduced in many

armies. These are designed for combating tanks at ranges of 200–300 meters. They fire hollow charge grenades which can pierce the armor of virtually any tank. Such weapons are operated by two men.

In the foreign press, a great deal of attention has been given to the questions of the further development of small arms. Ideas have been advanced that small arms should develop along a line of further automation, and by creating an automatic weapon which would be capable of hitting both point and area targets. It has been proposed that individual antitank guided missiles should be widely developed. The arming of each soldier with several guided missiles will make it possible for even small subunits to firmly defend broad areas.

In the United States, they are developing a special-purpose individual weapon which has two barrels and fires a grenade or rifle bullet. Also in development is an automatic rocket launcher (40-millimeter) and a 5.56-millimeter caliber machine gun.

In the armies of many foriegn nations, *antitank weapons* have been widely developed. In addition to the individual antitank weapons which have already been described, there are also recoilless guns as the basic antitank weapon of the battalions. This is a comparatively powerful weapon. It excels in simplicity of design and servicing, as well as lightness and maneuverability.

The recoilless gun is a thin-walled tube of varying caliber (from 57 millimeters to 120 millimeters, with the most widely found caliber of 82–107 millimeters) which is open at both ends. The gun fires a hollow charge, the firing range is up to 1,000 meters, and it can penetrate armor more than 300 millimeters thick. The recoilless guns can be fired from the shoulder (up to a caliber of 75 millimeters inclusively), or the barrel is put on a machine gun tripod, while the 107–120-millimeter guns are carried on vehicles or have their own mountings. The drawbacks of the recoilless gun are the tell-tale effect of the powder gases which escape from the breech and also represent a danger for the operating crew, as well as the low range of direct firing. The further development of recoilless guns, it may be assumed, will occur by reducing the danger zone behind the gun, by increasing the range of fire and the power of the charge, and conversion to a self-propelled chassis. Also being improved are the rifled and smooth-bore antitank guns which have a flat trajectory range up to 2,000 meters.

The antitank guided missiles (PTURS) have become a very effective antitank weapon. These projectiles can have a powder or liquid rocket engine, and a guidance system with the giving of commands over wire or by radio. They possess a great effective range (300–2,000 meters and more) and high firing accuracy, they can pierce armor up to 400 millimeters thick, they are maneuverable and simple to operate. The missiles can be fired from ground launchers, from a vehicle, from an aircraft, or helicopter. Some rockets have an infrared homing system (on the termi-

nal leg). The charge is ordinarily hollow, but can also be HE-fragmentation. Our PTURS are capable of neutralizing any armored target at a distance of 2 and more kilometers.

Abroad it is considered that the further development of antitank guided missiles will occur by increasing the range and armor-piercing capability, by improving the system and stabilization of the projectile in flight, by using tubular guides (barrels), and by raising their dependability and durability. In some foreign nations, they are examining the possibility of using a semiactive ultraviolet homing system as well as a laser for guiding the missile to the target.

In the last war, as is known, *field artillery* was the main firepower of the ground forces. Soviet artillery gained particular renown for itself, becoming the scourge of the Nazi invaders. Our 122-millimeter and 152-millimeter howitzers were so advanced that they went unchanged throughout the entire war. In the subsequent period, the artillery units have received weapons which possess even higher technical specifications. The performance of the ammunition for these weapons has also been significantly improved.

The rocket launchers ("katyushas") which possessed vast destructive properties won great renown among the Soviet soldiers in the Great Patriotic War. In the postwar years, the role and proportional amount of rocket artillery have increased even more.

Modern rocket artillery is characterized by an increase in the number of guides in one unit, the use of barrel guides along frame ones, and an increase in grouping and the rate of fire. The range of the foreign rocket artillery ordinarily reaches 9–18 kilometers. It remains a powerful means for neutralizing group targets on the battlefield and for fire support of infantry and tank actions.

Conventional artillery is an important means for neutralizing pinpoint targets on the battlefield, since it is not advisable to use multibarrel rocket artillery for neutralizing such targets. An increase in caliber, the predominant development of howitzer artillery and a continuous rise in the proportional amount of self-propelled artillery have become characteristic for the field conventional artillery of the capitalist armies. The caliber of divisional artillery of the U.S., French, English, and West German armies has increased to 105, 155, and even 203.2 millimeters. These armies are armed with 105 and 155-millimeter howitzers which possess a firing range of 10–15 kilometers (up to 18 kilometers for the French 155-millimeter howitzer), and a rate of fire of two-four and more rounds per minute.

Self-propelled artillery has been widely introduced. The armies of many capitalistic nations are armed with self-propelled antitank guns of 90–100 millimeters. The laden weight of such units is 7–23 tons, the effective range is 1,500–1,800 meters, the speed is 40–80 kilometers per hour, and the range is around 250–580 kilometers. The basic NATO

nations are armed with 105-mm self-propelled howitzers (the 105-mm cannon in England) and 155-mm howitzers. The weight of such a unit is 14–28 tons, the range is 14–20 kilometers (up to 25 km with the French active missile), a speed of 50–60 kilometers per hour and a fuel supply for around 400 kilometers.

The U.S. Army is armed with the 106-millimeter Ontos M50 self-propelled unit which has six recoilless guns with a maximum firing range (against tanks) of 1,200 meters. This U.S. self-propelled gun has been widely used in Vietnam. Moreover, in the United States there are also a 175-millimeter self-propelled gun and a 203.2-millimeter howitzer. The weapons are mounted open on a chassis; either of these two weapons can be mounted on the same chassis; and the changing of the barrels requires approximately 30 minutes. The weight of such a system is around 28 tons; the traveling speed is 55 kilometers per hour; and the range is around 700 kilometers. A 203.2-millimeter howitzer can also be mounted on the chassis of the M48 tank.

Mortars remain a means for combating personnel and infantry weapons, particularly in trenches and foxholes. The usual weapons are an 81-millimeter mortar with a range of up to 3,600 meters and a rate of fire of up to 18 rounds per minute; a 106.7-millimeter mortar with a range of 5,900 meters and a rate of fire of five rounds per minute; the 120-millimeter mortar with a range of up to 6,600 meters.

The further development of artillery and mortars can occur by increasing the power of the charges, the rate of fire, by raising the accuracy of firing, by lightening the systems and increasing mobility. It must be assumed that all artillery systems, and particularly rocket ones, will be developed. Important significance is being paid to raising the mobility of the artillery systems. Abroad it is felt that it is possible to develop light self-propelled chassis from aluminum and other light metal alloys. For some artillery systems, armor is being developed from light metal alloys (for protecting the gun crews against the effect of nuclear radiation, shrapnel and bullets). Great attention is paid to increasing the range, rate of fire, and accuracy of fire. The firing range can be increased by improving the ballistic specifications of the guns, by increasing the weight of the full charge and the muzzle velocity of the shells. The rate of fire is increased by automating the loading processes. The control and firing instruments are being improved, and electronic computers are being introduced for processing reconnaissance information and weather data, as well as for preparing, planning, and controlling firing.

Tactical and tactical-operational missiles are the basic means of destruction of the Land Forces. Soviet tactical-operational and tactical missiles, in terms of a number of indicators are the best in the world, and surpass similar missiles in the armies of the capitalist nations.

Missiles are divided into unguided and guided. In the U.S. forces, the tactical guided missiles of the Little John and Honest John types are

equipped with conventional and nuclear payloads with a range of 25–30 kilometers. Also among the tactical and operational guided missiles are the American missiles of the Lance, Sergeant, and Pershing types, as well as the French Pluton missile. The Lance missile with a long-storable factory-fueled liquid propellant comes with nuclear and conventional warheads, it possesses a range of from 8 to 110 kilometers, and is carried on an armored personnel carrier or truck. The Sergeant missile is a single-stage solid-propellant one, the warhead is a nuclear charge, although a conventional charge can be carried, the launch range is 40–135 kilometers; it is transported on wheeled semi's by a tractor. The Pershing missile is two-stage with solid propellant, it uses nuclear ammunition, it has a firing range of 180–740 kilometers, and is transported on carriers. The Pluton missile has a range of up to 120 kilometers and is transported on a tracked armored personnel carrier.

Abroad the opinion prevails that tactical missiles for a long time to come will remain the basic means of destruction of land forces. It is felt that their development can occur by reducing the weight and dimensions, by raising mobility, increasing the power of the charge, the range, and accuracy, by improving the fuel, and bettering the guidance system. A reduction in the weight and dimensions of the missiles can be achieved by using light, strong, fire- and corrosion-resistant metals (titanium, magnesium, aluminum alloys, and steel), graphite, glass fiber materials, plastics, and so forth. An increase in mobility can be achieved by improving the transporting vehicles on the ground, by making use of aviation and helicopters for moving the missiles, as well as preparing them for parachute dropping. Of major significance will be the conversion to rocket engines which do not require a long time for prelaunch preparation. The attention of foreign specialists has been focused on creating optimum formulas for solid missile propellants, mixed plastic fuels, and so forth. The development of gyroscopes which possess high accuracy and dependability as well as the development of various warhead homing systems will help to simplify the guidance system and to raise the missile's dependability.

Tanks in the last war played an exceptional role in conducting maneuvering operations, being the chief striking force of the land forces. Soviet tanks acquired the greatest renown for their fighting qualities. The remarkable T-34 medium tank surpassed any similar vehicle of Nazi Germany, as well as the United States and England. And in our times, the tanks of the Soviet Army are the best in the world. They have strong armor, powerful weapons, a dependable motor, a great range, and advanced driving and fire control instruments.

In the postwar period, for a certain time the role of tanks was uncertain, and this was the reason for a certain stagnation in their development. Almost up to the end of the 1950's, in a number of capitalistic nations, only insignificant improvements were made in tanks. However, nuclear

weapons testing and scientific research indicated that the tank is the strongest combat vehicle under the conditions of a nuclear missile war. By the end of the 1950's and particularly in the 1960's, work picked up on improving the tanks.

In the major nations of the world, new medium and light tanks were commissioned, possessing higher fighting qualities in comparison with the tanks of the World War II period. More advanced weapons capable of using subcaliber and hollow charge shells were mounted on them. Weapons stabilization was introduced, the armor was improved, protection against radiation was strengthened, speed and range were increased, and infrared equipment (for nighttime operations) was installed. Tanks were adapted for traveling under water.

The technical specifications of modern medium tanks (the M60 in the United States, the Chieftain in England, the Leopard in West Germany, and the AMX63 in France) can be reduced to the following: weight of 32–46 tons; frontal armor 70–150 millimeters, armor of turrets 150–200 millimeters, side armor 50–80 millimeters; weapons: 105-millimeter cannon (120 millimeters on the English tank), a coupled 7.62-millimeter machine gun, and on the turret a 12.7-millimeter antiaircraft machine gun; speed 40–70 kilometers per hour, and range of 320–560 kilometers. The guns are rifled, with a muzzle velocity of 950–1,000 meters per second, and 1,500 meters per second for a subcaliber shell, and a battle scale of ammunition of 40–60 shells.

Light and usually amphibious tanks have also remained in use. These tanks weigh around 15 tons and are armed with 75–80-millimeter cannons and machine guns, they have a speed of around 60 kilometers per hour and a range of 400–480 kilometers. The American Sheridan M551 light amphibious tank is armed with a 152-millimeter gun which can fire a conventional shell or Shillelah guided missiles. On the French light tank, equipment has been installed for antitank guided missiles (four missiles on the rocking part of the turret).

The armies of many nations are armed with *armored personnel carriers* (usually tracked) and various armored vehicles, many of which are amphibious. Armored personnel carriers are a means of transporting personnel, and they have machine guns and light cannons. An armored vehicle is predominantly a means of reconnaissance. Recently, certain imperialist nations have commissioned armored infantry vehicles (the XM723 in the United States, the Marder in West Germany, the Hotchkiss in France, and the Trojan in England) which can carry an infantry squad and can conduct combat without dismounting. They weigh 5–7 to 28 tons. The armor protects the personnel against shell fragments, bullets, grenades, mines, as well as thermal and radioactive radiation from nuclear explosions. The Soviet infantry combat vehicle has also demonstrated high qualities at the Dvina maneuvers conducted in the spring of 1970 as well as in other troop exercises.

The questions of the further development of the tank as before have attracted the attention of military leaders, designers, and scientists in many nations. In the West it is felt that the improvement of the tank can occur by reducing the weight, and this can be achieved by using new materials, including plastics, as well as by raising speed and maneuverability, providing missiles, using multifuel engines, and improving the protection against hollow charge, atomic, and chemical weapons. Abroad the opinion has been stated that two types of tanks should be in use, a light air-transportable one and a medium one. The tank could carry various weapons, use combustible-case ammunition, as well as PTURS, including with a nuclear charge. Instead of steel armor, aluminum can be used, although as yet this provides little benefit, while the use of plastics also as yet has not brought satisfactory results.

Abroad important significance is given to developing armor which is resistant to hollow charge and armor-piercing shells. Side screens are being developed, for example, a screen consisting of many closely packed corrugated sections which weaken the effect of the shell against the basic armor, in addition to multilayer armor, and so forth. An air-cushion tank is being developed; the plans exist for an articulated tank consisting of two sections, the combat and the motor-transport. A great deal of attention is being given to the creation of an armored combat vehicle which would be lighter and more maneuverable than a tank, and adapted for conducting combat on the move, without the dismounting of the crew.

The existing combat and transport vehicles, in the opinion of foreign specialists, no longer meet modern requirements. The next task is to create new combat and transport vehicles with high cross-country capabilities, able to move off the roads, over swamps, through deep snow, across land and water, and even fly at a low altitude. In a number of nations, wheeled vehicles are being developed with a large number of drive axles, as well as on rollers and tracks. Abroad great attention is being given to the use of the "zero pressure" and "air cushion" principles. The first models of such equipment are already being tested in a number of nations. Practical work is being carried out to create flying vehicles of the flying car or motorcycle type. It is assumed that in the future the land forces will be widely equipped with VTOL aviation and helicopters as a means of combat, as well as other flying vehicles.

Abroad they are studying the possibilities of using new light materials and more economical motors. In developing combat and transport vehicles, aluminum as well as magnesium and beryllium can hold an important place. A combat vehicle manufactured from aluminum alloys can be several times lighter than a steel one. It is sufficiently protected against bullets, shrapnel, and the destructive factors of a nuclear explosion. Vehicles manufactured from magnesium and beryllium alloys can be even lighter and stronger. Plastics and fiberglass will be widely used.

Abroad the following demands are placed upon the engines of combat

vehicles: high power with minimum dimensions, weight, and economy, the ability to operate on various types of fuel, as well as under different climatic conditions, and high reliability. Piston engines can be multifuel and omnifuel. Immediately on the agenda is the development of a rotary engine which excels in low weight, low dimensions, a long life, economy, and inexpensive manufacturing. Gas turbines may also be widely used; these differ from piston engines in their simplicity of design, the ability to operate on various types of liquid fuel, and also they start easily under low temperature conditions. As of now, gas turbines consume a great deal of fuel, they create noise in operations, and are very expensive. Work is being done in many foreign nations to eliminate these defects.

The necessity of sharply raising troop maneuverability and developing aviation equipment has brought about the appearance of a whole new branch of arms, *army aviation*, which includes helicopters (combat and transport) as well as certain types of aircraft (immediate troop support, visual reconnaissance, spotting, communications, and so forth).

In the United States and certain other imperialist nations, particular attention has been paid to developing helicopters and to raising their proportional amount in army aviation. Combat helicopters are being developed in a direction of raising their speed, improving the aerodynamic shapes, strengthening the firepower, and raising the survival and protection for the crew. They can be armed with air-to-ground missiles, rapid firing cannons, PTURS, rotary ammunition, machine guns, cluster bombs, and so forth. The transport and landing-transport helicopters are being improved by increasing the payload and life, as well as improving flight performance. Typical examples of army aviation in the basic capitalist nations for the immediate future can be considered to be: The Cheyenne AH–56A fire support helicopter; the Iroquois UH–1 multipurpose helicopter; the Pawnee OH–6A and Alouette–2 reconnaissance helicopter; the Chinook CH–47A transport helicopter; the CH–54A Flying Crane; and the Bronco OV–10A reconnaissance aircraft. The light helicopters (of the Pawnee and Alouette–2 type) have a speed of up to 200 kilometers per hour, a ceiling of up to 3 kilometers, a flight range of up to 500 kilometers, and a payload of up to 0.5 tons. The medium helicopters (of the Iroquois and Cheyenne type) have a speed of 200–380 kilometers per hour, a ceiling of up to 4.5 kilometers, a range of 500-800 kilometers, and a payload of up to 1.5 tons. The heavy helicopters and the helicopter cranes lift heavy loads. For example, new heavy helicopters are being developed with a payload of up to 40 tons.

Serious attention is also being paid to developing troop airborne equipment and combat material. Even now, significant advances have been made in parachuting both personnel as well as a large number of types of combat equipment, including comparatively heavy objects (armored personnel carriers, vehicles, guns, and so forth). However, it

is felt that the parachute method is not sufficiently safe. In line with this, new means are being developed for landing personnel and cargo from aircraft. For example, in the United States, the "paracone" has been developed, and this is a gas-filled cone from a strong elastic material. It should provide the more rapid and safe descent to the ground, and can carry up to a platoon of infantrymen and even a tank. Searches are underway for other flying vehicles as means for landing personnel and military equipment from aircraft.

Air defense weapons are given a major role in the weaponry of the land forces. In the foreign press, it has been pointed out that the land forces under present-day conditions can successfully conduct military operations only in the instance that they are able to win the engagement in the air. The carrying out of this mission is entrusted to the air defense forces and means of the land forces. In this regard, the air defense means in many foreign armies are developing intensively, and are being introduced into all the combined arms formations, units, and subunits.

Abroad, chief attention is being given to the development of antiaircraft missiles (ZURS). The armies of the basic capitalist nations have the following types of ZURS: the Nike-Hercules and Hawk, (United States), and Thunderbird (England) for destroying targets at medium and high altitudes (15–30 kilometers); the Chaparral (United States), Rapier (England), Crotal (France), Roland (West Germany and France), and Indigo (Italy) for low altitudes (300–4,000 meters); the Redeye (United States) and Blowpipe (England) which are portable close-range (at altitudes of up to 3,000 meters). The ZURS of the armies in the capitalist nations are being developed by increasing the range and accuracy of fire, as well as by increasing reliability, interference jamming, and maneuverability. Particular attention is being paid to developing systems for destroying low-altitude airborne targets. At the same time, systems are being developed able to destroy aircraft, air-to-ground winged missiles, and tactical ballistic missiles. The Americans have put in this system the SAM-D complex which is being developed and which will be in service in the second half of the 1970's. Extensive work is being carried out on improving radar equipment and automated control systems.

As before, antiaircraft artillery is still in use in the armies of the capitalist nations as a means for countering predominantly low-fiying aircraft and helicopters. Ordinarily, antiaircraft artillery is represented by the following: the 20–25–millimeter automatic AA gun with a range of up to 1,000 meters and a rate of fire of up to 3,000 rounds per minute; the 35–40–millimeter automatic guns with a range of fire of up to 4,600 meters and a rate of fire of 120 rounds per minute. In some nations, they still use the 57- and 75-millimeter antiaircraft guns with a range of fire of up to 6,400 meters and a rate of fire of 45 rounds per minute.

4. Air Force Conventional Weapons Systems

Aviation has continued to remain an important multipurpose means of combat, capable of waging effective military operations under the most diverse conditions. The conversion of aviation into missile-carrying has further raised its combat capabilities. It can destroy nuclear weapons, hit moving targets on the ground, at sea, and in the air, support troops, transport troops and materiel by air, and conduct reconnaissance. Regardless of the development of missile weapons, the role of aviation has not declined in carrying out combat missions.

Modern aviation has come to be divided into strategic, or long-range, tactical, and military-transport.

Strategic aviation is a strategic means for the delivery of nuclear ammunition. But it is also capable of using conventional weapons, as has occurred in Vietnam. Heavy and medium bombers as well as strategic reconnaissance planes comprise strategic aviation.

Aircraft of the American B-52 type are among the heavy strategic bombers. The B-52 has eight turbojet engines, and reaches a speed of up to 1,050 kilometers per hour; it has a service ceiling of up to 16 kilometers and a maximum range of up to 18,000 kilometers. The B-52 is armed with Hound Dog missiles having nuclear charges and a flight range of up to 1,000 kilometers, as well as the Quail ECM missiles (range of up to 370 kilometers). The airplane can also deliver conventional bombs to the target. Its weapons are four machine guns and a 12.7-millimeter or a 20-millimeter gun. The United States is developing the B-1 new heavy strategic bomber which will be in service at the end of the 1970's. According to the data of the American press, its speed at great altitudes will reach 2,500 kilometers per hour. For the strategic bombers, new air-to-ground missiles are being developed including the SCAD (range of around 1,500 kilometers) and the SRAM (range of 300 kilometers). The B-1 aircraft can carry up to 30 such missiles.

Aircraft of the American FB-111, the English Vulcan, and the French Mirage-IV are among the medium strategic bombers. They have two-four turbojet engines, and can reach a speed of up to 2,300–2,600 kilometers per hour, with a range of 4,000–6,000 kilometers. These aircraft are armed with a missile of the SRAM type, and can also carry bombs. It is assumed that the FB-111 will carry six SRAM missiles.

Tactical (frontal) aviation is divided into light bombers, tactical fighters, fighter-bombers, assault planes, and reconnaissance planes. The proportional amount of light bombers in the NATO nations has declined due to the delivery of tactical missiles. Still in use are obsolete turboprop and jet light bombers (usually with two engines) having a speed of 1,000–2,200 kilometers per hour, a ceiling of 15–20 kilometers, and a range of 4,000–4,500 kilometers. They have cannon weapons (up to four 20-millimeter cannons), guided and conventional bombs, 127-millimeter

unguided missiles, and can carry guided missiles with a range of up to 20 kilometers.

Tactical (multipurpose) fighters are used against other aviation, and can also be employed for supporting ground forces. The air forces of the basic capitalist nations are armed with the following multipurpose fighters: the Phantom F-4 (United States, England, and West Germany), the Mirage-IIIE (France), and the American-produced F-104G (West Germany) which has constantly suffered catastrophes. The maximum speed of these aircraft is 1,700–2,300 kilometers per hour, the ceiling is 16–19 kilometers, the range is up to 1,000 kilometers, and they are armed with air-to-air and air-to-ground guided missiles, unguided missiles, bombs, and cannons. In the United States, the F-15 aerial combat fighter is being developed, and its maximum speed, according to the data of the American press, is 2,400–2,700 kilometers per hour, the ceiling is 20–21 kilometers, and the range is 800 kilometers. The Soviet E-66 fighter piloted by Lt Col G. K. Mosolov in 1961 reached an altitude of 34.2 kilometers, while in 1962, the E-166 fighter reached a speed of 2,678.5 kilometers per hour, thereby breaking the world record.

West Germany, England, and Italy are developing the MRCA multipurpose variable wing fighter (a maximum speed of 2,300 kilometers per hour), while France is developing the Mirage G.8. In addition, in France they are testing the light STOL Mirage F.1 fighter (a maximum speed of 2,300 kilometers per hour and a ceiling of 18–20 kilometers).

In tactical aviation, a large proportional amount is made up of fighter-bombers designed for troop support. The air forces of the capitalist nations have the following fighter-bombers: the F-100, F-105, F-111 (United States), the Mystere IVA (France), the Hunter FGA.9 (England), and others. These aircraft have the following technical specifications: maximum speed up to 2,600 kilometers per hour, ceiling of 18–19 kilometers, and range up to 2,000 kilometers. They are armed with air-to-ground guided missiles, bombs, including cluster bombs, unguided missiles, cannons, and ECM missiles. In England, there is the Harrier GR.1 VTOL fighter bomber (ground speed of 1,100 kilometers per hour and a ceiling of up to 15 kilometers). In England and France, they are developing the light Jaguar fighter-bomber (maximum speed of 1,800 kilometers per hour, a ceiling of 14 kilometers, and a radius of up to 800 kilometers).

Subsonic and supersonic ground attack aircraft are continuing to be developed, and these are designed for destroying troops on the battlefield. In the United States, there is the A-7D ground assault plane (maximum ground speed of 900–1,100 kilometers per hour, ceiling of 12–14 kilometers, and radius of around 1,000 kilometers). The new A-X ground assault plane (United States) is also being developed.

The capitalist nations are giving great attention to the development and use of unmanned aircraft for carrying out various missions, including

fighters, reconnaissance aircraft, and so forth. It is assumed that this will be a highly flexible, effective, and inexpensive weapon.

Tactical reconnaissance aviation has developed basically from tactical assault aircraft, although there are also special reconnaissance aircraft. The air forces of the basic capitalist nations are armed with the following tactical reconnaissance-assault aircraft: the Phantom RF-4, the RF-111, the Harrier Gr. MK. 1, and others. They are equipped with photographic, radar, laser, and infrared equipment, as well as weapons. Among the special reconnaissance aircraft, one can mention: the RF-8G and RF-101C photoreconnaissance aircraft; the army reconnaissance aircraft; the long- and short-range unmanned reconnaissance aircraft. It must be assumed that the new tactical aircraft being developed will also be produced in a reconnaissance version.

Military air transport in the West is represented by strategic (superheavy and heavy) and tactical (light) air transport. The superheavy transports include the C-5A aircraft (United States) which is characterized by the following data: takeoff weight of more than 300 tons, payload of 100–120 tons, range of up to 10,000 kilometers (with a 45-ton load), and a cruising speed of 815 kilometers per hour. Our Antey transport, in terms of a number of indicators, surpasses the American C-5A.

Among the heavy and medium transports are: the C-141, C-133 (United States), VC.10, Belfast, Britannia, Comet (England), and others. These aircraft are characterized by the following indicators: takeoff weight of 100–150 tons, payload of 30–40 tons, speed of 500–800 kilometers per hour, and range of 6,000–10,000 kilometers (with a load of 10–14 tons).

Among the tactical transports are: the C-130, C-7A, C-123 (United States), C-130K, Argosy, and Andover, (England), the Noratlas, C.160 (the air forces of West Germany and France). The takeoff weight of these aircraft is 15–50 tons, the payload is 4–17 tons, the range is 1,000–7,000 kilometers, and the cruising speed is 400–500 kilometers per hour

In the opinion of foreign specialists, the further development of aviation will involve overcoming a whole series of serious difficulties. With an increase in speed (supersonic), the aerodynamic heating is sharply increased, and heat-resistant materials are required, for example, titanium and steel alloys. The wing resistance is also increased, and very thin and swept wings are essential. At present, work is being carried out in many foreign nations on surmounting all these difficulties.

Abroad, research is being conducted on the possibilities of creating an aircraft equipped with a control system for the laminar flow of air, and this should increase the range and duration of flight. The foreign press has expressed the opinion that the aircraft may use special engines with heat recovery (using the heat of the gases of the jet stream for the preliminary heating of the air delivered to the combustion chambers) which will sharply reduce fuel consumption, as well as employ new

engine designs (ramjet, turborocket, electric rocket, and so forth), and new equipment for burning the propellant, using hydrogen as the fuel; this can sharply increase the speed of flight.

Abroad great attention is being paid to the problem of vertical takeoff and landing as this would make aviation independent of airfields. The possibility of developing such aircraft has already been proven in practice. Various systems can be used including turning the wing and the prop, turning the props which are enclosed in ducts; with a bearing prop of turboprop engines; aircraft which deflect the exhaust jet of turboprop engines; taking off with a vertical fuselage position. But the practical solution to this problem, as the foreign press has announced, still encounters major difficulties related to the dangerous dust formation in taking off, payload losses, instability in flight, and high costs.

In the United States, England, and other nations, they are searching for the ways to develop strategic aviation. Hypersonic speeds are being given great attention. It is assumed that it is possible to create an aircraft with an atomic engine, a rocket glider, and an orbital aircraft with an unlimited range and cosmic speed.

Tactical aviation, in the opinion of foreign specialists, will develop by universalization, by reducing dependency upon airfields, and by developing aircraft able to fly at various altitudes. It has been pointed out that this is important for fighters. The emphasis is being put on the development of multipurpose fighters. Fighter-bombers with a variable-incidence wing are being developed. The possibility is being studied of creating a reusable rocket (missile) aircraft. Great attention is also being paid to the development of navigation equipment able to give automatically and continuously the coordinates for the location of the aircraft as well as speed and course. A great deal of attention is being paid to the further development of aviation missiles, to increasing the range of the homing systems, to broadening the sphere of attack, to raising resistance to jamming, and to developing missiles for waging "radio warfare."

In the foreign press, it has been announced that military transport aviation will develop in a direction toward reducing dependency upon airfields, creating aircraft able to take off from any unsurfaced airfield, as well as the development of transports with a hypersonic speed, great load capacity and range.

5. Conventional Naval Weapons Systems

The navy, like the other services of the armed forces, is able to carry out its basic missions in conducting military operations with nuclear missile weapons. However, there are many missions which, in a number of instances, are better carried out by conventional means. These include the following: the destruction of individual ships, the interruption of sea shipments, defense of one's communications, assistance to land forces, landing amphibious troops, support for marines, and so forth. For this reason, the present-day navies of the major nations of the world possess a range of conventional weapons.

As a rule, a navy consists of submarine, surface, and air forces as well as marines.

The submarine forces in the major nations have become the chief forces of the navy. Abroad they include: atomic missile-carrying submarines, antisub submarines, and auxiliary submarines.

Atomic missile-carrying subs armed with ballistic missiles of the Polaris-Poseidon and MSBS types are a strategic nuclear means. They are designed for making nuclear strikes against enemy objectives. They also have conventional weapons in addition to antisub self-defense equipment. These are the largest submarines (a displacement tonnage of 5,900–7,900 tons, and a submerged speed of around 20–25 knots). The antisub submarines are designed for combating other subs and surface vessels. They can be atomic or diesel-electric. The atomic subs of the Sturgeon (United States) and Valiant (England) types have a displacement tonnage of around 4,000 tons, a speed of 27 knots under water, and a diving depth of 220–400 meters. The diesel-electric subs are in use in the navies of many nations. American and English subs (of the Barbel and Oberon types, have a displacement tonnage of up to 2,200 tons and a speed under water of up to 20 knots. The West German subs (U-4 and U-13) have a displacement tonnage of 370–400 tons, and a submerged speed of 17 knots. The displacement tonnage of the French submarine Narval is 1,600 tons. The Soviet submarines with atomic engines have demonstrated their vast capabilities in many long voyages, including in the group around-the-world voyage under water in 1968 and in the Okean naval maneuvers in 1970.

At present, in many nations particular attention is being given to equipping the fleet with antisub weapons. The surface antisub vessels (frigates, destroyers, and patrol boats) are equipped with sonars having a range of from 10 to 55 kilometers. These ships are armed with homing torpedoes with a range of 5–18 kilometers, guided torpedo missiles with a range of up to 15 kilometers and more in the air and then under water, rocket depth-charge throwers for dropping depth charges at a distance of up to 2 kilometers away from the ship, as well as antisub guns with a caliber of 127, 114, 100, and 76 millimeters.

The foreign subs are equipped with sonars having a range of up to 60 kilometers. They are armed with electrically-driven, acoustic or wire-guided torpedoes with a range of 5–18 kilometers, and the Subroc-type torpedo missile (the missile after launching travels under water, then in the air, and at the end of the airborne leg, the warhead separates, drops into the water and moves toward the target) with a range of up to 65 kilometers. The submarines also carry missiles for destroying surface vessels and shore targets.

Various navigation systems (for example, the American Loran-C system, and the transit satellites) are being created for the successful combat use of submarines, and particularly missile-carrying ones.

The surface forces are armed abroad with the following: combat vessels (aircraft carriers, cruisers, and destroyers, patrol and escort vessels, small antisub ships, and launches; amphibious ships; mine sweepers (mine and net layers, fleet and coastal sweepers, harbor sweepers, and small mine sweepers); auxiliary vessels.

The largest surface combat vessels are the attack carriers and antisub carriers which are in service in the Navy of the United States, as well as England and certain other capitalist nations.

A modern attack carrier is a mobile air base. The American atomic attack carrier, Enterprise, has a displacement tonnage of 89,000 tons and a speed of 30 knots. The remaining U.S. attack carriers are 52,000–64,000 tons. The tonnage of the multipurpose English carriers is of around 50,000 tons, and for France, 30,000 tons. A carrier can carry up to 100 aircraft, including heavy attack planes (a speed of 1,100 kilometers per hour and a range of up to 5,000 kilometers, and armed with the air-to-surface and air-to-air guided missiles, atomic and conventional bombs), attack planes (speed of 1,100 kilometers per hour, range of up to 4,000 kilometers, and the same weapons), and fighters (a speed of 1,400–2,200 kilometers per hour, and weapons of air-to-surface or air-to-air guided missiles, bombs, and cannons). Up to 30 aircraft are carried on the multipurpose carriers. The antisub carriers have a tonnage of 30,000 tons and can carry up to 50 antisub aircraft and helicopters. The subchasing aircraft ususally have a low speed (500–800 kilometers per hour) and a range of around 3,000 kilometers; they are armed with guided missiles, torpedoes, and depth charges.

There is no doubt that the carrier is a major technical achievement of the 20th century. However, even in the years of World War II, aviation and submarines fought successfully against carriers. With the appearance of nuclear weapons, atomic submarines with homing missiles and torpedoes, as well as missile-carrying aviation, this ship has become more vulnerable. Nevertheless, the attack carriers continue to remain in service in the basic capitalist nations. The United States is continuing to build atomic attack carriers. New antisub carriers are not being built.

The navies of the United States and certain other nations are keeping the heavy and light cruisers, including one atomic one, the Long Beach. Their tonnage varies from 10,670 to 16,200 tons, with a speed of up to 30 knots. Usually the cruisers are armed with antisub weapons and ZURS, and are designed for the sub and air defense of the carrier attack and other ship formations. The U.S. atomic cruiser Long Beach has equipment for launching eight Polaris ballistic missiles. Often the cruisers are converted into carriers of antisub helicopters. In the Soviet Navy, the helicopter cruisers of the Moskva and Leningrad types possess broad combat capabilities.

Ships of the destroyer class (frigates and destroyers) have a tonnage of from 2,700 to 6,500 tons, and are armed with antisub weapons (torpedoes, rocket-assisted torpedoes, and depth charges), ZURS, and artillery. The United States is building two atomic missile frigates (with a tonnage of up to 8,000 tons). These ships are to be used mainly as submarine and air defense vessels for the ship formations and transport convoys.

The patrol, escort, and subchasing ships and launches are usually put in the group of patrol vessels. Their tonnage varies from several hundred to 2,000 tons and more. In this group in the foreign navies, hydrofoils are appearing which possess a great speed (60 knots and more). They are armed with automatic artillery, winged missiles, torpedoes, and depth charges. They have the missions of escorting and providing antisub defenses for the ship formations and convoys, subchasing, and shore defense.

In foreign nations, important significance has been given to the development of antisub aircraft and helicopters. Aside from the patrol aircraft which were described above, the navies of the capitalist nations are armed with coastal sub-chasing aircraft. They have a relatively low speed (600–700 kilometers per hour), but a comparatively great range (7,000–8,000 kilometers and more). These aircraft are armed with guided missiles, torpedoes, bombs, and mines. In recent years, in many nations, there has been a sharp rise in the number of antisub helicopters in use on many classes of surface vessels. The helicopters are equipped with torpedoes, bombs, mines, guided and unguided missiles.

The ships for amphibious operations are designed for transporting and landing amphibious troops. In the West this group of vessels is comprised of large amphibious helicopter carriers, transport docks, tank-landing vessels, and landing ships (a tonnage of 6,000–25,000 tons), and amphibious equipment including helicopters and landing craft carried on the amphibious ships.

The mine-sweeping group of vessels is made up of the fleet and high-speed layers (a tonnage of 2,000–6,000 tons) which carry a large number of mines for laying fields, in addition to various types of sweepers such as seagoing, coastal and harbor, and mine-sweeping boats (a tonnage of 200-700 tons) designed for mine sweeping.

In speaking about the prospects for the development of naval weapons, foreign specialists put in first place submarines with a continuously increasing tonnage (missile-carrying submarines are already being built with a tonnage of 9,000 tons, and antisub subs of up to 5,000 tons) with a speed of 50 knots under water, and subsequently up to 100 knots, with a diving depth of 1,000 meters and more. The following classes of submarines are to be improved: missile-carrying, antisub, radar patrol, trans-

port, as well as universal. U.S. military specialists some time ago showed the possibility and advisability of creating a subplane, that is, an aircraft which can submerge—a flying submarine.

In solving the questions related to the further development of surface vessels in foreign nations, a great deal of attention is being paid to using the air-cushion principle, to creating seasleds, and the introduction of hydrofoils. Ideas have also been proposed on creating semisubs, or a submerged hull and small superstructures protruding from the water. There has been specific discussion of building a tanker submarine, a submergeable amphibious vessel as well as a submergeable aircraft carrier. The development of STOL aircraft can increase the number of aircraft carried on surface vessels.

Abroad great attention is being paid to studying the possibilities of creating various types of atomic engines for ships (antisub carriers, large surface vessels, and possibly destroyers as well as, certainly, submarines). Research is being conducted on developing fundamentally new propulsion units including thermoelectric generators, fuel cells, and MHD generators.

Submarine weapons will be developed intensely. As foreign military specialists feel, first of all the ballistic missiles designed for destroying targets on the continent will be improved by increasing the range and payload, by raising the accuracy and creating homing torpedoes. Not excluded is the appearance of homing ballistic missiles with conventional charges of great precision for destroying such targets as radars, radio stations, navigation stations, and so forth. The intensive development of antisub weapons must also be expected.

At present, the missile-assisted torpedo of the Subroc type is considered to be the most effective weapon against subs. One can expect an increase in the range and accuracy of this type of missile. The submarines of foreign navies will continue to be armed with torpedoes which will develop as homing ones with a continuous increase in their range.

Abroad, intensive searches are underway for new means and methods to detect submarines. Sonar equipment is being improved, and new systems are being developed including gas analyzers, radioactive water detectors, and so forth. They are also studying the possibility of using the properties of metal to absorb electromagnetic oscillations from the "surface wave" (from the wake of the sub). They are also examining the possibilities of using infrared equipment, the biological and chemical changes in the water in the submarine's wake, the gravitational anomaly, temperature of water layers, water salinity, the character of the bottom, and so forth.

6. Conventional Weapons Systems for National Air Defense Troops

Under present-day conditions, the role and significance of air defense troops are constantly increasing, as they must destroy the air offensive

weapons in flight, and protect the nation and armed forces groupings against air attack. In the United States and a number of other nations, the air defense troops in organizational terms are part of the air force, but in actuality they have been given the role of an independent service of the armed forces. The air defense troops consist of fighter aviation, antiaircraft missile troops, and radar troops, as well as forces and means for warning of a missile attack and monitoring outer space. In this section, we will examine the state of national air defense troops using the materials of the foreign press.

Air defense fighter aviation is armed with short- and long-range interceptors. For antiaircraft defense of U.S. territory, the F-101 and F-106 interceptors are used. The NATO nations use for this purpose the multipurpose F-4, F-104G, Mirage-III, and other fighters. The modern interceptors have the following technical significations: range of 1,600–2,400 kilometers and up to 4,000 kilometers, speed of 2,000–2,500 kilometers per hour, and a ceiling of up to 20 kilometers. They are armed with several air-to-air guided missiles of the Falcon type (range of around 10 kilometers) and the Sparrow type (range of up to 15 kilometers). It must be expected that the F-15 and F-14 fighters which are now being developed will be used for actions over U.S. territory. The air defense interceptors more and more are approaching missiles, and they are being equipped with a guidance system which makes it possible, upon command from the operations center, to bring the interceptor automatically into the target region.

The antiaircraft missile troops are armed with long-, medium; and short-range missiles. The long-range antiaircraft complexes include the unmanned interceptors of the Bomarc type. They possess the following characteristics: horizontal range of up to 400 kilometers, a speed of M = 2.5–3, and an altitude of 19–23 kilometers. The medium-range antiaircraft complexes (Nike-Ajax and Nike-Hercules) have a range of up to 130 kilometers, an altitude of up to 30 kilometers, and a speed of up to 800 meters per second. The short-range antiaircraft missiles (Hawk and others) have a range of 15–30 kilometers, an altitude of 750–15,000 meters, and a speed of up to M = 2. Certain antiaircraft missiles as well as the air-to-air missiles can carry nuclear and conventional charges. The SAM-D missile which is being developed in the United States is to be used for covering U.S. territory (a range of up to 150 kilometers and an interception at high, medium, and low altitudes).

Radio-technical troops are armed with various types of early warning radars (a range of up to 5,000 kilometers) as well as close-range radars (up to 600 kilometers), and electronic equipment for target selection, guidance, warning, and control. In the missile attack warning system of the United States, they use the BMEWS radar stations located in Alaska, Greenland, and England, the 440L radar for direct probing from U.S. territory, and the 474N radar for detecting ballistic missiles launched from

atomic submarines. Outer space is monitored by radar and optical devices (the SPADREC system), as well as by special radars (the SPASUR system), the BMEWS system, and the entire reconnaissance system. For command of the air defense troops, semiautomatic and automatic systems have been created, usually including: radars for detection, identification of air targets, and guidance of the active weapons; computer controls at the centers; equipment and data transmission lines from the information sources to the center and from the center to the information users; active air defense weapons.

Under present-day conditions, antimissile defenses assume particular urgency. Work on developing missile defenses in the United States has been underway for a long time now. At present, in accord with the treaty between the USSR and the United States for limiting missile defenses (May 1972), on U.S. territory two antimissile complexes are being created (Grand Forks and Washington) on the basis of the Spartan and Sprint antimissile missiles. The Spartan antimissile complex is designed for the long-range interception of ballistic missiles at an altitude of several hundred kilometers, outside the atmosphere. The Sprint antimissile complex, with nuclear or conventional charges, is designed for intercepting ballistic missiles after atmospheric filtration. It can also be used for defending important objectives (military bases, command posts, governmental bodies, and so forth).

The antimissile complexes are equipped with PAR radars (interception range of up to 4,000 kilometers) and MSR radars (for guidance).

The U.S. existing active air defense weapons include the TAT complexes (a Thor missile with three launching boosters) on Johnston Island (the Hawaiian Islands) and the Nike-Zeus antimissile missile on Kwajalein Island (the Marshall Islands). In the American press, it has been pointed out that these complexes are able to intercept satellites from altitudes of 300–350 kilometers (Nike-Zeus) to 640 kilometers (TAT). Manned and unmanned space vehicles are used for carrying out the missions of satellite inspection.

In speaking about the prospects of antimissile weapons, it should be pointed out that abroad a great deal of attention has been given to improving the equipment for detection, interception, tracking, target selection, and guidance of active weapons to the air and space targets. Obviously the capabilities of radar equipment have been far from exhausted. In the West successful work is being carried out on creating a radar system which would operate on the principle of return angle probing from the ionized strata of the atmosphere, from the earth's surface, and from the ionized gaseous trail of the missile from a great range (4,000–9,000 kilometers) and a great accuracy in determining the current coordinates. Research is being conducted on the possibility of using the ionospheric disturbance caused by the flight of the target at a great altitude for detecting the targets, as well as the radio-frequency radiation from

the jet trail of the engines, the low-frequency sound waves which arise in launching the missile, and so forth. Great attention is also being given to the questions of using infrared equipment for detecting missiles and space targets. Particularly intensive research is being done on the possibility of using lasers for detecting the targets, for determining the current coordinates, as well as for identification, warning, and guidance.

The active means of defense, as is felt abroad, will develop as universal homing systems capable of destroying various targets including aircraft, missiles, and even spacecraft. In the United States, mobile systems are being created which supposedly will be able to intercept aircraft, flying bombs, and tactical missiles. Weapons against ballistic missiles can develop on the basis of systems similar to Spartan and Sprint. Their further improvement must be expected.

In a number of foreign nations, intensive searches are underway for other ways to solve antimissile defense.

Great attention is being given to the so-called screening missile defense system, consisting of a number of satellites with antimissile weapons. Research is being carried out on the possibilities of using electromagnetic energy for destroying the warhead on the terminal leg of the trajectory or for deflecting the missile, for changing the aerodynamic characteristics of the missiles. This can lead to the burning up of the missile in reentering the dense atmospheric layers. Recently, the eyes of Western scientists have turned more and more to the use of lasers, radio frequency radiation, plasma energy, a flow of high-energy particles, and magnetic energy for the purposes of missile defense.

Extensive research is also being conducted in the area of developing active space defense weapons. In the United States, research is being carried out in two directions: developing ground-to-space weapons and interceptor satellites.

Electronic equipment is being rapidly developed, in providing for control, reconnaissance, target designation, navigation, automatic weapons use, and electronic countermeasures.

The foreign press has given great significance to developing electronic systems of a higher type, that is: self-homing, self-controlling, "self-learning," and identifying.

At the present stage, the development of automated systems for controlling the armed forces, for reconnaissance and navigation is an urgent problem. In certain imperialist nations of the West they are examining primarily the possibilities of improving the methods and means for collecting and processing information. Radar and TV instruments, electronic computers, automatic sensors, and so forth will be more and more widely used for these purposes. In recent years, in the armies of the foreign states, along with cumbersome radars mounted on a wheeled or tracked base, they are also using portable radars based on the Doppler effect. They make it possible to determine the coordinates of ground targets

and the exploding of projectiles at distances of up to 20 kilometers. Great attention is being given to the development of aircraft radars for observing the battlefield.

Infrared devices are also being used for reconnaissance. They are divided into two classes: infrared radars and night vision instruments. The infrared radars detect targets from their thermal radiation, and they do not send any energy to the object. This makes it possible to conceal their work. The drawback of the infrared radars is their short range. The night vision instruments work in tandem with an infrared ray projector. They are widely used as weapons sights and night driving instruments for combat vehicles.

Abroad television sets are considered to be a very promising means of reconnaissance; they can be used for observing from ground posts, from aircraft, and from unmanned reconnaissance planes.

Abroad the LIDAR is considered to be one of the most promising means of battlefield reconnaissance. The LIDARS can be used for surveying the terrain, for determining location and range to targets, as well as for control.

Foreign specialists have pointed out that automated troop command facilities can include means of communications, radar and TV equipment, electronic computers, display screens, information storage equipment, equipment for the quick reproduction of documents, and equipment for the automatic circular transmission of signals and commands.

Abroad they are actively discussing the questions of the further development of the means of defense, reconnaissance, and forecasting for the destructive factors of weapons of mass destruction. It is a question of developing new therapeutic and preventive medicines, improving the individual and group means of protection, as well as developing the methods of automatic reconnaissance and contamination forecasting.

The brief analysis of the state and prospects of development for conventional means for waging war makes it possible to conclude that in this area there have been as significant changes as in the most recent means designed for the use of nuclear weapons. There has been the appearance of new tanks, aircraft, surface vessels and submarines, artillery, small arms, antitank and antiaircraft weapons, and the means of control. The land forces, aviation, navy, and air defense troops have acquired new, higher fighting qualities. For this reason, fundamental changes are also inevitable in the methods of conducting combat actions with the use of conventional weapons in comparison with the period of World War II. At present there will no longer be the former concentration of forces and means in limited areas in conducting military operations on land and sea areas, as well as in the air. This is caused not only by the presence of the constant threat of nuclear attack by the enemy, but also by the circumstance that conventional weapons have become much more effective than in the past.

Chapter IV. The Development of Military Technology and the Present Organization of Armed Forces

New weapons and military technology have constantly influenced the structure and organization of the armed forces.

The more significant the changes in weaponry, the more rapidly the organizational structure of the troops alters. This is a natural process which can be traced over the long history of the army and navy.

Over the entire history of wars and military art, weaponry and military technology have undergone a long path of development, including both periods of gradual, evolutionary development, as well as periods of rapid revolutionary jumps.

The improvement in the already known examples and types of weapons, military technology, and various combat vehicles does not tell immediately on troop organization. These weapons, in being gradually introduced into the subunits, units, and formations, in a way "thrust themselves" into the existing organization of the troops. At the same time, these improved examples of weapons and the increase in their quantity gradually lead to the growth of the combat capabilities of those subunits, units, and formations, to which they have been supplied. The improvement in firearms has led to an increase in fire density, piercing strength, and the destructive properties of ammunition, as well as the accuracy of fire, and has created possibilities for the simultaneous destruction of enemy objectives to a great depth. The improvement in the types of engineering works, transport, communications, and other technical means has made it possible to raise the quality of combat and operational support, to increase the mobility of troops both on the march and on the battlefield, and to improve troop command.

The slow growth in the quality and quantity of weapons has led to a gradual improvement and development in the organizational structure of the troops. The appearance, though, of qualitatively new types of weapons has led to a situation where the new weapons cannot be "forced" into the existing organizational forms. The need arises of creating new sub-

units, units, and formations, the organizational structure of which would make it possible to most efficiently utilize these weapons. In this manner arise not only subunits and units which are new in terms of their structure and fighting capabilities, but also new branches of arms and then new services of the armed forces.

1. General Fundamentals in Development of the Organizational Structure of the Armed Forces

The Development of the Organization of Armed Forces

Since antiquity to the beginning of the 20th century, the armed forces consisted perpetually of ground forces and the navy.

The infantry, the oldest and basic branch of arms, underwent a long path of development from soldiers armed with silent weapons to modern motorized rifle troops. The invention of gunpowder and small arms led to the appearance of riflemen in the infantry, and these men were in the front ranks of the closed-up columns and other battle formations, and then the artillery. The long development of the infantry led to its most effective organization, that is, squads, platoons, companies, battalions, and regiments on the inferior level, and divisions and corps on the superior.

As hand weapons and artillery improved, with the appearance of automatic weapons (various types and systems of machine guns), and the development of other military equipment, the infantry units and subunits incorporated and acquired subunits and units of artillery, engineers, communications, reconnaissance, as well as units of new branches of arms such as tank and chemical. The structure of the infantry rear was also improved.

In line with the mass introduction of firearms, the methods of military actions grew more complex, while the significant quantitative increase of the infantry in the war required the combining of infantry formations in the army, and then into army and navy groups.

The infantry gradually lost its old appearance, and in the course of the wars in the second half of the 19th century, developed into a qualitatively different branch of arms, that is, into rifle troops which for a long time became the basic branch of arms of the land forces and which carried out the basic missions of war.

Slowly, in keeping with improvements in the quality of artillery guns and their ammunition, artillery developed into an independent branch of arms, and was formed as subunits, units, and formations, that is, batteries, battalions, regiments, brigades, divisions, and corps. This was necessitated primarily by the interests of creating high densities of artillery fire, command in combat and the engagement, as well as command and training of artillerymen in peacetime.

The cavalry which in many wars of the feudal period played a significant independent role, subsequently did not attain the same development as the infantry. During individual periods and particularly in the old Russian Army, as well as in the Red Army, the cavalry had a comparatively high proportional amount, and was used for carrying out important missions of not only tactical but also a strategic sort. For a long time, the cavalry was the basic means for developing an operation in depth. The horse army was the largest force in the cavalry. After World War II, in line with the gigantic development of weapons and military equipment, and the complicating of the conditions and methods for military operations, the cavalry left the scene, abandoning its place in combat and the operation to the mobile armored and mechanized troops.

The navy, due to the specific missions carried out by it, has always been an independent service of the armed forces. It has undergone a long path of development. The appearance of submarine naval forces and naval aviation, and particularly nuclear rocket weapons and atomic propulsion units in the 20th century, fundamentally altered the appearance of the navy as an important type of armed forces, as well as its role in the war, the scope and methods of military operation.

World War I showed the significant role for the new weapon which the aircraft had become. In the period between the two world wars, aviation developed both quantitatively and qualitatively, and gradually became a new, independent service of the armed forces. This, in turn, led to the rapid development of the weapons for countering aviation, as well as to the creation of such a type of armed forces as the air defense forces. The development of aviation also caused the creation of a new branch of arms, the airborne forces. Finally, rapid military technical progress, by the beginning of the 1960's, had led to the formation of missile troops able to carry out missions on a varying scale. The strategic missiles armed with nuclear charges are of the greatest significance in changing the nature of modern war.

How the Structure of the Soviet Armed Forces Has Developed

The Soviet Armed Forces, created and led by the Communist Party, have grown and developed along with the growth and strengthening of our state.

The overall structure of the USSR Armed Forces, up to the end of the 1950's, remained basically unchanged. The Land Forces occupied the largest proportional share in them. This can be seen from the data relating to the Great Patriotic War. The Land Forces in the early stages of the war comprised from 80.7 to 87.2 percent of the personnel of the armed forces. The other types, respectively, were: 8.7 and 6.2 percent for the

Air Force, 7.3 and 4.5 percent for the Navy, and 3.3 and 4.8 percent for the National Air Defense Troops.

After the end of the Great Patriotic War, the Communist Party gave enormous attention to the further development and strengthening of our Armed Forces. Here the party has followed the instructions of V. I. Lenin that the army, in order to carry out the missions entrusted to it of defending the socialist state, should be well organized, and its weapons should be on the level of the modern achievements of science and technology.

The process of improving the organizational structure of the armed forces has occurred continuously. Not only in the course of military operations but also in the course of peacetime military preparations, contradictions have arisen between the individual aspects of troop organizational structure and the increased possibilities of the new weapons, new tasks and methods of actions. For example, the necessity of increasing the rate of advance of land forces has caused changes in their structure for better coordinating fire and movement. The greater demands made upon the mobility of command over forces and troops have necessitated an improvement in the organs of command, the signal troops and their technical outfitting. The development of enemy air attack weapons and methods of their actions has placed new demands upon the weapons and structure of the air defense troops, and so forth.

Political and Organizational Principles in the Development of the Soviet Armed Forces

The development of the armed forces is a complex and many-faceted process. This process is based on the political and organizational principles which have been elaborated and tested over the more than 50 years that the army and navy of the Soviet State had existed.

The underlying fundamental of Soviet military construction is leadership by the Communist Party over the Armed Forces. Even in 1918, the Party Central Committee, upon the initiative of V. I. Lenin, approved a decree which stated that "the policy of the Military Department, like all the other departments and institutions, is conducted on the precise basis of the overall directives issued by the party in the form of its Central Committee and under its direct control." [1] This Leninist thesis has also been stated in the CPSU Program. Its constant observance provides for the continuous strengthening of the military might of the Soviet Armed Forces.

The unity of the army and the people is the most important principle of Soviet military development. The Communist Party, in all its activities

[1] *V. I. Lenin i Sovetskiye Vooruzhennyye Sily* (V. I. Lenin and the Soviet Armed Forces), Moscow, Voyenizdat, 1967, p 128.

in the area of military development, has proceeded from the fact that the Soviet Army is the blood offspring of the Soviet people, and that the strengthening of the defense capability of the nation as well as the military might of the Armed Forces is the duty of all the people and each Soviet citizen.

Of enormous significance is the principle of socialist internationalism which was clearly manifested during the years of the Civil and Great Patriotic wars and underlies the development of the armed forces in the socialist states at present. "The Soviet Armed Forces," said Mar SU A. A. Grechko, "are in a single battle formation with the armies of the fraternal states. Under the conditions of the existence of the world socialist system, the international commitments of our Armed Forces have broadened, and the possibilities of defending the victories of socialism and communism have changed. At present, in contrast to the past, there is an opportunity to defend each member of the socialist community not only by its own forces, but also by the joint forces and means of all the socialist states . . . The Soviet Armed Forces, together with the armies of the other Warsaw Pact states, have become a steel barrier blocking the aggressive plans of the imperialists as well as defending peaceful labor." [2]

Also among the basic principles is one-man leadership in the Soviet Army and Navy, providing a unity of the will and actions of large masses of people, iron discipline and organization in the course of a war and under peacetime conditions.

Along with the political principles, the organizational principles for the development of the armed forces also are of important significance. There is above all the principle of providing the fullest possible conformity of the organizational forms for the armed forces to the nature of modern war, as well as the goals and tasks which must be achieved in conducting it.

Another organizational principle is the harmonious development of the services of the armed forces, the observance of which provides for determining the main services of the armed forces which must carry out the basic and most important tasks of war, as well as determine the main branches of arms and types of forces within each service. The unswerving realization of this principle helps to develop all the other services of the armed forces and branches of arms as is necessary for providing their successful coordinated actions and the achieving of the goals by common efforts. The nature of modern war and the goals and tasks in it for our armed forces require the observing of the principle of maintaining a regular standing army on the basis of universal military obligations.

A task for the commanders and staffs of all levels is a profound study of the experience of the Great Patriotic War and peacetime military preparations; this will make it possible to successfully carry out the missions of strengthening the defense capability of our motherland.

[2] A. A. Grechko, *Na Strazhe Mira i Stroitel'stva Kommunizma*, p 107.

2. Military-Technical Progress and Present-Day Organization of the Armed Forces

The Army, Air Force, and Navy of the Soviet Union are qualitatively new Armed Forces which differ from those which emerged from the Great Patriotic War. Their new weapons, military equipment, and organization provide, in the event that the imperialists start a war, for the successful carrying out of the major and involved tasks related to defeating the aggressor on land, in the air, and at sea.

The Soviet Armed Forces at present consist of the following types:

The Strategic Missile Forces;

The Land Forces;

The National Air Defense Forces;

The Air Force;

The Navy.

The Formation of the Independent Service of the Armed Forces—the Strategic Missile Forces

The outstanding discoveries of Soviet science in the area of atomic physics, along with the enormous achievements of other sciences, and particularly mathematics, chemistry, and electronics, have been the scientific-technical basis for creating nuclear weapons and missiles in our nation; the missiles are the most advanced means of delivering this mighty weapon to the objectives. This led, at the beginning of 1960, to the formation of a new, independent service of the Armed Forces, the Strategic Missile Forces which are the basis of the military might of our Armed Forces.

What are the most important distinguishing features of the Strategic Missile Forces [RVSN]?

As was already stated, the ballistic missiles with which the RVSN are armed possess virtually unlimited range. In the event of a war, this will make it possible to carry out combat missions differently in comparison with the last war. The missile strikes will be directed mainly at objectives and targets which are deep in the enemy rear, to the entire depth of the theaters of military operations, and on any continents from which aggression originates even if they are separated by broad expanses of seas and oceans. Consequently, there are no unreachable objects for the RVSN.

One strategic missile is capable of carrying a nuclear charge of a power which surpasses the energy of all the explosives used during the years of World War II. The power of the missile nuclear charges is calculated in terms of the quantity of energy given off in detonating a certain amount of a conventional explosive, for example, TNT.

The nuclear charges of strategic missiles reach a power of many hundreds of thousands and millions of tons. According to the calculations of American scientists, one thermonuclear bomb is sufficient to obliterate a major city. This means that not only individual targets and objectives can be destroyed, but also entire military-economic regions on enemy territory. The use of a certain number of strategic missiles with nuclear charges of the megaton capacity can lead to the withdrawal of entire states of a hostile coalition from the war.

Among the important qualities of the RVSN is the exceptionally high accuracy of hitting the target without any ranging, with the first missile launch.

The high dependability of reaching the target is also an important characteristic of strategic missiles.

The speed of a missile is many times greater than the muzzle velocity of an artillery shell and the speed of a modern fighter. Strategic missiles can be used at any time of the day or the year, regardless of weather conditions.

A major feature in the performance of the missiles used by the RVSN is their enormous combat capabilities in terms of the force of destruction and their high combat readiness. For this reason, the Communist Party and the Soviet government have given constant and unflagging attention to the qualitative development of these forces, as well as to improving the system and means of their control on the basis of scientific and technical achievements.

All mentioned characteristics of the RVSN emphasize the enormous incomparable force and effectiveness of their use. The creation, continuous development, and improvement of strategic nuclear missile weapons and the development of the mass production of these weapons by our industry, in making it possible to develop the new service of the armed forces, the RVSN, have fundamentally altered the nature of modern war, as well as the methods and forms of the combat use of the other services of the armed forces. The enormous combat strength and the constant combat readiness of the RVSN, at present make them the chief means for thwarting the aggressive desires of the imperialists.

The Land Forces

The modern Land Forces are designed for carrying out important tasks related to armed struggle on the continental theaters of military operations. In recent years, the entire appearance of the Soviet Land Forces has changed decisively. Their firepower, striking force, and mobility have risen enormously.

The Land Forces have powerful nuclear weapons, and are equipped with high-quality military equipment. The strategic and tactical missile forces are the basis of the firepower of the Land Forces for defeating

the enemy, and are able to destroy his objectives to a depth of many hundreds of kilometers. This factor alone has greatly increased the depth and rate of advance of the Land Forces, and has also raised their resistance under the conditions of conducting defensive actions on any area of the front. The National Air Defense Forces have gained significant development, and are equipped with modern combat equipment. This makes it possible for them to successfullly combat airborne targets at different altitudes, and provide constant cover for the units and subunits of their own troops and rear against air attack.

The motorized rifle troops have eliminated from the Land Forces the traditional infantry with its weak weapons and slow advance on the march and in combat. The motorized rifle troops have automatic weapons, artillery and mortars, and effective weapons for countering enemy tanks in close combat, and they operate on armored military vehicles. Their maneuverability has risen by many times.

Tank troops are the basic attack force of the Land Forces. The modern Soviet tank is an advanced vehicle which in terms of a number of major technical specifications, surpasses the new tanks of the capitalist armies. Of all the branches of the Land Forces, the tank troops are most adapted to rapid and fluid combat operations under the conditions of using nuclear weapons. High mobility and firepower make it possible for them to use nuclear strikes quickly and effectively. The tank troops are a modern and very promising branch of arms.

The Land Forces at present are equipped with modern communications, engineer equipment, and other means.

The signal troops consist of subunits and units, and have powerful radios of various bands and other communications equipment providing the transmission of orders, commands, and reports under any complex and rapidly changing situation, over long distances, and under the conditions of using radio jamming by the enemy.

In the actions of the engineer troops, a prominent place is held by supporting the movement and maneuvering of the troops on the terrain. For this purpose various highly productive machines have been designed, and these, at a high speed, build crossings over gulleys and ravines, fill in pits and holes, cut brush, clear snow off of roads, and so forth.

The cutting of passages through enemy mine fields is done not by hand, as was the case even in the last war, but by mine-clearing tank attachments. The rate of clearing is very high. For quickly preparing the terrain for defense, the engineer troops have a very diverse range of earth-moving equipment, mine layers for laying mine fields, and other machines.

In the Land Forces, water-crossing equipment is being rapidly developed, and this makes it possible to cross water obstacles in a very short time. This includes diverse amphibious vehicles and tracked transporters, temporary floating bridges of varying load capacity, as well as other water-crossing gear.

The engineer troops as a whole consist of units and subunits of the most diverse purposes for supporting combat activities of all services of the armed forces.

As weapons and military equiqment have developed, as well as a result of studying and utilizing combat experience, the organizational structure of individual units and the Land Forces as a whole has changed. The Land Forces which operated on various axes were divided into large strategic formations, or armies made up of divisions and corps. Thus, by the beginning of the Patriotic War of 1812, the Russian troops on the western frontier consisted of three armies: the First Army of Barklay de Tolli which was deployed in the region of Vil'no and numbered 127,000 men and 550 guns; the Second Army of Bagration which was to the west of Slonim and consisted of 45,000 men and 170 guns, and the Third Army of Tormasov in the region of Lutsk with 40,000 men and 168 guns.

In World War I, the increased number of troops and the scale of combat in the theaters of military operations led to higher strategic groupings of the Land Forces, that is, fronts. With the beginning of the war in 1914, there were two fronts in the Russian Army. The Northwestern Front was made up of two armies (27.5 infantry and cavalry divisions with 381,000 men) and the Southwestern Front which had four armies (47 divisions with 697,000 men). In the course of the war, one other (Western) front was formed.

With the beginning of the Great Patriotic War, on the western frontiers of our state, there were five fronts (Northern, Northwestern, Western, Southwestern, and Southern). Later on the number of them increased significantly, and by the end of the war, we already had 12 fronts. The defeat of the Kwantung Army of imperialist Japan in August 1945 was carried out by three fronts.

In the course of the Great Patriotic War, the fighting composition of the fronts was determined. Ordinarily the front consisted of up to five and more combined-arms armies (each of nine rifle divisions in three rifle corps), one and sometimes two tank armies (of two-three tank and mechanized corps), and one air army which consisted of several aviation corps such as bomber, assault, and fighter. The front also included separate tank, mechanized, and cavalry corps, the artillery and engineer formations of the RVGK [Reserve of the Supreme High Command] and other special troops which were used most often for the qualitative strengthening of the combined-arms and tank armies operating on the main axes.

If one were to trace the development trend in the organizational structure of the fronts during the period of the Great Patriotic War, a general pattern of this development could be noted, and that is, the continuous growth of their fire and attack power by including a significant number of artillery formations, tank troops, and aviation, the fighting qualities of which also developed continuously.

The continuous development of air attack weapons even during the period between the two world wars led to the development of an independent service, the National Air Defense Forces, in the Soviet Armed Forces with the start of the Great Patriotic War. Under present-day conditions, their main task is to repel a surprise air attack by the aggressor and to provide for the continuous running of the national economy and state administrative bodies as well as the combat capability of the armed forces in the course of the military operations.

The National Air Defense Forces were created and developed as an independent service of the armed forces during the period of subsonic speeds in aviation. The weapons of the Air Defense Forces corresponded to this, and they consisted of fighter aviation, antiaircraft guns, and machine guns. The air observation and warning system was based upon visual observation from the ground, and had very primitive communications.

At present the National Air Defense Forces are one of the most important services of the armed forces. They have been rearmed with modern weapons and military equipment.

At present antiaircraft missile troops and missile-carrying interceptors are the basic combat might of the National Air Defense Forces. The missile, as a new and most advanced type of weapon, has also altered the structure and organization of the National Air Defense Forces. Aside from these two basic branches of arms, the National Air Defense Forces also include the radar troops.

The antiaircraft missile troops are armed with various types of combat complexes.

The antiaircraft missile troops are able to destroy enemy airborne attack weapons under the most diverse conditions at the distant and near approaches to the defended objectives and areas. A particular feature of the missiles is their controllability in flight. While in the past conventional antiaircraft artillery wasted hundreds of shells on destroying one aircraft, at present the target can be destroyed with the first missile.

The air defense fighter aviation at present is armed with all-weather, supersonic missile-carrying interceptors able to operate at low and high altitudes. The fighter aviation units are also armed with long-range interceptors which can destroy various airborne targets under any weather conditions, and at any altitudes and speeds.

The radar troops perform important tasks in the national air defense system. The various radioelectronic devices used by these troops make it possible to detect any airborne enemy weapons at a great distance, to identify them, to determine the precise coordinates, and provide prompt target designation for the antiaircraft missile troops and the guiding of fighter aviation to the targets. The combat activities of radar troops are

carried out continuously at any time of the year or day, regardless of weather conditions and enemy interference.

The National Air Defense Forces are constantly in a high state of combat readiness and stand combat duty continuously.

The Air Force

The Air Force is a service of the armed forces the history of which goes back just several decades. Aviation began to be used in World War I, although at that time it did not play an important role. In the period between the two world wars and particularly in World War II, aviation which by that time had undergone great quantitative and qualitative development became an important strategic weapon.

After the Great Patriotic War, the Soviet Air Forces was fundamentally changed. Its fighting capabilities have constantly grown. In the development of the Air Force one can feel particularly strongly the achievements of scientific-technical progress in the area of developing powerful jet engines, as well as elaborating the aerodynamic properties of new aircraft, new types and grades of fuel, radioelectronic equipment, missile weapons, and so forth.

In the development of aviation over the last 20–25 years, the main thing has been that aviation received supersonic jet aircraft from our industry. Modern jet aircraft fly at a speed of 2,500–3,000 kilometers, and reach an altitude of 30 kilometers.

The second important factor for the decisive growth of the combat capabilities of aviation has been the arming of aviation with nuclear weapons. Aviation has become missile-carrying and able, from great distances, to destroy not only large stationary targets, but also, and very importantly, small mobile ground and sea targets.

The modern Air Force includes various branches of aviation.

At present *long-range aviation* plays an important role, and is armed with aircraft able to carry nuclear missiles. This aviation is able to destroy important strategic and tactical objectives at a great depth and with sufficient reliability. The strikes by long-range aviation can substantially supplement actions of the Strategic Missile Forces and the Navy.

The Air Force formations and units designed for joint operation with Land Forces comprise *frontal aviation*. Tactical aviation includes aircraft with a range making it possible to destroy objectives and targets to a significant depth in direct line with the strikes by tactical missiles and the actions of assault tank groupings.

For even closer coordinated action with Land Forces, in tactical aviation there is also the fighter-bomber able to destroy targets in close operational and tactical depth, and by this immediately contribute to the success of military operations of the motorized rifle and tank troops.

Fighter aviation units carry out missions of covering troops and objectives of the rear.

The Air Force is also entrusted with the tasks of landing airborne troops deep in the enemy rear, supporting troop maneuvers over great distances within limited periods of time, as well as transporting important cargo to the troops. The importance of these missions carried out by *military air transport* which is a branch of the Air Force, with the present nature of war, has risen significantly. At present the Air Force includes helicopters which can carry out a broad range of missions such as neutralizing the enemy on the battlefield and in his rear, transporting troops and equipment, and so forth.

Finally, *reconnaissance aviation* has effective equipment able to establish and identify various important objectives in the enemy positions. However, the missions of air reconnaissance can also be carried out by other combat aviation aircraft.

There has been a continuous growth in Air Force support units, and above all the various types of technical and engineering units able to quickly carry out airfield basing for aviation and provide technical servicing for combat operations of the various branches of the Air Force.

The role of the Air Force in armed combat is so important that no significant operation in a future war, and military operations as a whole in their various forms and manifestations, can occur without the active involvement of aviation which is able to carry out major and diverse missions both independently and in collaboration with the other services of the armed forces.

The Navy

In the development and organization of the navies of the major states, prior to World War II, preference was given to large surface vessels (battleships and cruisers) with heavy artillery weapons. Submarines as well as naval aviation also occupied a significant place in the navy even from World War I.

The Soviet Navy played an important role in the Great Patriotic War, in cooperating closely with the Land Forces in defensive and offensive operations involving the coastal axes. After the Great Patriotic War, our Navy decisively altered its qualitative combat composition.

What processes have occurred in the development of the Navy, considering the experience of World War II and the qualitative changes in the postwar period related to arming the Navy with nuclear weapons and building submarines with atomic propulsion units?

The main pattern in the development of the Soviet Navy has been the continuous rise in its firepower. The increased maneuverability of the modern forces of the Navy has made it able to carry out combat missions in remote areas of the world ocean.

The Soviet Navy consists of diverse types and classes of ships with modern tcehnical equipment and powerful nuclear missile weapons. At present, *atomic submarines and missile-carrying naval aviation* are the main attack force of our Navy. These means, and above all the atomic missile-carrying submarines, can attack important enemy objectives located deep in his territory, as well as groupings of enemy naval forces.

Soviet atomic missile-carrying subs have powerful nuclear weapons, they possess a great range and are able to appear quickly for carrying out combat missions in virtually any region of the world ocean. The around-the-world voyage of a group of our atomic submarines and the voyage of subs under the ice of the Arctic Ocean show their high seaworthy qualities and combat capabilities.

Missile-carrying naval aviation at present consists of units armed with missile-carrying aircraft, the basic weapons of which are air-to-ship and air-to-ground missiles. The missile-carrying naval aviation, in cooperating with submarine forces as well as independently is able to detect and make strong atacks against aircraft carrier forces of the enemy in the open sea, as well as against other sea and ground enemy objectives.

In the Soviet Navy, means have also been improved for combating enemy atomic subs in the open sea, as well as enemy carrier strike forces and for fighting on the sea communications.

Surface vessels of the Soviet Navy are also represented by modern ships which have high seagoing qualities and modern weapons.

In the Navy there are also marines, the amphibious and combat equipment of which makes it possible to carry out amphibious operations in major regions of theaters of military actions.

Aside from designated basic combat missions, during a war the navy can be confronted with any other missions, for example, protecting its own sea communications, antiamphibious defense, transporting by sea human reinforcements and materiel as well as a number of others. For these purposes, the navy has the appropriate forces and classes of ships.

In recent years the Soviet Navy has received many new weapons, and is on the level of the present-day demands for combating a strong imperialist enemy.

All the services of the armed forces, branches of arms, and branches of forces, their weapons, military equipment, composition and organizational structure are constantly developed. The concern of the Communist Party and the Soviet government is focused on making the Soviet Armed Forces constantly on the level of the most recent achievements of our science and technology.

The present state of the Soviet Armed Forces conforms to the chief demand which is placed upon them by our party and government, that is, to be in a state of constant combat readiness. The 24th CPSU Congress gave very high praise to the present state of the Soviet Army and Navy.

The process of changing the structure of the armed forces at present is occurring in all nations of the world. It is manifested most clearly in those states where economic conditions make it possible to produce a sufficient quantity of new weapons and military equipment.

The armed forces of the United States and the other developed capitalist states (Great Britain, France, and West Germany) consist of three independent services: land forces, air forces, and navies.

The U.S. armed forces possess the greatest combat might. They have significant strategic nuclear forces consisting of ballistic missiles, strategic aviation, and atomic submarines armed with Polaris missiles.

In Great Britain and France, the strategic nuclear forces as a whole are insignificant both in terms of their composition as well as in terms of their fighting quality. The West German armed forces formally do not have nuclear weapons, but these weapons belonging to the Americans are stockpiled in significant amounts in dumps located on West German territory, and with the beginning of imperialist aggression against the socialist nations can be turned over to the units and formations of the Bundeswehr which have the carriers of these weapons. The representatives of West Germany revanchist circles are not abandoning the hope of obtaining nuclear weapons.

The U.S. land forces consist of motorized infantry, armored troops, artillery, army aviation, engineer troops, signal troops, and various services. There is no clear delimitation between the branches of arms and the services. For example, army aviation, engineer troops, and certain others are simultaneously considered to be branches of arms and services.

In the U.S. land forces there is a significant amount of tanks, artillery, and various tactical missiles. Nuclear weapons are an organic part of the armies, formations, and units. The U.S. land forces include infantry, mechanized, armored, and airborne divisions which in necessary instances can be grouped into army corps and armies.

The U.S. Air Force consists of tactical aviation commands, the Strategic Air Command, and the Air Defense Command which are the basic large strategic formations of the American Air Force.

A particular feature of the U.S. Air Force is the fact that it includes not only strategic aviation, but also strategic missiles and air defense means. The Strategic Air Command consists of air armies, while the tactical command is made up of air divisions.

A particular feature of the navies of the United States, Great Britain, and France is the presence, in addition to the formations of submarines and surface vessels and marines, of aircraft carriers which are formed into attack carrier formations and formations of antisub carriers.

The structure and organization of the U.S. Armed Forces reflect the predatory goals of American imperialism and its desire to suppress by force of arms the struggle of peoples in all regions of the world. In 1971, the United States had abroad more than 400 large bases and around 3,000 small bases and strongpoints with more than 1 million American soldiers and officers. Special strategic forces have been created on the continental United States for reinforcing its forces on overseas territories at the needed moment. These include airborne formations and land forces formations which are constantly ready to move quickly to remote regions of the world. These are the so-called "fire-fighting teams" of the U.S. Army.

As a whole, the multimillion U.S. Army exceeds by many times the size of the armed forces from prewar times. From foreign sources it is known that the United States has more than 1,000 strategic missile launching units, 41 missile-carrying atomic submarines, more than 500 strategic bombers, and a significant quantity of aircraft able to carry nuclear weapons in tactical aviation.

Aggressive imperialist military blocs in different regions of the world also represent an enormous threat to peace. The chief bloc, NATO, has deployed a major strategic grouping of armed forces in the center of Western Europe. The NATO armed forces number 6 million men. There are more than 7,000 nuclear warheads at American depots and bases on the territory of Western Europe. The political and military leaders of the United States are applying great effort so that the military potential of imperialist blocs, and above all NATO military potential, continues to grow.

3. The Structure and Organization of Formations, Units, and Subunits of the Armed Forces

Requirements for the Organization of Troops

Scientific-technical progress and the appearance of new types of weapons have brought to life new methods and ways for conducting military operations as well as the corresponding structure and organization of formations, units, and subunits.

In World War I, the combined-arms formations of land forces were represented by infantry and cavalry formations and units which included infantry, cavalry, artillery, and a certain limited number of special troops. In the armies of a number of nations, there were no tanks or aviation, and in those armies where they had just appeared, they were primitive in organizational terms and possessed poor technical specifications. In the navies there was a predominance of surface vessels with a limited range.

The infantry was armed with a magazine rifle, while the artillery had a light cannon. Moreover, there was a very small quantity of heavy artillery (150 millimeters and larger caliber), and this was used to reinforce

infantry formations. The formations and units had small arms which possessed comparatively low effectiveness, and, in particular, limited range. The development level of weapons and military equipment determined the static character of the entire war in which static defense and its piercing were the basic methods of combat actions for the troops. Piercing of the defense, as a rule, was carried out by a massed troop attack after preparatory artillery fire for many days. All of this made it necessary to have a large number of personnel in the formations, units, and subunits. Also characteristic was structural uniformity. This is proven by the table on the following page from which it can be seen that the troop organization which existed at that time made formations and units cumbersome and immobile on the battlefield while combat actions themselves involved little maneuvering.

With the appearance of tanks and aviation and the further development in automatic weapons, the strike and firepower of troops rose significantly, and methods of conducting combat operations changed. They acquired a more fluid and dynamic character. This, in turn, required changes in the structure and organization of formations and units.

In the course of the Great Patriotic War, in our army new types of combined-arms formations and units appeared and underwent further quantitative development. These included tank, mechanized, motorized, airborne, mountain-rifle, and artillery machine gun (for defending fortified areas).

The trend in the organization of formations and units was a desire to make them more compact, maneuverable, and better controlled. The size of the line, support and maintenance subunits was reduced, while their firepower and striking force rose.

The appearance of tanks and aviation on the battlefield made it necessary to counter them, and this required the creation of units and subunits armed with antitank and antiaircraft weapons and in organizational terms part of the combined-arms units and formations. Moreover, in the land forces there were formations of engineer and chemical troops, signal troops, and others designed for carrying out special missions.

With the development of aviation equipment, it also became specialized in terms of the character and methods of missions to be carried out. Formations and separate units of bomber, attack, fighter, reconnaissance, spotting, and other special aviation appeared. In the Navy there also was further specialization of the submarine and surface fleet, as well as naval aviation, and formations appeared of marines, coastal defense, and formations and units of special troops and services.

Under the present conditions of rapid technical progress and development of new weapons, questions of military development are determined proceeding from the possible character of a future war and the forms and methods for conducting combat operations.

Nuclear and missile weapons, jet aviation, atomic submarines, and

Comparative Table for the Organizational Structure of a Rifle Division

Units and subunits	Year		
	1914	1941, December	1945
Infantry:			
Regiments	4	3	3
Battalions	16	9	9
Submachine gun companies	—	—	6
Machine gun battalions (crews)	1	—	—
Cavalry:			
Cavalry regiments	—	—	—
Cavalry squadrons	1.5	—	—
Artillery:			
Field (conventional):			
Brigades	1	—	—
Regiments	—	1	3*
Battalions	2	3*	6
Rocket:			
Battalions	—	1	1
Antiaircraft:			
Battalions	—	—	1
Batteries	—	3	3
Armored and mechanized:			
Regiments	—	—	—
Battalions	—	—	—
Battalions (batteries) of assault guns	—	—	1
Engineer (sapper):			
Battalions	—	1	—
Companies	1	2	3
Signal:			
Battalions	—	1	1
Companies	—	—	—
Reconnaissance:			
Battalions	—	—	—
Companies	—	1	1
Chemical:			
Companies	—	1	—
Platoons	—	—	—
Total personnel in divisions	17,400	14,483	11,700
Weight of salvo (in kilograms)	297.6	1,700	2,040

* Including one mortar.

other types of weapons have made fundamental changes in the nature of modern war, as well as in the methods and forms of combat operations, and consequently, they have had a substantial influence on the structure and organization of formations, units, and subunits of Land Forces, Air Force, Navy, and National Air Defense Forces.

Under present-day conditions, combat operations of the troops will develop continuously. Certain units and formations will advance rapidly deep into enemy territory, while others will wage a fierce battle with the enemy and repel his attacks. Under these conditions, the units and formations should be able to conduct combat independently, to make powerful and rapid strikes for the purpose of most effectively using the

results of nuclear weapons against the enemy and carrying out his defeat in a short period of time, and to conduct combat at a high pace, to a great depth, continuously, during night and day, and under any weather conditions. And on the part of the formations, units, and subunits, this requires high combat capability, viability, mobility, and maneuverability.

The use of nuclear weapons and other means of destruction by the enemy can not only cause great losses to troops, but also create vast zones of destruction. For this reason, the structure, organization, and weapons of modern formations, units, and subunits should make it possible to conduct combat operations under these complex conditions, to rapidly cross areas of contamination, and provide maximum security for personnel against radioactive contamination.

A most important demand placed upon the present structure of troops is convenience in organizing preparation and control. This means the structure and organization of formations, units, and subunits should make it possible to quickly create the needed grouping of forces and means, to reinforce motorized-rifle and tank units with subunits from other branches of arms, as well as execute a flexible maneuver on the battlefield.

The organizational structure of our formations, units, and subunits provides superiority in forces and means as well as in mobility and maneuverability in comparison with formations and units of the probable enemy. This will make it possible to anticipate the enemy in his actions, to make strong strikes against him, and create conditions for defeating him.

Aside from what has been said, the organization of formations and units and their weapons should conform to specific features of conducting combat operations under conditions of that theater for which they are destined. This is necessitated by the fact that with the present technical level in the development of weapons and military equipment, the exploitation and methods of using them to a significant degree depend upon the terrain, its passability, the capacity of given axes, as well as climatic and other conditions. It is quite apparent that conditions for conducting military operations and using military equipment in mountainous, desert-steppe, or northern regions will be quite different, and methods for conducting combat will be varied. This will place new demands upon the structure and organization of formations, units, and subunits.

Conformity of Troop Organization to Modern Conditions of Conducting Military Operations

Due to the concern of the Party and Government, at present our Armed Forces are the most up-to-date. They possess a sufficient quantity of nuclear weapons, missiles, new types of tanks, artillery systems, and other types of weapons and military equipment.

As a result of major advances in the area of science, the rise in economic possibilities of the nation, the continuous development of new weapons and improvement of old ones, as well as equipping the troops with new types of combat and transport equipment, the structure of units and subunits has changed significantly for all services of the Soviet Armed Forces. Their combat missions have also changed. At present, they have everything necessary for successfully carrying out complex and responsible missions, for achieving the goals of combat, and for conducting broad maneuvers. In each formation and unit, in addition to combat and support units and subunits, there are also service subunits.

In modern formations, the proportional amount of tanks and artillery has constantly arisen, while the caliber of cannons and howitzers has increased. As a result of this, the firepower of a salvo from a modern division, in comparison with a division from the period of the Great Patriotic War, has risen by several fold.

In a speech at the Third Session of the USSR Supreme Soviet, Seventh Convocation, in October 1967, entitled "On the Draft Law Concerning Universal Military Obligations," the USSR Minister of Defense, Mar SU A. A. Grechko, gave very indicative data on the technical level and combat capabilities of the present-day motorized rifle division of the Soviet Army. Today's motorized rifle division surpasses a 1939 rifle division by 16-fold in terms of tanks, by 37-fold in terms of armored personnel carriers and armored vehicles, by 13-fold in terms of automatic weapons, and by five-fold in terms of radio communications. The quality of modern equipment is also significantly higher. Available power of the division rose respectively from 3 to 30 horsepower in terms of motor power per man. The weight of one artillery-mortar salvo is also indicative. While in 1939, it was 1,700 kilograms, at present this salvo equals 53,000 kilograms, meaning that it has increased by more than 31-fold.

The modern formations and units have been completely motorized, and this has significantly improved their maneuverability, and raised their protective capabilities against weapons of mass destruction, particularly in the tank troops.

The equipping of troops with nuclear missile weapons as well as qualitatively better conventional ones, in addition to the complete mechanization of formations, units, and subunits of troops have immeasurably raised their firepower and attack force, their maneuverability, and have provided an opportunity to carry out in combat various missions both independently as well as in cooperation with all the forces and means participating in combat.

Modern formations and units of Land Forces can successfully pierce defenses, conduct a meeting engagement, repulse enemy counterthrusts and counterattacks, and advance at a high rate and to a great depth. Formations and units of the Air Force are able to conduct combat in the air and make powerful bomb strikes against objectives in the deep rear. Formations and units of the Navy are able to conduct combat operations

in the open sea at any time of the day or year, as well as under difficult weather conditions. The Air Defense Forces are constantly ready to fight enemy air attack weapons.

The present organization of formations, units, and subunits provides for their necessary mobility and maneuvering. This is achieved by a harmonious and effective combination of the number of personnel, the quantity and quality of weapons, combat and transport equipment in organizing the units and formations, as well as by a rational balance between combat and service personnel in the formations and units. A violation of this balance can entail a reduction of their fighting qualities.

The presently used system for organizing the formations, units, and subunits provides convenience in organizing and maintaining coordination and command on the battlefield, as well as the effective use of the organic weapons, mobility, and maneuverability.

Thus, the existing organization of formations, units, and subunits corresponds to present-day tactical needs.

4. The Organization of Troop Rear Support

The Role and Significance of the Rear in Supporting Combat Actions of the Services of the Armed Forces

The process of revolutionary transformation in the methods of conducting a war, in the theory of military art and in troop combat training practices, in occurring under the effect of quantitative and qualitative changes in the military-technical base and structure of the Armed Forces, has had a substantial influence on rear troop support. The role of the rear services has grown immeasurably.

The appearance of nuclear missile weapons in mass quantities, as the main means of destruction to be used against troop groupings and military objectives in the enemy rear has led to a change in the content of rear support.

The unprecedented dynamism of military operations and the mobility of units and formations caused by motorizing the troops have required more maneuverable and mobile subunits and units in the rear able to support the troops under complex conditions.

Participation of large forces from various branches of arms in combat actions has increased the demand for materiel, particularly for fuel, and this, objectively, has led to a complicating of the rear's work.

The possible use of nuclear weapons by both sides, the related appearance on areas of radioactive contamination, and extensive damage on lines of communications, in addition to the increase in losses of personnel and equipment have posed for the rear serious tasks in eliminating the consequences of an enemy attack and raising the mobility and survival of the rear subunits.

The presence of nuclear weapons in the hands of the probable enemy has complicated and broadened the range of work for many of the rear services. The role of transport has changed substantially. The basic type has become the automobile. Pipeline transport has also appeared. Military air transport has also begun to play an important role in the rapid shifting of troops and materiel.

The increased mobility and motorization of troops have confronted the rear services with the task of fully utilizing all types of transport, as well as the entire network of the means of communication. At present, it is difficult to move a group of tanks, artillery, and motor transport with the motorized infantry, materiel and other means of support over one or two roads, as was the case during operations of the Great Patriotic War. Under conditions of the possible use of nuclear weapons against communications, the significance and role of rail and road repair and traffic control troops have risen, the amount of work has increased, and it has also become more complex in terms of rebuilding destroyed sections of roads, junctions, bridges, water crossings and other means of communications, and has also necessitated the equipping of these troops with new equipment.

Medical support for troop personnel has also been organized in a new manner. Under modern conditions the occurrence of areas of destruction will be a frequent phenomenon. This circumstance places great duties on the medical service. Medical units and institutions under conditions of fluid operations and the appearance of areas of destruction must show high mobility and move rapidly toward the areas of destruction.

The organization of technical support for troops has also changed substantially. At present their basic attention should be focused on quickly repairing combat equipment in the areas of its greatest accumulation. For this purpose, mobile repair bodies are to be set up, able to move quickly to areas where damaged equipment has accumulated, and to repair first of all those machines which can be returned to duty soonest.

The significance of the survival of the rear has increased sharply. The rise in maneuverability, diversity of activities, great volume, and the necessity of maintaining the combat capability of the rear units and institutions have posed the question of rear command in a new light. Greater and greater significance is being given to centralized leadership over those bodies which are daily concerned with questions of rear troop support. Mechanized hand tools as well as computers have found wider use in rear command.

Mechanization and Motorization of the Rear

The productivity and mobility of rear units and subunits to a significant degree depend upon the level of mechanization and motorization in the

rear. Under present-day conditions, the demand for materiel for conducting combat operations has grown immeasurably.

Over the entire period of World War I, the army of tsarist Russia received 55.6 million artillery shells and mortar shells of all calibers through all levels of the rear, while during the years of the Great Patriotic War, the army in the field received 777.6 million, that is, 14-fold more. In the period of the Great Patriotic War, one Soviet field army as an annual average consumed as much fuel as the entire Russian Army spent during the entire World War I. In a future war, a large quantity of artillery and mortar shells will also be needed. If we add to this missiles, fuel, engineer and uniform equipment, protective equipment, foodstuffs, and other types of supplies, it becomes clear what a quantity of man-days must be spent in order to load all of this, then trans-ship it from one type of transport to another, and finally deliver it to the troops.

In order to clothe 1 million troops, 2,500 railway cars of clothing and footwear are required, in order to feed them for a month, tens of thousands of railway cars of food are needed, and in order to arm them, many thousands of carloads of weapons and ammunition are needed.

For fueling 100 tanks, many tens of tons of fuel and scores of tank trucks are needed. It is impossible to carry out all of this and other work without mechanization. The organization of full mechanization for all heavy and labor-intensive work, including freight handling, has become a necessity in the production activities of depots, dumps, and all types of transport.

During the years of the Great Patriotic War, and particularly in its initial period, due to the poor mechanization of freight handling, truck stoppages for loading and unloading sometimes took up to 40 percent of the working time.

In examining the possibilities for using various equipment at large field storage areas, it must be pointed out that even now, the warehousing and storage system employs truck cranes of varying capacity, lift trucks of 3 and 5 tons capacity, conveyors (belt, movable, and sack with a productivity of 65 cubic meters per hour), freight trolleys with a capacity of up to 500 kilograms, and other equipment.

Mechanization is particularly essential for freight handling at mobile storage areas which are often moved and operate under difficult conditions. A portion of the freight-handling equipment for these storage areas is mounted on motor vehicles designed for delivering equipment.

Mechanization of the jobs related to supplying troops with fuel has also assumed major significance. At present, barrel lifts are used for quickly loading fuel into the motor transport. Tank trucks and sided trucks are used for transporting fuel. The availability of a tank truck accelerates the process of loading and delivering fuel to the troops. Thus, in order to load and transport 30 tons of fuel, 10 trucks and 40 minutes of work by one worker are required, but in order to deliver these same

30 tons by sided vehicles, 200 barrels must be loaded, requiring 2 hours of work by two men, while 11 3-ton vehicles are needed for transporting and a barrel lift must be used for loading the barrels into the truck, requiring 5 hours of working time for four loaders.

Fueling aircraft is also of important significance. Modern centralized fueling equipment is used for this.

Ships are fueled both at the base on shore as well as at sea, where fuel must be delivered by the appropriate means. In order to mechanize the process of fueling ships, it is advisable to deliver fuel to the ships by boat. Such unmoored fueling is the fastest and most effective.

Along with mechanizing the work process of the rear, its elements have also been motorized.

At present, the food supply service has highly productive mechanized bakeries making it possible to bake bread on the road, hulling mills, refrigeration units, refrigerator trucks, mobile slaughterhouses, and other motorized units.

The elements of the medical, uniform, and other rear services have also been motorized.

Basic Special and Rear Subunits, Units, and Facilities and Their Tasks

Modern rear services for supporting combat operations of the troops have different subunits, units, and facilities. The basic ones are: the railroad, road repair and traffic control, and the motor vehicle troops, as well as the technical and medical units and facilities.

The railroad troops. During the period of the Great Patriotic War, up to 90 percent of all material supplies was moved from the rear to theaters of military operations over the railways. Local rail shipments on the fronts also comprised a large amount.

In a future war, the pace of military operations will be very high. For this reason, the rate of rebuilding destoryed railroads should be higher than in the past. In this regard, the railway troops of today are now equipped with more powerful and highly productive equipment.

The rebuilding of railway bridges is a complex question. In the last war, the rate of rebuilding bridges ordinarily did not exceed 100 linear meters a day. For example, the railway bridge across the Dnepr in Kiev, regardless of the continuous attacks and strikes by enemy aviation, was rebuilt in 30 days by the railway troops. The rate of rebuilding equaled approximately 80 linear meters a day. At present, this rate has increased significantly. Floating railway bridges can be put up in several hours.

Road repair and traffic control troops. The increase in the number of motor vehicles and military equipment moving over roads (several thousand over one road per day) has posed new, more responsible tasks for the road repair and traffic control troops. At present, they have become more mobile. In the last war, the road units were basically concerned

with routine repairs on roads, since, regardless of the effect of the enemy, with the exception of bridges, there was no mass and complete destruction of roads. In a future war, the role of road repair and traffic control troops in terms of road support, in line with the heavy destruction on dirt routes, as well as the high rate of advance will increase significantly. In the work of road units, the rapid rebuilding of bridges will be one of the complex and basic areas, and for this, at present they have special forces and means.

Motor vehicle troops. Motor transport under present conditions is of important significance in supplying the troops.

In the course of the Stalingrad operation, motor transport moved 20 rifle divisions. In the Berlin operation, motor transport of the First Ukrainian Front carried around 1 million tons of different freight.

From May 1941 through March 1945, for the entire Soviet Army, motor transport carried 100 million tons of various military freight.

Under present-day conditions, motor vehicle units will carry troops as well as supplies in even greater quantities and over greater distances. The motor vehicle troops, at present, are equipped with heavier-duty and more advanced vehicles of varying capacity with trailers, and in terms of their organizational structure and equipment are maneuverable and easily controlled.

Air transport. Under present conditions, aviation in a number of instances can be the sole type of transport capable of delivering materiel to the required place. The appearance of new, powerful aircraft and helicopters which can lift scores of tons of various cargo has turned air transport into one of the most important types of transport. At present, in a short period of time it can deliver all sorts of cargo to the troops, evacuate wounded, transport medical units and facilities, control traffic on the lines of communications, and so forth.

It must be pointed out that under present-day conditions, helicopters are used as combat vehicles, they perform transport functions, and are a good means of freight handling. It has been established that ships, railway cars, and flatcars can be unloaded with helicopters. Helicopters can also be used in building and repairing railway and motor vehicle bridges, especially for placing heavy beams, spans, and other structural elements.

Pipeline transport. The increased needs of troops for fuel have required the organization of uninterrupted fuel delivery in mass quantities.

Efficiency in delivering fuel to the troops can be guaranteed under the condition of utilizing all types of transport including pipeline. There are pipeline units and subunits for setting up field pipelines and for operating them. In the Great Patriotic War, pipelines were used for supplying fuel to besieged Leningrad over Lake Ladoga, across the Volga in the region of Vladimirskaya Pristan', across the Don near Rostov, across the Dnestr and Danube, as well as in the Ploesti-Reni area.

A system of field pipelines is a dependable means for supplying the troops and aviation with fuel, particularly with modern highly fluid operations. The field pipelines are laid behind the advancing troops and into the air basing regions.

The rate of laying pipelines depends upon the degree to which the laying process has been mechanized, upon the terrain, the presence of water and other obstacles, upon the season, as well as upon the labor productivity of personnel in the subunits. Special mechanized equipment is used for accelerating the laying.

Medical subunits and facilities. For providing medical aid in the armed forces, there are various medical units and subunits, including medical battalions, hospitals, hospital bases, ambulance, and other special subunits and facilities.

The special subunits, the sanitation-epidemiological laboratories and other medical bodies are among the subunits and facilities providing prophylactic measures and eliminating the after-effects of nuclear weapons.

For the purposes of providing medical institutions with blood and blood substitutes, the medical service has donor stations and blood transfusion stations, and oxygen-generating stations for supplying oxygen.

Technical subunits and facilities. For the purposes of providing technical support in the troops, there are various repair and evacuation subunits and facilities. Among the repair ones are the shops, repair and rebuilding battalions, repair enterprises, equipment repair subunits, and units for disassembling broken-down combat, transport, and other equipment. For evacuating equipment there are individual evacuation subunits and facilities able to haul armored, motor, and tractor equipment as well as various types of weapons off the battlefield.

The repair and rebuilding subunits and facilities have the job of repairing first of all that equipment which will require less forces, means, and most importantly, time, that is, the equipment requiring routine and partially medium repairs.

During the Great Patriotic War, the mobile repair subunits repaired up to 85 percent of the damaged motor vehicles and tractors, while 15 percent was done by the stationary enterprises.

Particular Features of Rear Support for services of the Armed Forces

Under present conditions, the organization of rear support includes new, larger measures than in preceding wars. Thus, *the rear of the Land Forces* should carry out an increased amount of work in a shorter period of time and in the course of the offensive more often bring the storage areas closer to the troops, utilize all means of transport with maximum effect and comprehensively, increase the rate of road rebuilding, carry out measures related to protecting the rear against nuclear weapons,

maneuver the rear units and subunits, support the troops operating on individual axes, and eliminate the consequences of nuclear weapons used by the enemy against the troop and rear objectives.

In organizing rear support, a particular role is played by the prompt use of transport, by the quick maneuvering of its various types, and by combining separate and combined methods of shipments in accord with particular features of the developing combat situation.

Rear support of the Strategic Missile Forces is carried out by special subunits with maximum automation of the processes involved in the preparation and maintenance of the missiles. The rear of the Missile Forces should possess high survival and dependability of work under the most complex conditions.

In organizing *rear support for the Navy*, basic attention is given to the complete supply of submarine and surface vessels operating at sea or in the ocean a great distance away from the shore supply bases.

In addition to material supply and other types of combined-arms services, the sphere of actions of the Navy rear includes the solving of diverse specific problems including: ship repair, emergency rescue work, technical, engineering, and commander support, as well as providing protective equipment.

The organization of rear support for missile-carrying naval aviation is basically identical to the organization of rear support for aviation of the Land Forces.

Rear support for the National Air Defense Forces derives from the presence of aviation, anti-aircraft, radar, and other units in them. The re-equipping of air defense troops with missiles has introduced much that is new in the organization of their rear. The delivery of missiles comprises a completely new area of rear activities. There are special subunits for readying and transporting the missiles. The rear of the National Air Defense Forces is always in a state of combat readiness, and is able, if need be, to continuously conduct combat operations to repel an enemy attack.

The replenishing of expended supplies, and particularly missiles, ammunition, aviation and motor fuel, should be continuous and provided by all types of transport. For supplying fuel, and particularly for aviation as the basic consumer, pipelines can be used from the fuel dumps and unloading stations to the airfields. The necessary grades of fuel can be supplied over the pipelines.

The rear support of the Air Force is carried out by various aviation-technical and other rear subunits and facilities equipped with new technology.

The work of preparing aircraft for flight is particularly complex. For these purposes, in the aviation rear there is a great deal of special equipment such as oxygen, nitrogen, and hydrogen generating and fueling stations, as well as machinery and equipment for inspecting the hydraulic,

electrical, and other aircraft systems. Major changes have also occurred in aircraft fueling equipment. The necessary special rear service subunits have appeared at airfields.

The rear is concerned with questions of building and repairing airfields, equipping them, camouflaging, building roads to them, delivering materiel, medical and technical support, defense, security, and protection of aviation against enemy action. Aviation technical support directed at containing the combat readiness and safe flight activities of aviation as well as the airfield engineer support has become a very complex organizational and technical task.

Rear Command

Under present conditions, rear command has assumed greater efficiency than was the case in previous wars.

Rear command is carried out by the commander through the staffs, the chief of the rear, and the chiefs of the branches of arms and services. Mobility of command requires that the chief of the rear always know the combat situation and take necessary measures in accord with it to deploy rear units and facilities, and to organize supply and medical support, without constricting actions of the troops in so doing. Flexibility and efficiency of rear command in the course of an operation will depend greatly upon the prompt guidance of the rear chief by the combined-arms staff which must supervise the work of the rear and provide appropriate aid to its chief.

Communications are of important significance in organizing rear command. In the rear units and institutions, various communications are used, including: radio, telephone equipment as well as mechanized instruments. The immediate command of the rear is carried out by the chief of the rear from the rear command post which is organized at the place determined by the commander.

Chapter V. The New Means of Waging War and the Methods of Military Operations

By the methods of military operations one understands the aggregate or combination of different and very diverse procedures and methods for using armed forces in the course of a war, and differing in terms of the types of actions, their level or scales, as well as in terms of the forces and means of combat.

The methods of conducting armed combat are divided primarily in terms of the types of actions of the armed forces. There are the offensive and defensive as basic types of actions characteristic for both wars of the past and modern ones. For each of these types of operations, that is, offensive and defensive, there are different inherent methods, procedures, and forms of actions for the troops corresponding to the unique conditions of individual combat, an operation, or the war as a whole.

The methods of armed combat are also differentiated in terms of scales of action. The methods of using the armed forces as a whole or strategic groupings in the theater of military operations provide an opportunity to speak about the methods of armed combat on a strategic scale. There are also methods of actions on the operational and tactical scales.

Finally, for each service of the armed forces, branches of arms, and branches of forces there are the corresponding methods of actions inherent to only them.

The task of military theory and practice is to seek out the best methods of actions which correspond to the very diverse conditions of combat activities. The methods of waging a war change not only in individual eras and in different wars, but they also develop rapidly even in the course of a single war, as can be seen from the experience of the two world wars of the 20th century. The military leader or commander can and should select out of the existing methods the ones which correspond most to the existing situation, or seek out new methods of actions within a single campaign, operation, or battle.

Modern military operations are characterized primarily by the diversity and richness of combinations. The determining or choice of the methods of armed combat is a creative process which cannot tolerate any routine.

1. The Dependency of the Methods of Conducting Combat Operations Upon the Development of Weapons and Military Equipment

Regardless of the broad range of methods of armed combat, the same chief patterns lie at the basis of their development and change. What is the basic, repeating, and general thing in the dialectics of the development and change in the methods of armed combat?

The Influence of Economic Conditions on the Development of the Methods of Conducting Military Operations

All aspects of social life and all social phenomena ultimately depend upon the development level of the productive forces and production relationships, that is, upon economic conditions. This applies fully to the methods of armed combat. Moreover, here this dependency is felt very strongly, and rapidly leads to essential changes. F. Engels for the first time in the theory of military art expressed this in the formula: "Nothing so depends upon economic conditions as the army and the navy. Weapons, the composition, organization, tactics and strategy depend primarily upon the level of production achieved at the given moment and upon the means of communication." [1]

But, in speaking about the influence of the development level of the productive forces and production or social relationships, it cannot be asserted that there is a direct dependency between this level and the methods of armed combat. This dependency is implemented through a change in the awareness of people and the production of new weapons and military equipment. For this reason, Engels, in pointing to the significance of economic conditions, explained that the methods of military operations, tactics and strategy, or, as he said, the combat method of the army, depend primarily upon human material and upon weapons. Engels was the first among the Marxists to point out this dependency. "Military tactics," said V. I. Lenin, "depend upon the level of miltary technology. This truth was chewed over and put in the mouth of the Marxists by Engels." [2]

Production relations influence the development of the methods of armed combat through the economy, politics, and the political morale qualities of people. For example, it can be pointed out that production relationships and the advanced economic system of our state made it possible during the years of the Great Patriotic War to produce more weapons than our enemy, Nazi Germany, and relatively more than our former allies in the anti-Nazi coalition, the United States and England, although our nation mined less coal, and produced less metal and electric power.

[1] K. Marx and F. Engels, *Soch.*, Vol 20, p 171.
[2] V. I. Lenin, *Poln. Sobr. Soch.*, Vol 13, p 374.

This, ultimately, made it possible for Soviet troops in the course of the war to use the most active and decisive methods for conducting battles, operations, and strategic actions as a whole.

Social revolutions fundamentally change the attitude of people, that is, the soldiers and the officer personnel, to the wars which become revolutionary and just. The decisive and just goals of wars waged by the socialist state, the growth of political awareness of personnel in a socialist army, and the growth of its general educational and technical training also cause the growth of the activeness and decisiveness of the forms and methods of armed combat. This can be seen from the experience of the Red Army during the years of the Civil and Great Patriotic wars, as well as from the present level of military art in all the types of Soviet Armed Forces.

The development level of productive forces comprises the material and technical basis for producing weapons and various military equipment of the appropriate quantity anl quality. New weapons have a slow effect upon the methods of conducting armed combat, upon tactics and particularly upon operational art and strategy, if the weapons change insignificantly or their first models are still imperfect. History knows many examples of this.

Gunpowder was invented in Europe in the 14th century, however, the decisive effect of firearms on the methods and nature of armed combat began to be felt several centuries later. During World War I, the use of a small number of very primitive tanks on a narrow section of the front, the use of poisons on the area of one division on the Ypres River, or the use of aircraft which at that time carried out very limited combat missions could not have a decisive effect upon the methods of conducting an offensive and breaking through the defenses of the ground forces which were deeply echeloned and well equipped in engineering terms. The problem of piercing defenses was not solved in that war.

Although such an automatic firearm as the machine gun appeared as early as the Anglo-Boer War, in 1900, the Russian Army entered World War I with a machine gun team of just four machine guns in an infantry regiment. Only the mass use of automatic firearms in the Red Army, and particularly in the cavalry, during the Civil War period, along with other circumstances, played a marked role in changing the tactics of combined-arms combat.

The use of the fire of rocket launchers in the Red Army in 1941 by individual batteries or battalions could not have a decisive effect on the tactics of the Land Forces. Only in subsequent campaigns did the massed use of artillery and rocket fire, aviation and tanks, their onslaught, maneuver, and speed, along with other factors, tell decisively on the methods and pace of piercing the prepared defenses of the Nazi forces, as well as on developing the success of offensive operations to a significant depth.

The massed use of new weapons tells decisively on the change in the methods of armed combat. The effect of nuclear missile weapons on the methods of armed combat at present has assumed a new content. The question is not only in the quantity of new weapons, but above all in its quality, that is, the combat might and destructive factors.

When we speak about the effect of weapons on the development of the methods of armed combat, we must not have in mind merely the weapons, the ammunition, and the military equipment directly in use by the army, aviation, and navy. For successfully carrying out the new methods of armed combat and employing new weapons under present-day conditions, there must also be the development of all types of transport and state communications in the nation, the accumulation of various types of material and technical stocks for conducting a broad armed combat, the development of technical repair facilities on which the repair and rebuilding of military equipment will be based in the course of military operations and the importance of which has risen greatly in modern war, the complete preparation of theaters of military actions and the territory of the entire nation, as well as many other questions. In our times, the effective conducting of military operations by large troop groupings and the use of nuclear missile weapons require the broad development of various communications and the introduction of radioelectronics. Consequently, a modern war places new, higher demands upon productive forces than the wars of the past.

With the mass introduction of new weapons and military equipment, new, previously unknown methods of armed combat appear in tactics, operational art and strategy, or a qualitatively new feature is introduced into the previously known methods. For example, the encircling of an enemy grouping has long been known. But the operations of encircling enemy troops as carried out in the course of the Great Patriotic War differed fundamentally from the operations at Cannami and Sedan.

Engels pointed out that new weapons lead, without fail and sometimes compulsorily, outside the will and wishes of the leaders and command, to new methods of combat. The Franco-Prussian War of 1870-1871 was an example of this. In the expression of Engels, in this war the soldier was smarter than his officer, when under the conditions of severe losses from the fire of a new gun in closed ranks, the soldier changed to open ranks. Such an effect of new weapons on the development of the methods of armed combat is one of the patterns. Our commanders should be aware not only of the spontaneous development of the methods of armed combat, but also anticipate their appearance, and move the theory and practice of military art forward.

One can observe a definite pattern in the course of the development of wars and military art. In step with the accelerating development of society's productive forces, the process of improving weapons and mili-

tary equipment also accelerates, new types of weapons appear more rapidly, and consequently, the process of the development and change in the methods of military operations accelerates. In actuality, the Napoleonic methods of armed combat brought to life by the new level of the productive forces at the end of the 18th and the beginning of the 19th centuries, as well as the social consequences of the French Revolution began to give way to new methods under the effect of the changing conditions only in the second half of the 19th century. The methods of military operations changed even more slowly in antiquity and the Middle Ages.

The situation is quite different now when rapid scientific and technical progress, the quickly developing productive forces and the equally rapidly changing social conditions in the world as a result of socialist revolutions and the national liberation movement had led to a fundamental change in our ideas concerning the nature of armed combat and its methods. To a significant degree this has been caused by the unabating process of the replacement and improvement of nuclear weapons, their carriers and other means of armed combat.

All of this and other factors have caused such a rapid process in the development and change of the methods of military operations, as well as the growth of their activeness, complexity, and diversity. While in the past new weapons for a long time coexisted with the old ones and changed the methods of armed combat comparatively slowly, nuclear weapons in a short period of time have become the basic and decisive weapons capable of carrying out the main tasks of war. These weapons have brought to life completely new methods of actions for all types of armed forces, and have fundamentally altered the entire structure of the armed forces and military art themselves.

The Role of Science in Developing the Methods of Conducting Military Operations

Along with the effect of the level of productive forces on the methods of armed combat, science has also had an enormous effect on them. Science is the historically formed system of systematized knowledge, the truth of which is checked and constantly adjusted in the course of social practices. "The use of science," states our party's Program, "is becoming the decisive factor in the mighty growth of society's productive forces." [3]

The further prospects for scientific-technical progress in the present period are determined above all by the achievements in mathematics and the leading sectors of natural sciences. The high level of development in physics, chemistry, biology, and astronomy is an essential condition for raising the effectiveness of all other sciences, including military science. The development of social sciences is also of enormous significance,

[3] *Programma KPSS*, Moscow, Politizdat, 1971, p 125.

since they comprise the scientific basis for directing the development of society. Military affairs are an important part of social practices, while the defense of the nation is an important task for our socialist society.

Consequently, the level of scientific development is a condition and indispensable part of the overall development level of the nation's productive forces. The effect of science on the development of productive forces is increasing rapidly.

In our times, there has been a gigantic competition in the scientific and technical area, and in this competition the nations of the socialist community have a number of achievements and advantages over the science of bourgeois society. This competition cannot help but be felt on the further development of the methods of armed combat. It must be kept in mind that in the United States, not only military and technical research is being developed widely, but also research in the area of military art, and above all in military strategy. There is an intense search for new methods of armed combat corresponding to the scientific and technical achievements of today and the near future.

Soviet military theory, in relying on Marxist-Leninist teachings about war and army, as well as on our achievements in the area of inventing weapons and military equipment, and the experience of military and operational preparations, has every opportunity not only not to stand still, but to move ahead of its probable enemies in this regard. Scientific development has substantially reduced the role of spontaneous processes in the rise of new methods of armed combat, as was described by Engels. To assume that the soldier himself will find a method for using new weapons or new actions on the battlefield, as was the case in the Franco-Prussian War, means to doom oneself ahead of time to a number of failures and defeats.

Under our conditions, the creation of new methods of armed combat occurs not spontaneously but rather on the basis of scientific prediction. It is based on the creative activeness of professional military personnel, upon generalizing the experience of military training, and upon the introduction of new types of weapons and military equipment. All of this makes it possible to draw scientifically sound conclusions concerning the possible methods for conducting armed combat.

The Development Patterns of the Methods of Military Operations

In speaking about the development patterns in the methods of military operations, it is sometimes felt that the methods of conducting combat change most rapidly, and then the methods of conducting operations, and that under the influence of new weapons, tactics change first and then strategy. However, such a view must be recognized as obsolete. This was actually the case in the past when new weapons were found in the tactical

subunits, units, and formations, on aircraft and ships, and were used only in close combat, while the operational and strategic successes in the war were formed out of the quantity and quality of tactical successes.

The situation is different now when the powerful and far-reaching means of armed combat, used in a mass quantity, are able in the shortest time to carry out strategic missions on a scale which could only be dreamed of by military leaders of the past. The new means of armed combat at the same time have brought about a complete change in all areas of military art, and there is reason to assert that in the strategic forms and methods of combat these changes occur even sooner than in tactics and operational art.

The essence of the changes in strategic forms and methods of armed combat consist chiefly in the fact that now the military leadership possesses the forces and means the use of which can, in the shortest time, determine the outcome of the war. And the new means of combat, obviously, will be used as weapons in the future, while the fighting qualities of them will rise significantly.

In examining the question of the effect of new weapons on the methods of armed combat, the other side of this question must not be forgotten. The developing methods of military operations place constantly newer demands upon weapons, and upon improving their technical specifications, and in doing so they set the pattern for their further development. In studying the development patterns of the forms and methods of armed combat, we are already formulating new demands upon science and technology in the area of the further improvement of different types of weapons. On the basis of scientific forecasting, we can establish the direction of development for the nature of modern combat and the operation, and reach the conclusion on the need to increase the range of field artillery and the accuracy of hitting objectives, and put new, higher demands on the fighting qualities of aircraft, on the means of destroying air targets at various altitudes, on the existing means of communications and reconnaissance, engineer equipment, and so forth.

Thus, here we can see the inverse effect of the methods of armed combat on weapons and military equipment. Possibly, this effect is less clearly expressed than the direct effect of weapons on tactics, operational art, and strategy, but it, this inverse effect, does exist and must be taken into account.

In life and in the practices of military and operational training, and even in a war, a contradiction can arise between the increased capabilities of new weapons and the obsolete methods of combat or the obsolete structure of the troops. History knows examples when the armies of certain states had entered a war having obsolete views in the area of tactics and strategy. This contradiction is manifested constantly to a greater or lesser degree. We are not always able to keep up with the new, and this is explained by a number of objective and subjective factors. The resolution of this contradiction occurs on the basis of a profound understanding of the entire mechanism of patterns and principles lying at the basis of the development of military art.

The development of the methods of waging a war occurs continuously, however, tangible changes in tactics, operational art, and strategy, and particularly abrupt shifts in their development, occur only when these changes reach a certain quantitative and qualitative level. This expresses the well-known law of dialectics, the law of a change of quantity into quality.

A recognition of the continuity of the development process for the methods of armed combat does not mean that this process occurs evenly, as a straight and unbroken rising line. In military art, in the past there have been and at present do exist revolutionary changes which fundamentally transform the methods of conducting military operations. However, there are also periods of slow and gradual, evolutionary development and even periods of stagnation and decline.

Among the development patterns in the methods of military operations, one should put first of all the fact that these methods become more and more active and designed for achieving the decisive goals of the battle, operation, and war as a whole. In examining only offensive operations, it can be seen that more and more frequently they are directed at the total defeat and destruction of the enemy. A rise in the activeness and decisiveness of the actions and their purposefulness are related above all to the decisive character of political goals in the era of class and national liberation wars as well as to the appearance of new weapons. Here, constant competition between offensive and defensive weapons is of important significance. As a rule, the upper hand has always remained with the offensive weapons, and this has been particularly apparent in the age of nuclear missile weapons.

Another pattern is the increasing scale of combat and operations in terms of the number of forces participating in them, the employed fire onslaughts, as well as the depth and pace of actions of all types of armed forces. We can see how quickly the depth of the simultaneous destruction of battle orders, operational formation, and other enemy objectives has increased on land and sea theaters of military operations. In our times we already can speak about the possibility of the simultaneous destruction of enemy objectives over the entire strategic depth, no matter how significant it might be. The power of the fire onslaughts and the maneuverability of all types of armed forces grow constantly.

Another pattern is the ever increasing diversity and complexity of the methods for conducting combat and an operation. This has given rise to and accelerated the development of such a trend as the necessity of coordinated efforts by different branches of arms and types of armed forces as well as cooperation with any method of military operations.

2. Modern Means of Conducting Military Operations and Military Strategy

Strategy is the highest area of military art. It consists in the questions of using the armed forces as a whole or large groupings of different types of armed forces in the course of the war in theaters of military operations for achieving victory over the enemy, as well as questions of preparing the armed forces for carrying out combat missions. At the same time strategy is also an area of activity for the bodies of the superior military command to prepare the armed forces in peacetime and for leadership over them in the course of armed combat. Consequently, strategy represents an area of practical activities for the armed forces and bodies of superior military leadership.

Military strategy as a theory is a system of scientific knowledge concerning the patterns for conducting armed combat. On the basis of the theses of military doctrine, the experience of past wars and analysis of political, economic, and military conditions of the contemporary situation, in the theory of strategy the following questions are examined and elaborated: the nature of modern war (from the standpoint of its saturation with military and technical means); the structure and organization of the armed forces; the preparation of the nation and armed forces for war; the planning of armed combat; the strategic use of the armed forces as a whole and their individual types in war; the forms and methods of conducting strategic operations; the principles of strategic leadership over the armed forces; the questions of all-around support of the actions of the armed forces; the general principles of civil defense.

The Dependency of Strategy Upon Political Policy and Economics

Military strategy depends upon political policy. This is expressed primarily in the fact that strategic goals which should be achieved by the armed forces in a war as well as the strategic missions should conform to the requirements of political policy. In the given regard, strategy is a means for achieving political goals and tasks in a war, and it is the instrument of political policy. In turn, the goals and tasks which political policy poses for military strategy should conform to the capabilities of the armed forces, their quantity and quality, and to their ability to successfully carry out strategic missions in the war, proceeding from the specific conditions of its starting and development.

The dependency of military strategy upon political policy and its subordinate position vis-a-vis political policy are emphasized in the Marxist-Leninist definition of war as the continuation of the political policy of states and classes by other, namely violent, means. Military strategy, as a means of political policy in all historical eras and in all states, has always had a class character. In the military strategy of the capitalist states, this is manifested in defending the interests of the imperialist bourgeoisie.

Soviet military strategy proceeds from the great and noble goals of our state expressed in building a communist society and the necessity of the armed defense of the nation against aggression. This strategy serves the interests of the Soviet people and its efforts are focused on elaborating the main questions of raising military might and the defense capability of the socialist motherland, as well as the fraternal community of socialist nations.

The desire of the Communist Party and the Soviet government to guarantee peace conforms to the fundamental vital interests of not only the Soviet people and the peoples of the other socialist nations, but also to the interests of all mankind. However, as long as capitalism exists, the threat of war from the imperialist aggressors remains. The Soviet Armed Forces, in the event that such a war is started against the Soviet Union and the socialist nations, are always ready to retaliate with crushing blows against the aggressor, and thwart his perfidious ideas. In a just war which can only be waged by our state, Soviet military strategy will have a decisive, active, and offensive character.

Military strategy also depends upon the economy, and specifically upon the development level of the productive forces and science in a state. The dependency of a strategy upon the economy has also existed in the past. A characteristic feature for modern conditions is the increase of this dependency deriving from the rapid development of the military technical means of waging war, as well as their quantitative and qualitative growth.

While previously the strategic military leadership bodies did not have at their immediate disposal the military means capable of carrying out strategic missions, at present the economic conditions have made it possible to have such means. Among them are the Strategic Missile Forces, long-range aviation and the submarine forces of the Navy (the atomic missile-carrying submarines). To a significant degree this has altered the character of armed combat and the functions of its military leadership.

The Appearance of Objective Laws for Waging War in Strategy

As is known, the laws of waging war are expressed in the principles or fundamental provisions of military art (grand strategy, strategy, and tactics). In Soviet military science, the principles of military art are viewed in their development. With a change in historic conditions, the principles of military art and their content also change. This development depends ultimately on the changing materials and social conditions. The methods of using the principles of military art and their application in combat, in operation, and in war as a whole also change. Soviet military science

decisively rejects metaphysical judgments concerning the inexorability, perpetualness, and invariability of the principles of military art.

The principles or basic provisions of military art must be viewed and employed only as initial standards and in no way as an overall pattern. They are of significance only under typical circumstances or with the presence of certain conditions. The actuality of war is richer than any theoretical provisions, and the application of the principles of military art should be reasonable, and should take into account the specific conditions of the political and strategic situation, the particular features, and the scale of the phenomena occurring in armed combat in their inseparable development and change. Fundamental changes in the conditions under which armed combat can develop with the broad use of nuclear weapons by the armed forces of the warring sides are more often possible than was the case in previous wars, and they will be more substantial and radical.

The founders of Marxism-Leninism concluded that principles are valid only to the degree that they correspond to historical conditions.

The course and outcome of any war are not the result of random factors. They are natural and are determined by numerous factors, the basic ones being the following:

The morale of the people and their armed forces, their ability to withstand all the trials of a war and to focus their forces on the successful attainment of its goals, and this depends upon the social system, the dominant ideology, as well as upon the political goals of the war;

The high quality of weapons and the technical outfitting of the armed forces, providing military technical superiority over the enemy. This depends upon the development level of the economy, science, and technology in the nation;

The size and level of organization in the armed forces, the training level of the troops, the level of preparedness of the leadership, and the broad circles of commanders, engineers, and technicians;

The ability of the nation to furnish the front from the outset of the war, when the most intense actions may develop involving the use of various weapons as well as in the course of the development of the war [providing] the new material and technical means and supplies, as well as militarily trained human reserves;

The use of advanced forms and methods of armed combat which conform best to the nature of the war, and particularly the forms and methods of strategic operations.

These and other general patterns of armed combat are manifested most completely and vividly in strategy.

The basic provisions (principles) of strategy are based on the conclusions of Soviet military doctrine and at the same time develop and concretize these conclusions, giving them the character of theoretical and practical rules for solving various problems involved in the preparations for and conduct of armed combat.

Soviet military strategy views and examines a world war under modern conditions, if the imperialists start it, as the decisive clash between two opposing world socioeconomic systems, in which both warring sides will pursue decisive political goals. Such a war can be a nuclear one involving the use of the entire might of the existing nuclear missile weapons by both sides. At the same time, in such a war conventional weapons can also be employed. Under certain conditions, the units and subunits will fight only with conventional means. The development of the war is possible in various means, including the surprise use of nuclear weapons or conventional means of destruction.

The enormous scope of a war, the diversity of conditions for conducting it in the various theaters of military actions, as well as the complexity and diversity of strategic goals require the use of joint and coordinated efforts by all types of armed forces, and the use of various means of combat, including conventional weapons. In such a war, the basic states of the world will be involved, and the armed combat will be intercontinental in terms of spatial scope. This means the opportunity and inevitability of destroying important objectives and entire regions of the warring sides by direct strikes with strategic nuclear means from other continents at the very outset of their use. This will mark one of the basic differences of a modern world war from the character of the first and second world wars.

The balance of forces on the world scene leads to a situation where a new world war will inevitably assume a coalition character, and the coalitions will be made up of nations located in different regions of the world.

A nuclear war can be comparatively short in time, since the chief political and strategic goals can be achieved as a result of the massed use of strategic nuclear means and active operations by all types of armed forces in the basic theaters of military operations. This thesis poses definite tasks for preparing not only the armed forces for the war, but also the nation or coalition of nations as a whole, and particularly in terms of their economic preparation. At the same time, in examining various political, economic, and strategic problems related to the preparations for war, it is also essential to consider those conditions which can lead to a relatively long and protracted war.

In contrast to previous wars, when the main objectives of destruction were groupings of armed forces in the theaters of military operations, in a nuclear war such objectives can be, simultaneously with military objectives, the chief sectors of the economy of the warring nations which have the job of supplying the war, the centers of transport communications, the state administrative bodies, the bodies of military strategic leadership, and the basic centers of state communications. The mass destruction, annihiliation, or neutralization of these objectives in a short period of

time can lead to the disorganization of all vital activities in the enemy nations, to a weakening of their organization and will to continue the struggle, as well as to the rapid withdrawal of individual nations in the enemy coalition from the war. At the same time, the groupings of enemy armed forces and the regions where tactical nuclear weapons are based will be destroyed, in addition to large groupings of ground forces, aviation, the navy, air defense weapons, and other objectives of the probable enemy.

The possibility of using nuclear missile weapons has required the development of active and decisive forms and methods for strategic as well as tactical operations without any delay from the very outset of the war.

Soviet military strategy considers that with the beginning of a war, along with nuclear strikes, active operations can be started in the theaters of military operations by all services of the armed forces.

Under present-day conditions, from the very outset of the war, the most important strategic tasks can be carried out and the basic strategic goals of the war achieved. The character and content of the subsequent actions of the armed forces will be determined by this.

Also among the important theses of strategy is the necessity of complete preparations for and execution of a whole series of measures in peacetime providing for the organized conduct of military operations by all the services of the armed forces.

Military strategy proceeds from the necessity of creating the state and strategic manpower and material-technical reserves even in peacetime, with the use of them from the beginning of armed combat and the maintaining of them on the proper level in the course of the war. The significance of these reserves under the conditions of modern war grows decisively.

An important strategic principle is the necessity of providing firm and continuous strategic leadership over the armed forces and their groupings in the theaters of military operations even in peacetime and particularly with the start of military actions. The probability of using enormously powerful weapons over great distances and within a short period of time requires high mobility and exceptionally centralized strategic leadership. The rise in centralization of leadership provides for development of the initiative of those strategic and tactical levels which must actually carry out the directives of superior strategic leadership bodies within the limits of strategy and plans.

The Methods and Forms of Strategic Operations

The basic method of operations used in the last two world wars has been the consecutive achieving of intermediate strategic goals. These wars were long, the armed struggle was carried out on an enormous scale, and the achieving of the general goals of the war was to pass through a

number of stages, with a large number of strategic missions arising in each of these stages. If we examine the methods of the operations of the Soviet Armed Forces in the Great Patriotic War, then in it a number of consecutive defensive and offensive missions were carried out in important strategic axes, and in their total these missions led to a fundamental change in the strategic situation on the entire Soviet-German Front, and had a decisive effect upon the development of armed combat in other, even very remote theaters in which our former allies in the anti-Hitler coalition were conducting their military operations.

The war was protracted, and the consecutive carrying out of strategic missions went through a series of stages or periods, forming within the individual campaigns. As a total in the Great Patriotic War, two defensive and seven offensive campaigns were waged. Among the important strategic missions which were achieved within the offensive campaigns, one must put: the defeat of the major strategic enemy groupings on the chief strategic axes; the capturing of extensive regions of political, economic, and strategic importance; the liberation of territory of the allied nations captured by the Nazis at the outset of World War II; the withdrawal of individual allies of Nazi Germany from the war. The consecutive achieving of these goals occurred both within the individual campaigns as well as in the course of the entire war. Each offensive campaign was a step toward achieving the overall goal of the war of completely defeating Nazi Germany.

In the course of the campaigns, the strategic missions were carried out not only in time and depth of actions on one axis, but by their consecutive shifting from one strategic axis to another. Most characteristic in this regard was the summer-autumn campaign of 1944, when the attacks by the Soviet forces were shifted in sequence to new axes along the entire Soviet-German Front stretching from the Barents to the Black seas. In the concluding winter campaign of 1945 in Europe and in defeating the Kwantung Army of imperialist Japan in August 1945, the altered conditions made it possible to employ the method of the simultaneous achieving of strategic goals on all axes of the front of armed combat.

During the Great Patriotic War, the basic forms of the strategic offensive were offensive operations by the forces of the groups of the front cooperating in certain instances with the forces of long-range aviation, and on the coastal axes, with the naval forces. Such operations in terms of their goals, missions, the makeup of the groupings of armed forces (two-four fronts), and the achieved results were of a clearly expressed strategic character. Simultaneously with the operations of the groups of fronts, offensive operations by individual fronts were carried out on certain axes. The consecutive and simultaneous offensive operations of the groups of fronts and the individual fronts within the campaign represented in their aggregate a strategic offensive on several strategic axes or even on the scale of the entire Soviet-German Front. Such a broad strategic offensive was

carried out according to the overall plan and under the leadership of the Supreme Headquarters.

In a nuclear war, the modern methods of armed combat on all levels—tactical, strategic, and grand strategic—will differ significantly from the methods of armed combat during the wars of even the recent past in terms of vast territorial scope, the number and diversity of forces and means participating in combat, the operation and the war, the greater maneuverability of actions on land, in the air, and at sea, the rapidity of operations, the rapid and abrupt changes in the quantitative and qualitative balance of forces and means, as well as in the fundmental changes of the situation not only in combat and an operation, but also as a whole on extensive theaters of waging the war, and by the complicating of the entire process of commanding the troops and the forces, their coordination and all-round support.

In relying on the basic laws governing the development and change in the methods of armed combat and in considering the prospects for the further improvement of weapons and military technology and the organizational structure of the armed forces, our commanders with great probability can predict the directions along which the methods of armed combat will develop in the immediate historical period. It can be asserted with suffiicent confidence that such characteristic features of the modern methods of armed combat as maneuverability, high speed, great effectiveness, and the general scope will develop in the future. The diversity of weapons will increase, and, as a consequence, the diversity of the methods of military operations in the land and sea theaters as well as in the air.

At the present stage, the main task for military science is to elaborate the problems for maintaining constant combat readiness of the Armed Forces to thwart the attack and defeat the aggressor under any conditions. Using the experience of previous wars and the conducted exercises as well as considering the prospects for the development of weapons and military technology, it is essential to profoundly examine the objective laws of war, and to work out scientifically based principles for conducting military operations. Furthermore, it is essential to seek out new forms for raising the mobilizational readiness of the Armed Forces, as well as forms for organizing the units and formations, and the command bodies. One of the important problems of military scientific research is to determine the optimum quantitative and qualitative relations between manpower and equipment in the troops, between the services of the Armed Forces, and within them, between the branches of arms.[4]

In the previous world wars, the methods and forms of strategic operations were not static. They were in constant development and improvement. The development of the means of armed combat, the experience

[4] See A. A. Grechko, *Na Strazhe Mira i Stroitel'stva Kommunizma*, Moscow, Voyenizdat, 1971, p 57.

of military and operational preparations, and the creative activities of our commanders create conditions for a further improvement in Soviet military art.

3. Modern Means of Waging War and Operation-Level Strategy

Operation-level strategy, in being a component part of military art, is concerned with elaborating theory and practice for preparing and conducting joint and independent actions by task forces. This level of strategy is the connecting, intermediate link between grand strategy and tactics. Proceeding from the demands of grand strategy, operation-level strategy determines the methods for preparing for and conducting operations for achieving the strategic goals, and at the same time represents the initial data for tactics which organizes the preparations for and conducting of battle in accord with the tasks and goals of the operation.

The Development of Operation-Level Strategy

Operation-level strategy is the youngest part of military art. As is known, certain elements of military operations appeared in the 1812 Patriotic War in the course of military operations related to the defeat of Napoleon's army, in the wars of the middle of the 19th century and the Russo-Japanese War. However, their features began to appear most vividly only in World War I. But in this period as well, the operation had still not gained its complete development as a consequence of the fact that up to the end of the war, both warring sides could not use their available means (the cavalry, and in the concluding stage of the war, tanks and aviation) for transforming a tactical success into an operational one.

Soviet operation-level strategy was born during the years of the Civil War. It considered all the positive experience of World War I, and successfully employed it on enormous battlefields. Even then, new forms and methods for conducting operations were worked out and used in practice, and these corresponded to the nature of a class revolutionary war.

As a consequence of the fact that the Civil War developed over great expanses with a relatively poor technical outfitting of the troops, Soviet operation-level strategy preferred maneuver actions. For developing a tactical success into an operational one and for making deep attacks against the enemy, for the first time in history new task forces were used effectively, the cavalry armies. As a whole, all the operations of the young Red Army during that period were characterized by a vast scope, by activeness and devastatingness of the attacks.

After the Civil War, on the basis of considering its experience and the experience of previous wars, as well as scientific forecasting, operation-level strategy was enriched with new methods of conducting operations.

A theory of the deep offensive operation was thoroughly studied and elaborated. The most important prerequisite for this was the industrialization of the nation making it possible to outfit our Armed Forces with all the modern technical means of combat. The basic principles of the operation in depth maintain certain validity under modern conditions.

The Great Patriotic War was a new stage in the development of Soviet operation-level strategy. Due to the advantages of our state and economic system, to the unstinting labor of the people in the rear, and to the leadership of the Communist Party, our Red Army, with every passing year, received more and more diverse military equipment. On the basis of this, in the war period, our Air Force developed particularly rapidly, and our troops received significantly more tanks. This made it possible to create task forces of armored and mechanized troops, these powerful means for developing the tactical break-through into an operational one. Moreover, the saturation of the troops with artillery rose both quantitatively and qualitatively, rocket artillery appeared, and the role of the air defense troops rose significantly.

In the war period, further progress was made on such questions as the preparations for and conducting of amphibious operations, the coordination of troops in operations, and the all-round support of troop combat actions. The forms and methods of the operational maneuver, of conducting operations, and developing a tactical breakthrough into an operational one became more diverse. A solution was also provided to such an important and new problem of military art as the preparations for and conducting of an offensive operation by the forces of several fronts. Finally, during the period of the Great Patriotic War, new types of operations were developed such as air and antiaircraft operations, and joint operations by the Land Forces, Air Force, and Navy.

After the Great Patriotic War, our nation, in a short historical time, took a gigantic step in its economic development. Our Armed Forces also changed fundamentally. They were equipped with first-rate nuclear missile weapons, as well as other types of weapons and military technology which were the basis for revolutionary transformations in military affairs. All of this has caused a qualitatively new period in the development of Soviet military art and operation-level strategy in particular.

The arming of the army and navy with nuclear missile weapons and other new military technology has immeasurably increased the fire and strike power of all the services of the armed forces and branches of arms. A fundamentally new general thesis of operation-level strategy is the fact that at the present stage, nuclear missile weapons have become the basic means of destroying the enemy in operations. This has led to a fundamental change in the methods of conducting operations, to a different relationship of operation-level strategy with grand strategy and tactics, and to a diversity of the forms of operations conducted by different services of the armed forces.

In operations involving nuclear missile strategic weapons, the strategic missile troops hold the main role in carrying out the chief tasks of the war as a whole. It goes without saying that under different conditions of conducting a war, the role of all the other services of the armed forces as before will be very significant in defeating the enemy.

In a nuclear missile war, the conditions for conducting ground operations by the Land Forces will change substantially.

Strikes by strategic missiles against major enemy installations will create favorable conditions for conducting offensive operations by the Land Forces to a great depth and at a pace significantly exceeding the pace of a troop offensive during the operations of the last war. This will make it possible to achieve the decisive goals of the operation in a very short time.

The role of the other services of the Armed Forces will also change significantly. Thus, the Air Force will be able not only to participate in the combat operations of the Land Forces and Navy, but also independently carry out operation-level and strategic missions.

The Navy is now able to conduct operations over vast ocean expanses, and make powerful nuclear missile strikes not only against enemy naval groupings but also against its major objectives on the continents.

The National Air Defense Forces possess capabilities which allow them to conduct combat operations over the entire airspace of the nation's territory.

Consequently, the role and place of the branches of arms and the different services of the Armed Services in a modern war have changed substantially in all regards. At present, the question of the relationship of operation-level strategy with grand strategy and tactics must be examined in a new light. Prior to the appearance of nuclear missile weapons, strategic leadership, for the purpose of influencing the course of military operations on a certain strategic axis or theater of military operations, reinforced the task forces of the Land Forces with aviation, tanks, artillery, engineer troops, and other technical means. This increased the combat might of the task forces, and their particular successes led to strategic results. At present, strategic leadership possesses powerful means able to rapidly change the situation in vast regions and as a whole in the theaters of military operations.

The Change in the Content of Modern Operation-Level Strategy

The content of operation-level strategy has changed in line with the revolution in military affairs. Depending upon the material and morale capabilities as well as upon the forces and means available to one or another task force, and depending upon the military political situation and other conditions, the basic categories of operation-level strategy, and

the principles of preparing for and conducting an operation have assumed new features. Certain operation-level concepts which were elaborated prior to the appearance of nuclear weapons are now changed.

Fundamental changes in the development of the theory of operation-level strategy occurred in the middle of the 1950's, when the chief attention of military science and troop practices was focused on the problems of preparing for and conducting an offensive under the conditions of using nuclear weapons which had become the decisive factor for conducting operations and the war as a whole.

For achieving the operation-level goal, it is now important to defeat not only the land and aviation enemy groupings in the theater of military operations, but above all its nuclear groupings, as without their decisive destruction one can sparsely count on the successful carrying out of the missions in the operation.

The decisiveness of the goals and the great spatial scope of the operation are a general thesis in the theory and practice of operation-level strategy for all services of the armed forces.

The increased decisiveness of the target of the operation is determined primarily by increased combat capabilities of the troops. Having at its disposal nuclear weapons and diverse means for delivering them to the target, the offensive side can virtually instantaneously break apart the enemy defenses simultaneously to a great depth, and cause irretreivable losses to its reserves. Bourgeois military specialists have estimated that with just one nuclear warhead with a power of 10,000 and 20,000 tons, it is possible to destroy openly deployed manpower on an area of, respectively, 4.5 and 5.3 square kilometers. Against the same objectives, a nuclear warhead with a power of 100,000 tons can destroy enemy troops on an area of 15 square kilometers, and with 1 million tons, on an area of around 100 square kilometers. For this reason, the troops in an offensive can be given missions to defeat superior enemy forces, and in shorter periods of time.

Decisive victory in an offensive is achieved by using the results of nuclear strikes, by having the commanders of all levels take daring decisions, by carrying these decisions out unswervingly, and by having the advancing troops fight energetically, actively, and wholeheartedly until the defending enemy is completely defeated.

The increased decisiveness of the targets greatly predetermines the exceptional intensity and great spatial scope of operations.

The scope of modern offensive operations can be judged to some degree from the experience of NATO troop exercises. For example, in the Desert Strike Exercises (United States), the Third Army Corps advanced in an area of 70–80 kilometers, while the Phoenix Operations Group advanced over an area 220 kilometers wide. In the Hermelin-2 Exercises (West Germany), the Second Army Corps advanced in an area 70 kilometers wide, the Third Army Corps in one 90 kilometers wide,

the First Motorized Infantry Division in an area 30–40 kilometers wide, and the Third Tank Division in one 20–30 kilometers wide. Here the rate of advance was planned at up to 40 kilometers per day.

The intensity of warfare is also due to the fact that, as in the past war, an offensive can be carried out at night and during the day, in any season and under different conditions.

With an increase in the combat capabilities of troops and the presence of the constant threat of using nuclear weapons, the spatial scope of the offensive widens. While in the past war, a division usually advanced in an area up to 2 kilometers wide, having a mission of capturing a perimeter 8–10 kilometers in depth, at present the width of the zone of advance, for example, of the U.S. divisions, has increased by 10–15-fold, while the depth of the combat mission has risen by 4–5-fold. This is due to an increase primarily in the fire capabilities of the troops. During the years of the last war, using tactical weapons the enemy was able to be neutralized basically to a depth of up to 10 kilometers, but now the depth of his destruction using only the means of the combined-arms formations reaches 40 kilometers and more.[5]

Moreover, the increase in depth of the offensive is related to the wide use of airborne and aeromobile troops, the use of which is conceived of as special operations.[6] As a result, warfare can quickly encompass the entire depth of the defending troop grouping. At the same time, the rear and flanks of advancing troops can also be subjected to strikes by the aeromobile troops and reconnaissance-diversionary groups of the defending side. Consequently, along with destroying the defending troops, the advancing troops will be forced to allocate necessary forces and means for securing and defending their rear and flanks. Inevitably this will lead to a greater increase in the spatial scope of the offensive.

The methods of defeating enemy groupings and conducting operations for all forces and means of the types of armed forces will have their own specific features depending upon the combat properties of the weapons and equipment, upon the nature of the missions to be carried out, and the specific conditions. However, any of these methods under the conditions of using nuclear weapons is based upon nuclear strikes and coordinated highly fluid operations by other forces and means.

The basic method of the offensive is the making of nuclear strikes against selected axes and the rapid advance of tank and motorized rifle units and formations deep into the defended area through the breaches which have been formed. Indicative in this regard was the conducting of an offensive by the First Mechanized Division of the U.S. Army in the course of the NATO Certain Thrust Troop Exercises (19–24 October 1970). After repelling a counterattack by the "oranges," the troops of

[5] See *Taktika* (Tactics), Moscow, Voyenizdat, 1966, p 68.

[6] See *Field Manual of the U.S. Army FM 100–5*, Moscow, Voyenizdat, 1964, p 196.

the "blues" at an advantageous moment used a tactical nuclear weapon against the main grouping of the opposing enemy, destroyed him, forcing him to retreat, and assumed rapid pursuit in this direction, without waiting for the completion of the breakthrough to the tactical depth of defense on the other axes. In the opinion of the leaders of the exercise, this caused the success of the offensive.

An offensive along the axes provides for the effective use of the results of nuclear weapons, the shattering of defenses in several areas and the rapid shifting of efforts in depth. Moreover, it makes it possible to fully realize the increased maneuverability and strike force of the attacking troops, to carry out the offensive on a broad front and at a high pace, to cut off the opposing enemy, to make strikes against his flanks and rear and destroy him unit by unit.

The theoretical research of many foreign authors has shown that an effective means for conducting an offensive operation is to make nuclear strikes and advance the troops along converging axes for the purpose of encircling and destroying the basic forces of the defending troops with the simultaneous development of the offensive in depth. The development of the offensive along the axes, the possibility of bypassing the defender through broad spaces and openings in his formations, and the high mobility of the advancing troops create favorable conditions for the use of such a method of advance.

The Great Patriotic War provided many brililant examples of the encirclement and destruction of surrounded troops. But previously this mission was carried out in sequence, while now the increased capabilities of troops, and particularly the use of nuclear weapons, make it possible to carry it out simultaneously, without resorting to the creation of an internal and external encirclement front.

With the successful development of the offensive along the axes, individual groupings of the defending troops can be cut off from escape routes and pushed up against the sea, a forest-swampy area of terrain, a mountain range, and so forth. Their destruction should be carried out as decisively as the encircled enemy. Here the basic efforts of the advancing troops should be focused mainly on the breaking up and destruction of the enemy pushed up against the natural perimeter unit by unit with the simultaneous development of the offensive in depth.

As foreign specialists feel, on a coastal axis, it is possible to make wide use of such an offensive method as cutting off the basic enemy grouping from the sea by a strike along the seacoast in order to deprive the enemy of support by the navy, to break up the enemy forces and destroy them in the course of a rapid offensive in depth.

The use of aeromobile and airborne forces is an important direction in improving the methods of an offensive under present conditions. Being used in massed numbers after nuclear strikes, these forces are capable of playing the role of a unique echelon for developing the success, however, with the essential difference that they will carry out these missions simultaneously with completing the defeat of the first enemy operational echelon.

The new conditions have altered the role of the maneuver in the offensive, as well as its goals and content. At present, a maneuver may be carried out not only for the purpose of placing one's troops in an advantageous position vis-a-vis the enemy, but also for carrying out such missions as the rapid use of results of fire and above all of nuclear strikes for rapidly advancing in depth; the shifting of efforts to a new axis; the crossing or bypassing of areas of radioactive contamination and fire regions; the withdrawal of troops from under possible nuclear weapons strikes; the replacing of units and formations which have been put out of commission by enemy nuclear strikes.

The possibility of rapidly shifting efforts in depth and from one axis to another, old skirting and encircling actions, and the making of surprise attacks from different directions require new methods of conducting operations in a nuclear war.

An important feature of a modern offensive is the high maneuverability and dynamism of warfare as a result of equipping the troops with nuclear weapons and their complete motorization.

During the years of the last war, the advancing side first penetrated the tactical depth of the enemy defenses and only after this was able to conduct maneuvering operations in strategic depth. Nuclear weapons make it possible in the shortest period of time to cause great losses to the defending side, and to create breaches in its battle formations, while the high motorization of troops allows the use of these conditions for rapidly shifting efforts in depth. In other words, a possibility for conducting active maneuvering actions under the conditions of using nuclear weapons can be created from the very outset of the offensive.

The high maneuverability and dynamic nature of warfare cannot help but lead to sharp changes in the situation. Nuclear weapons create an opportunity to quickly alter the composition of the troop movings and the balance of forces of the sides, as well as make it necessary to change not only the methods but also the types of warfare. The increased role of the time factor is also caused by this. One of the decisive conditions for success in an operation is the anticipating of the enemy in making nuclear strikes, particularly against the enemy's nuclear missile weapons.

The radiation situation, as well as the presence of vast zones of destruction, fire and flooding will be a new factor having a major effect on the character and methods of an offensive in a nuclear war.

It is quite obvious that as a result of the massed use of nuclear weapons by the warring parties, inevitably enormous areas of radioactive contamination will occur, population points will be destroyed, and major areas of fires and flooding will be formed. This will lead to a change in the

appearance and character of the terrain. In the course of the offensive the troops must cross not only individual areas of contamination, but also conduct warfare for a long time on contaminated terrain. This will complicate the conditions of the offensive, and will make it necessary to strengthen the protection of personnel. It will also necessitate the carrying out of additional measures for engineering support and the solution of a whole series of other tasks. All of this cannot help but tell substantially on the character and methods of actions of the advancing troops.

The most characteristic features of an offensive occurring under the effect of this factor are the following: 1) an offensive along the directions with the least radiation levels, bypassing areas of fires, and extensive ruins; 2) the consecutive crossing of zones of contamination depending upon the degree of protection for personnel; 3) in the course of the offensive a combination of different types of combat operations, the rapid transition from one to another, and the conducting of them simultaneously. These features inevitably will cause changes in the organization of battle formations of the troops, as well as in the depth and content of their missions.

4. The Effect of New Means of Waging War on Tactics

In line with the introduction of nuclear missile weapons, the tactics of the services of the Armed Forces and the branches of arms have changed fundamentally, and in this regard the relationship of tactics with operation-level strategy has also changed . At present the scope of battle and the methods of waging it have become quite different. Many questions of preparing for and conducting battle have been solved in a new manner, including the choice of the direction of the main thrust and the concentration of forces and means. Greater significance has been given to the factors of time and surprise, the maneuvering of forces and means, the continuity of combat operations, and the all-round support of troops. Important significance has been acquired by the solving of such questions as reconnaissance, the protection of troops against weapons of mass destruction, and the prevention of routine actions. The independence of the subunits, units, and ships has risen in carrying out their missions.

The Principles of Conducting Modern Combat

Soviet military science proceeds from a recognition of the objective development pattern of military affairs on the basis of change in military technology and weapons. M. V. Frunze pointed out that "many tactics correspond to a certain historical era; if the type of weapons changes

and new technical improvements are introduced, then the forms of military organization and the methods of leading the troops also change." [7]

Consequently, the basic reason for the change in the nature and methods of conducting combat by the subunits and units is primarily the development of military technology and weapons. These changes occur both directly due to the high effectiveness of new means of destruction, as well as a result of the strong morale effect of previously unknown means of combat on the personnel of the subunits.

Modern combat is characterized by intensity, rapidity, and dynamism of actions by the subunits and units. The maneuverability and strike force of motorized rifle and tank subunits have risen. This makes it possible for them to quickly make use of the results of using nuclear weapons and make rapid strikes against the enemy, carrying out a bold and flexible maneuver on the battlefield. The opportunities for using tactical airborne landings have also increased. The motorized rifle subunits of the land forces, in acting as airborne troops, can carry out different missions in any form of combat, and particularly in a meeting engagement and an offensive battle.

More often tactical assault landings can be used in piercing the defenses, in crossing water obstacles, and in pursuing the enemy. The increased danger of mass destruction necessitates resorting to dispersing the battle formations, and because of this spaces and breaks will occur between the subunits in conducting combat operations both on the offensive and on the defensive. This necessitates a particularly careful coordination of efforts in carrying out the missions. The engineer and other equipment supporting the subunit in combat is also being improved.

All of this has had a great effect upon such indicators of the scope as the depth and rate of the offensive. The subunits in an offensive battle, naturally, will have significantly greater missions in depth and conduct warfare at a higher pace than was the case in the last war. Under such conditions, the commanders of the subunits should organize combat operations with great skill, making effective use of the military equipment and weapons of their subunits in carrying out the posed missions.

One of the methods of combat operations for the motorized rifle (tank) subunits in an offensive will be rapid actions along individual advantageous axes behind nuclear, air, and artillery strikes for the purpose of completing the defeat of surviving enemy subunits and capturing important objectives and perimeters, the taking of which provides for the carrying out of the posed mission.

There can also be other methods for conducting an offensive. These are: making fire onslaughts and an offensive of the subunits along convergent axes for the purpose of encircling and destroying the enemy which has, for example, put up resistance in a strong point or in defending

[7] M. V. Frunze, *Izbrannyye Proizvedeniya* (Selected Works), Vol I, Moscow, Voyenizdat, 1957, p 272.

a population point; cutting off the enemy paths of retreat, the breaking into the rear and attacking the enemy from the rear, as well as a combination of the various methods.

The countering of enemy reserves brought up from the rear on the axis of the offensive of the subunits will be carried out employing nuclear weapons and aviation, upon orders of the superior chiefs, and as the enemy reserves reach the impact zone of the supporting artillery, the strikes against the reserves will be made by the fire of artillery and tanks as well as by rapid actions of the subunits. In a number of instances, conditions can be created for destroying the enemy piecemeal by isolating the individual subunits and units from the enemy's other forces. This can occur in piercing the enemy defenses, when massed nuclear strikes will be made against the enemy, as well as in the course of developing the offensive in the operational depth, when the tank subunits, in penetrating deeply into the enemy's disposition, will capture the enemy's path of retreat.

An offensive under modern conditions will be carried out, as a rule, in a deployed battle (approach march) formation and in different formations. On those axes where decisive destruction with nuclear weapons will be made against the enemy and he will be incapable of organized resistance, the motorized rifle and tank subunits will be able to advance in depth in approach march formations and columns of route, organizing reconnaissance ahead.

Combat under the conditions of prepared enemy defenses, with the impossibility of skirting them or capturing them on the move, will begin with a breakthrough which consists in breaking the defenses by nuclear weapons and air strikes, by artillery and tank fire, and an offensive of the subunits with the subsequent development of actions in depth.

The offensive starts by making nuclear strikes with tactical missiles and aviation for the purpose of destroying the means of mass destruction and defeating the basic enemy grouping on the axis of the main strike of advancing troops.

After the nuclear strikes, for neutralizing and destroying the enemy which has not been destroyed by the nuclear weapons on the front line and in the tactical depth, preparatory firing and fire support of the advancing subunits will be carried out.

The experience of wars teaches that the concentration of basic efforts on the main axis is always a most important condition for success in combat. It is impossible to be superior over the enemy in all areas, but there must be superiority on the main, decisive axis in order to make a crushing strike and achieve victory.

The concentrating of basic efforts on the main axis maintains its significance under present-day conditions, however, its content has changed. In contrast to previous wars, when on selected axes, for example, in conducting combat by the subunits of the land forces, a multifold superiority was created over the enemy in infantry, tanks, and artillery, under present-day conditions, superiority in forces and means is achieved primarily by making nuclear strikes at the main enemy groupings with the means of the superior chiefs. By making nuclear strikes primarily against the nuclear means and tank groupings it is possible to quickly and sharply alter the balance of forces and achieve the necessary superiority over the enemy.

In modern combat, superiority over the enemy is achieved primarily by concentrating the fire efforts of the forces and mainly the nuclear strikes. The concentration of the troops on the main axis should be carried out on the basis of strict and detailed calculations so that their grouping and number make it possible primarily to utilize the results of the nuclear strikes, to successfully pierce the enemy defenses, and rapidly complete the destruction of the forces which have remained after the nuclear strikes. It is extremely important to concentrate the necessary forces and means on the direction of the main strike in a rapid and covert manner, from different directions and only for the time necessary for making the strike. As soon as such necessity is passed, the troops must be immediately dispersed. This is caused by the constant threat of the enemy's use of nuclear weapons. The dispersion of the troops on the battlefield at the same time should provide for carrying out the mission, it should not obstruct a new concentration of the units and subunits for making a strong strike against the enemy, and at the same time should exclude the possibility of the simultaneous destruction of several subunits by a medium-powered nuclear explosion.

The determining of the limits for deploying the subunits, units, and ships cannot be a constant amount. These limits depend upon the power of the nuclear ammunition which the enemy can use against our troops, as well as upon the degree of protection for the troops and the ability to use the protective properties of the terrain by them. In order to specifically determine the limits of troop dispersion, it is essential to carry out calculations which would consider the power of the nuclear ammunition and the radius of its destruction, as well as the position of troops (open, in foxholes, or in different combat vehicles). Protection of the subunits and units against strikes by nuclear missile weapons is carried out primarily by the dispersion, protection and careful camouflaging of them.

Dispersion is not the only means for protecting the troops. In this regard of enormous significance is, primarily, a rapid closing with the enemy and the making of powerful strikes against him, the careful camouflaging of the troops, the construction of fieldworks and the use of the protective properties of the terrain, as well as the able and prompt use of mobility and maneuverability of the motorized rifle and tank subunits.

The significance of time and surprise factors in conducting combat has risen due to the fact that at present fundamental changes in the situations can occur in a short period of time. By massed nuclear strikes in

several minutes it is possible to destroy and put out of action not only subunits but also entire units and formations. From the very start of combat, a fierce battle develops for gaining time. For this reason the actions of commanders and staffs of all levels and personnel in the subunits of all services of the Armed Forces and the branches of arms should be bold and exceptionally quick. The desire to gain time proceeds from the necessity of making prompt and forestalling strikes in the course of combat against the enemy.

Surprise in Combat

Surprise in combat makes it possible to catch the enemy unaware, to spread panic in his ranks, to paralyze the will to resist and to sharply reduce the combat capability of troops, to disorganize command, and to create favorable conditions for achieving victory even over superior forces. The presence of nuclear weapons, the increased mobility and maneuverability of tanks and other means of motorization make it possible to achieve surprise strikes and attacks. Surprise is achieved by confusing the enemy of one's intentions, by keeping secret the overall purpose of the forthcoming actions and preparations for them, by rapid and concealed concentration and deployment of forces in the region of making the strikes, by the unexpected use of weapons, and particularly nuclear ones, as well as by the use of tactical procedures and new weapons unknown to the enemy. In other words, surprise is achieved by making strikes against the enemy at a place and at a time where he does not expect them.

A profound and complete knowledge of the enemy is of enormous significance for achieving surprise. This knowledge must include the organization of enemy troops, weapons, and military equipment, and the tactics of units, subunits, ships, and formations in various types of combat. Here it is particularly important to promptly spot a grouping of enemy troops as well as their location and intentions in one or another type of combat.

Under conditions of using nuclear weapons, when rapid and abrupt changes occur in the situation, while the subunits and ships are forced to fight in open combat and approach march formations (formations and orders) to avoid mass destruction, with the presence of spaces and exposed flanks, the significance of maneuvering forces and means in the course of combat has immeasurably risen.

In any type of combat and under any conditions a maneuver can achieve its goal in the instance that it is carried out quickly. The slightest delay under present conditions can nullify a correctly conceived maneuver. This is why the maneuver should be simple in terms of goal and not require a great deal of time for implementing it.

The success of a maneuver also depends upon the concealment of its execution. Concealment can be achieved by the able use of terrain, by careful camouflaging, by creating effective interference in enemy reconnaissance equipment, and by active operations by subunits in different areas, thus distracting the enemy from the troops making the maneuver.

In modern combat, troops can successfully carry out a maneuver only with their proper protection against enemy air strikes.

What should be understood as a tactical maneuver? By a maneuver, one understands the shifting of primarily the nuclear strikes and artillery strikes to new targets and objectives, as well as the shifting of forces and means to new directions for creating the most advantageous grouping of the troops for a rapid advance in depth, for bypassing or encircling the enemy and making decisive and surprise strikes against his flanks and rear from different directions.

A fire maneuver consists in the consecutive concentration of fire on the major enemy groupings and objectives or in the allotment of the fire for the simultaneous destruction of several groupings (objectives).

At the basis of maneuvering the subunits and units should lie a desire to make effective use of the results of employing nuclear weapons and other means of destruction for a decisive advance deep into the enemy's positions and the completion of their destruction in the shortest time, and under an unfavorable situation, to quickly bring the troops out from under the strikes by nuclear missile weapons.

The possibility of moving troops by air is of great significance for carrying out a broad maneuver. The moving of subunits by air will be carried out for the purpose of utilizing the results of nuclear strikes, for cutting off and destroying enemy groupings, as well as for crossing various man-made and natural obstacles.

Continuous Cooperation in Combat

The precise organization and the achieving of continuous coordination among the subunits and units involved in combat are a decisive condition for their success. Cooperation consists in coordinating joint actions with aviation, artillery, and tanks in terms of the objective (target), place, and time in the interests of the most successful execution of the main mission.

In conducting combat by the subunits of the land forces under modern conditions it is particularly important to carefully coordinate the efforts of all the branches of arms for making fullest use of the results of employing nuclear weapons on the offensive and for repelling a nuclear attack as well as the following strikes by the enemy tanks and infantry on the defensive.

Cooperation in the naval and air forces is organized between ships,

aircraft, flights, squadrons, and other subunits operating against one enemy objective with time intervals between the strikes preventing the enemy from regaining his combat capability.

It should be stressed that the basic questions of cooperation are reflected in the commander's decision for combat and in the missions set for the subordinates. However, the decision chiefly determines what mission should be carried out by a certain executor. But in organizing coordination, the commander indicates how the troops should act, and how their actions should be coordinated so as to most successfully carry out not only the particular missions but also the overall one.

Due to the use of nuclear weapons, the organization and particularly the maintaining of cooperation among the troops in the course of battle have become significantly more complex. Under modern conditions, it is impossible to rely solely upon the original organization of cooperation. In the course of combat, abrupt changes in the situation may occur and the previously organized cooperation can be disrupted. Because of this the missions must be changed for the subunits and the artillery and aviation supporting them, and thus their cooperation should conform to this. Moreover, it cannot be excluded that in a number of instances the necessity may arise of reorganizing it completely in a short period of time and under complex conditions.

Consequently, the organization of cooperation should be understood not as a one-sided or single-act measure, but rather as a continuous process of creative activity on the part of the commander and staff from the moment of taking the decision to the end of combat. Cooperation should be continuous and purposeful, that is, organized primarily in the interests of that subunit which in the given period of combat, in carrying out the given specific mission, is performing the leading role in the overall complex of combat. The efforts of all others should be focused on supporting and supplying this subunit.

Coordination is organized, as a rule, on the terrain and more rarely on maps. In organizing coordination during an offensive, it is essential to clearly coordinate the actions of the subunits in terms of the position (perimeters), objectives and the time for achieving the goal of combat in a short period of time and with fewer losses. If an airborne assault force is in the area of the offensive, then the procedure is indicated for joining with the troops advancing from the front, and the signals for mutual recognition, target designation, and the radio operating data for communications are given.

On the defensive, coordination is organized over the entire depth for the probable directions of the enemy offensive, and in terms of the missions and directions of the counterattacks of one's own forces. Here coordination is secured for the actions of artillery, tanks, subunits in the

first and second echelons, as well as reserves with nuclear strikes and air strikes, and between the coordinating units.

Basic Types of Support for Combat

Under present-day conditions, reconnaissance is of decisive significance for the success of combat. The basic purpose of reconnaissance is the prompt attaining of dependable information on the enemy and above all on his nuclear weapons, the terrain, weather, and state of the area of forthcoming operations.

The purpose of reconnoitering the enemy is to establish his location, forces, composition, grouping, the nature of actions, intentions, and combat capability, the equipping of the region of forthcoming combat (the nature of defensive structures and enemy obstacles), the location of enemy control posts; to detect new weapons, the procedure of their use, and new methods of conducting combat.

In organizing and conducting reconnaissance in combat, particular attention should be focused on discovering nuclear weapons and other important objectives against which a nuclear weapons strike will be made.

The purpose of reconnoitering the terrain in conducting combat by the subunits of the land forces is to detect the character and particular features of the topography, natural obstacles, and local objects, the state of the ground and roads, as well as the degree of the terrain's influence, under the given specific weather conditions, on the position and actions of one's own troops and the enemy troops, and particularly on the use of nuclear weapons and other means of combat and defense against them. The purpose of reconnoitering the region of forthcoming actions is to ascertain the political mood of the indigenous population, as well as the economic and health-epidemiological state of the region.

In conducting combat using ships and naval subunits, it is important to clarify the military-geographic features of the area of combat.

It is essential to point out that the quantity of missions relating to reconnoitering the enemy under modern conditions has significantly increased. Such important missions have appeared as detecting enemy preparations to use weapons of mass destruction, to establish the location and shifting of enemy nuclear, chemical, and bacteriological weapons, to detect and determine the location of enemy electronic devices and night vision instruments. The necessity has arisen of conducting radiation, chemical, and bacteriological reconnaissance as well.

Reconnaissance can be carried out by the forces and means of all the subunits of the services of the Armed Forces and branches of arms participating in combat.

The defense against weapons of mass destruction is organized and carried out for the purpose of excluding the surprise use by the enemy

of nuclear weapons, poisons, and bacteriological weapons, to minimize possible losses, to maintain fighting capability, and to provide for the fulfillment of the posed missions by the subunits.

Anti-atomic protection is of primary significance, and for this reason particular attention must be given to organizing it.

Defense against weapons of mass destruction includes: forecasting the zones (areas) of destruction, as well as of radioactive and chemical contamination; notifying all levels of troops on the immediate threat of nuclear attack, chemical attack, radioactive contamination, and the use of bacteriological weapons by the enemy; dispersion and camouflaging of the subunits, use of protective properties of the terrain, construction of fieldworks and preparation of shelters in anti-chemical terms (engineer and technical measures to provide the survival of ships and shore objectives); carrying out of sanitation and special prophylactic measures; providing the troops with individual and collective means of defense against contamination by radioactive and toxic substances and bacteriological agents; elimination of the aftereffects of using weapons of mass destruction by the enemy and restoring the fighting capability of subunits which have been subject to enemy strikes.

The protection of personnel, weapons, and equipment against weapons of mass destruction is organized and carried out by the commanders and staffs of the services of the Armed Forces, by the branches of arms, and the special forces considering the actual and expected weather conditions.

Rear support includes a range of measures to organize the rear, as well as material, technical, airfield-technical, medical, and other types of support and services for the troops.

In assessing the situation, the commanders and staffs of all levels study, among other questions, the state, the level of supply, and the capabilities of their subunits for carrying out the forthcoming mission. In assessing the level of their supply with material means, it is particularly important to establish the following: the availability of ammunition, fuel, and foods, what is to be allocated by the senior commander and at what time, what is to be brought up and at what time, the state of the roads, the capabilities of motor transport, the assumed consumption of materiel and the necessity of maneuvering them.

After taking the decision relating to combat, commanders immediately give instructions for the rear in which they determine: the routes of delivery and evacuation; the disposition of the rear and the direction of its movement; the amounts and dates of creating material stockpiles in the subunit; consumption standards for ammunition and fuel, and when necessary for other materiel; basic measures relating to technical and medical support; the forces and means allocated when necessary to help the rear. The command of the rear subunits is an inseparable function of troop command in modern combat.

5. Modern Demands on the Combat Training of Troops

Under present conditions, combat training of personnel in subunits and ships requires the use of new more advanced methods of personnel training. This is caused above all by those fundamental changes which have occurred in the content, means, and methods of conducting combat by the subunits. The occurred changes have strengthened the role of man and have immeasurably raised the requirements on his training. The new military equipment and the corresponding methods of conducting combat raise even higher the significance of the combat morale qualities of the men, and bring out new complex tasks in training the armed defenders of our motherland.

Studying Weapons and Military Equipment

At present, in line with the great quantity of diverse and complex military equipment and weapons in the subunits, units, and on the ships, it is particularly important that each soldier, sailor, petty officer and officer have a perfect knowledge of the weapons and military equipment entrusted to them, that they become masters of their military specialty and are always ready to honorably carry out any assignment of the command.

High combat readiness is achieved by a firm knowledge of new weapons, by skilled servicing and by keeping all means of combat in an exemplary state. The significance of scientific-technical knowledge of all personnel has risen sharply. At present, military-technical training of soldiers, sailors, sergeants, and petty officers should be, as a rule, on the level of a class specialist and even a technician, while that of officers and a number of ensigns and warrant officers should be on the level of an engineer.

In order to master weapons and military equipment, personnel should manifest tenacity, stubborness, and firm discipline. It must not be forgotten that in modern combat, with the presence of powerful weapons, to a greater degree than before, not only the life of a soldier, but also the life of his comrades in arms as well as hundreds of thousands of other Soviet people depend upon the knowledge and ability of the soldier. At present the time factor has assumed decisive significance. The better personnel know weapons and military equipment, the more rapidly they can use it. In many instances success in combat will be determined not by hours, but by minutes and even seconds.

It goes without saying that particularly high demands should be placed upon the officers who are commanders of subunits, units, and ships. Precisely they set an example of profound and intelligent studying and mastering of weapons and military equipment. The officers master basic military specialities of the men of their subunit, unit, or ship, they are able to correctly operate the equipment, they can perform all operations on it, and work better than their subordinates.

Success in modern combat will depend greatly upon how profoundly and thoroughly personnel of subunits, units, and ships know the weapons and tactics of the probable enemy. In order to be victorious over the enemy, it is essential to know him. The task is to see to it that personnel of subunits, units, ships, services of the Armed Forces, and branches of arms constantly and thoroughly study the probable enemy, and have a firm and profound knowledge of the technical specifications of the basic types of his weapons and military equipment, the organization of troops, and combat capabilities of subunits and units, as well as tactics in different types of combat. Here it is particularly important to promptly detect the strong and weak points of the enemy both in terms of weapons and military equipment as well as particularly in his tactics. This will make it possible under specific conditions to find the most effective methods of action to defeat the enemy and to promptly counter the enemy with one's own countermaneuver.

A study of the weapons, military equipment, and possible nature of the actions of the subunits and units of the probable enemy is not an easy task since the enemy possesses diverse weapons and diverse military equipment. The carrying out of this task requires, above all, high organization, stubbornness, and tenacity on the part of commanders of all levels and personnel.

The Cohesiveness of Subunits

The nature of modern combat sharply raises the importance of independent actions by the teams, crews, and subunits of all services of the Armed Forces and branches of arms. Fast and highly fluid combat requires from each troop organism rapid and decisive actions aimed at the precise and unswerving fulfillment of the set mission. This will depend primarily upon the coordinated, skillful, and close actions of all the men in each team, crew, and subunit as a whole.

The increased demands upon teamwork and coordination of the teams, crews, and subunits in their conducting of combat make it essential to seek out the best and most effective methods for training each man individually, as well as the team, the crew, and the subunit. First of all soldiers should be highly educated people, they should know mathematics and physics, and be able to make calculations and estimates quickly and accurately. The main thing is to have an excellent knowledge and ability to use the weapons and military equipment assigned to the men in combat; to have a profound and complete knowledge of one's functional duties in the team (crew) and be ready to take over for one another. Only on this basis is it possible to achieve united, accurate, and coordinated actions by the crew, team, and subunit.

Considering the diversity of weapons and the complexity of military

equipment, particular attention should be given to the field training of crews, teams, and subunits. Tactical training is the heart of it, including instructing personnel in rapid and precise, highly fluid and rapid actions to a great depth under conditions of a rapidly changing situation, nuclear action by the enemy, and radioactive contamination of the terrain.

Any exercise conducted in the field, at sea, and in the air with a squad, crew, team, or subunit cannot get by without elements of tactics. It is essential to see to it that all the methods and procedures for the troop organisms be worked out in coordination and considering the tactical situation. The new equipment and corresponding methods of conducting combat have brought to life new methods for training personnel. At present such training methods as comprehensive training in the subunits which is the concluding stage of instruction, programed instruction of personnel for a number of specialists, and others are now being more and more firmly established.

It is particularly important that all the exercises and tactical training, the marches and flights be carried out in strict accord with present-day requirements corresponding to the nature of combat. Oversimplification and indulgence which are inadmissible at any time in combat training at present are triply inadmissible, for they may cause in the personnel a distorted notion on the nature of modern combat and weaken the training of troops for surmounting enormous difficulties.

Combat Readiness

To be in constant combat readiness means to be ready at any minute, upon the order of the Soviet government, to come to the defense of one's motherland and defeat any aggressor if he attempts to disturb the peaceful labor of our people. "At the present stage," said the USSR Minister of Defense, Mar SU A. A. Grechko, "the Armed Forces should be able under any conditions to thwart a surprise attack by the aggressor using both nuclear as well as conventional weapons, and by rapid crushing strikes defeat his basic nuclear missile weapons and troop groupings, having provided favorable conditions for the further conduct and victorious completion of the war." [8]

High combat readiness of the troops is not an abstract concept, but rather a specific one embodied in precise calculations, figures, and times in hours and minutes which cannot be violated without risking destruction by the enemy before being able to do something. There cannot be any deviations from scientifically calculated standards of combat readiness. That a violation of them is inadmissible is what must be firmly assimilated by the personnel of subunits, units, and formations. For this reason the personnel, teams, crews, subunits, units, and formations as a whole should

[8] A. A. Grechko, *Na Strazhe Mira i Stroitel'stva Kommunizma*, p 64.

always be in constant combat readiness to immediately carry out the missions confronting them.

The best defense against a surprise enemy attack in combat is constant readiness to destroy the enemy at the maximum range, and to deal a crushing strike against the enemy launchers, artillery, tanks, and command posts. Constant readiness will depend upon speed, decisiveness, and mastery of the personnel, crew, team, and subunit.

To always be in a state of combat readiness is a sacred duty of the personnel. The subunits, units, ships, and formations possess everything necesary for this. Each soldier and sailor, and each officer have every opportunity for the excellent fulfillment of complex missions and for combat improvement. The nature of military service is such that it can be successfully carried out only by a disciplined and industrious soldier. No matter where the soldier, sailor, or officer may be, and no matter what obligations he performs, the results of his work are most closely related to providing for the security of the nation. An awareness of this gives a political purposefulness to the activities of soldiers and officers, and creates in them noble feelings of patriotic pride.

The General Secretary of the CPSU Central Committee, L. I. Brezhnev, at a reception in the Kremlin in honor of the graduates of military academies in July 1967 thus stated the demands of our party and government on the constant combat readiness of the Soviet Armed Forces:

"The Soviet Armed Forces as a whole, each formation and each troop unit should be in a state of such readiness which would exclude the slightest opportunity for the enemy to catch us unaware. You, as military personnel, are aware that the combat readiness of the troops mirrors the enormous efforts and material expenditures by the people on arming the army, the awareness, combat skill, and discipline of all military personnel, the art of command in leading the troops, and much else. This, of course, is the crowning point of military expertise in peacetime and the key to victory in a war.

"We have everything necessary for providing the high and dependable combat readiness of the Soviet Armed Forces. For this reason a further rise in the level of the combat readiness of the Army and Navy depends greatly upon the practical activities of the military personnel, and upon their ability, will, energy, and tenacity.

"The party, the Soviet government, and all our people are firmly convinced that the USSR Armed Forces are capable of carrying out the missions entrusted to them, and that their personnel, weapons, and equipment are in constant combat readiness." [9]

It must be stressed that indoctrination of military personnel in a spirit of constant combat readiness is one of the most important tasks of commanders, political workers, the party and Komsomol organizations. Without strictest discipline and the aware fulfillment of military duty, there can be no question of maintaining combat readiness of subunits, units, ships, and formations on the level of modern demands. Here the decisive role is played by the commanders. "The most important principle of developing the Soviet Armed Forces," the CPSU Program states, "is one-man leadership." [10] This provides actually rapid, centralized, and dependable command, unity of the will and actions of the crew, team, subunit, unit, and the entire complex Army and Navy organism, as well as personal responsibility of each man for the assigned job.

Tactical training holds a leading place in the complex of combat training of subunits, units, and ships aimed at providing their complete readiness for conducting active and decisive combat under the difficult conditions of modern war.

In the course of tactical training, the officers, staffs, subunits, units, and ships should master the principles and methods of organizing and conducting the fluid forms and methods of combat, as well as the carrying out of marches over great distances at a high speed under conditions of the massed use of nuclear weapons and with the presence of large areas of destruction and radioactive contamination. It is essential that the commanders and the staffs learn to control troops under the conditions of using nuclear and conventional weapons, while the troops must learn to carry out a maneuver promptly and skillfully for the purpose of effectively using the maneuver to quickly complete the defeat of the enemy and successfully carry out the posed missions.

Teaching the troops what is actually essential for victory in a war should be a most important principle in tactical training. The successful introduction of this principle into troop training practices is aided above all by the hgh training of the commanders and staffs of all levels as well as their ability to promptly detect and correctly consider the changes occurring in military affairs in order that they always be perfectly aware of what is essential in a war under present-day conditions and under one or another specific combat situation.

All the exercises relating to tactical training should be conducted under the conditions of a rapidly changing situation which is as close as possible to combat in accord with the character of modern combat in order to teach trainees the ability to quickly analyze a complex situation, and to instill initiative, will, and daring in them. The enemy must always be represented as strong and armed with nuclear weapons and all other types of modern means of destruction. This will make it possible even in peacetime to develop the methods for successfully countering the enemy. Exercises with the subunits, units, and ships are best carried out each time under new conditions, during different seasons, in any weather, and with the maximum use of nighttime.

[9] L. I. Brezhnev, *Leninskim Kursom* (By the Leninist Course), Vol 2, Moscow, Politizdat, 1970, pp 49–50.

[10] *Programma KPSS*, p 111.

In the tactical training of officers, staffs, subunits, units, and ships, different forms and methods of practical training are used, the most widely found being: lectures, seminars, group and training exercises, the solving of short quizzes, command post exercises, military games, the holding of troop and special exercises using weapons and military equipment, tactical flight exercises, and so forth. The creative use of the designated forms and methods of training as well as the prohibition of any routine and sketchiness make it possible to train the subunits and units as a whole in a spirit of present-day requirements.

Command post exercises and military games are an effective form for training commanders and staffs. They are aimed at improving, training, or testing knowledge and abilities of the commanders and staffs on questions relating to the command of subunits, units, and ships as well as the complete support of their combat. At the command post exercises and military games, commanders and staffs improve the methods and skills of rapid and complete analysis of the situation, the ability to draw correct conclusions from it, to make tactical calculations, to formulate the decisions of the commander, and to work out combat orders, instructions, reports, and other combat documents. At the same time, they play a major role in further improving the questions of military theory. The experience of recent years has shown that these exercises and games provide an opportunity to test out and improve theoretical views on the conduct of modern combat as well as on the combat application of weapons and new military equipment.

Tactical short exercises are the simplest and at the same time very effective method of individual practical training for officers under present-day conditions. They are conducted for the purpose of improving the officers' knowledge on individual important questions of tactics and particularly for the purpose of developing flexibility and mobility of thought in the officers, as well as for training them in independent work related to command of the subunits, units, and ships under the conditions of a crisis combat situation and in a limited time. In tactical exercises conducted by the short quiz method, officers gain practice and add to their experience in independent and rapid analysis of the situation. This method also helps in rapidly making calculations and taking sound decisions, in the precise and intelligible formation of one's decisions and the assigning of missions to subordinates in a limited time, the intelligent and rapid formulation of the taken decisions graphically on maps, and, lastly, drawing up the combat documents in a short period of time. They are also designed for testing the knowledge and skills of trainees on individual questions relating to command of the subunits and raising their knowledge on poorly mastered questions. They also help to prepare the officers

for forthcoming military games, command post exercises, and tactical exercises.

In terms of their content, the tactical short exercises can be commander, staff, rear, and special.

The troop and special exercises involving the use of weapons and military equipment are the most effective method for training commanders, staffs, and all personnel. At these exercises, subunits and units of all the branches of arms and the special forces carry out a common mission. For this reason there are the broadest opportunities for improving the methods of organizing and conducting joint combat. The commanders and staffs, in being concerned with really fighting troops, in practical terms become convinced of the correctness or erroneousness of their decisions and actions, and they acquire the necessary skills in working under conditions which are as close as possible to combat reality. The generalized experience of troop exercises is the basis for working out new theoretical provisions.

The practical actions of subunits, units, and ships provide an opportunity to thoroughly examine the entire complex of measures related to preparing for combat, organizing coordination, command, the all-round support of subunits in combat, as well as to check the correctness of allocating missions to them, the times of their fulfillment, the combat, maneuver, and march capabilities of the subunits and units, that is, the basic tactical standards.

Moreover, the troop exercises make it possible to elaborate completely sound technical specifications for further improving the existing types of weapons and military equipment and creating new types, as well as to determine the proper staff organizational structure for modern subunits.

The generalizing and introduction of new advanced experience into practice are of very important significance for improving combat training. The active introduction of this experience makes it possible to successfully develop a communist ideology and high combat morale in the troops, to better master the new equipment, to constantly improve the methods of its combat application, and to significantly surpass established standards for combat readiness and capability of the teams (crews), subunits, and units (ships). It is particularly essential to consider the experience of the exemplary collectives which opens up the path to success for other subunits, units, and ships.

All the work of studying and generalizing advanced experience in the area of combat and political training is organized and carried out by the responsible commander. He directs military-scientific and rationalization work, the propagandizing of military-technical knowledge, the studying of advanced training methods and their introduction into practice.

Chapter VI. Troop Control Under the Conditions of Modern War

The processes of controlling troops, along with the processes of training and indoctrinating subordinates, comprise the basic content in the activities of the commanders and staffs of all levels, beginning with the tactical elements and ending with the superior strategic leadership element.

By control in the broadest sense, one has come to understand the purposeful effect of the control body on the controlled object.

The essence of troop control consists in provding constant purposeful leadership by the command and staffs over all the activities of the subordinate troops. The control process is one of the most difficult areas of man's activity requiring profound knowledge, experience, and high volitional qualities.

Victory or defeat in modern war depends not only upon the balance of the means of combat which the warring sides possess, but also upon the balance of the leadership levels. History knows many examples when even superior forces have been defeated while numerically fewer ones have been victorious as a consequence of more correct leadership. Able control of the troops turns into reality those combat abilities which reside in the troops and the weapons systems.

To provide a high level of control means each time, under the given specific conditions, to take and carry out the best decisions, that is, the decisions which conform most to the existing situation and set goal.

To control proficiently means each time to spend as little as possible time on the control processes in order that the maximum possible time is available to the troops, for precisely the troops with their weapons cause losses to the enemy, they change the balance of forces in our favor and thereby directly influence the course and outcome of combat.

The requirements of proficiency and a high level of control are closely linked, since under present conditions it is impossible to be slow in decision taking in a combat situation or in a situation preceding the beginning of combat. In these instances, even the best but delayed decisions inevitably lose their positive qualities. Moreover, a delay in decision taking in a number of instances may be the equivalent of defeat.

Under ordinary conditions, we find it quite natural that a good deal of time is spent on settling important and complex problems, figuring in this instance that speed of decision taking and a good quality of the decisions in some way contradict one another. However, experience shows that use of the most rational methods of control as well as broad application of the most recent technical devices can minimize this contradiction.

For this it is essential first of all to analyze the increased role of troop control and the particular features inherent to it.

1. The Increase in the Role of Troop Control in Modern Combat

The revolution in military affairs has immeasurably raised the significance of troop control and the demands placed on it. The role of troop control is determined by the role and the scale of combat, by the quantity and quality of employed weapons, and by the possible consequences of combat.

Reasons for the Increase in the Role of Troop Control

Under present-day conditions, combat can be carried out on a global scale, and in all spheres (on land, in the air, and at sea) with the possibility of an active effect from one sphere on another. In battle enormous masses of men will participate on both sides, and these men will be controlled from single centers through a complex and diverse structure of control bodies.

The scale and level of arming troops with equipment have risen immeasurably. The range and speed of weapons as well as their destructive properties have increased sharply. All of this has raised the responsibility of command levels for the leadership level, for the proficiency and quality of control, and at the same time this has complicated the exercising of all control processes.

The role of troop control has risen so much that more and more it acquires the significance of a major sector of military affairs which is developing on scientific principles. Cybernetics is a science studying the most general laws of control in systems of any nature and complexity.

Any controlled system, both in society as well as in nature and technology, when viewed from the positions of cybernetics, in its simplest form consists of the object of control, the controlling body, and the two-way link connecting them.

In each system of troop control, there is also the controlling body (the commander, the staff or command post), the object of control (the troops with their weapons, the combat complexes, and so forth), as well as the

communications channels between them over which one side receives reports while the other receives signals, commands, and orders.

But, in addition to the general features in the structure of controlled troop systems and the processes occurring in them, there are specific features which under present-day conditions are manifested particularly vividly. This circumstance has caused the development of a special branch of cybernetics, and namely military cybernetics as a science studying the most general laws of controlling troops and weapons.

Particular Features of Troop Control in Modern War

These particular features are determined primarily by the significant amount of information which each staff should collect, transmit, and process. This applies to the information concerning the position, grouping, and state of one's troops and the enemy troops, the technical specifications of weapons and equipment used by the sides, the state and equipment of the theaters of military actions, the terrain and hydrometeorological conditions, the radiation situation, and so forth.

Here in contrast to control in the civilian sphere of activities, for example production control, combat occurs under conditions of uncertainty. Combat is always a two-sided process. And neither of the sides ever knows accurately either the position or the state of the opposite side, or its intentions, for they are most carefully concealed. For this reason, information on the opposite side must, in essence, not be collected but rather extracted, obtaining fragmentary and often contradictory information from various sources, on the basis of which, by intense analysis, it is essential to create an integrated picture which more or less dependably reflects the actual situation.

The necessity of carrying out a large number of diverse calculations in the process of processing the obtained information is the next feature in troop control under modern conditions. These calculations are essential for a correct assessment of the situation, for correctly determining combat capabilities of the forces and means and for using specific types of weapons, for forecasting the possible results of combat and for taking optimum decisions, as well as for organizing all types of combat, material-technical, medical, and other types of supply. Many events comprising combat have not only a mass but also a random character. For this reason, in different calculations it is essential to use those methods of mathematics which consider the presence of elements of uncertainty and randomness, and the probability character of the processes of combat. In carrying out the calculations, staffs follow not determined values but rather the most probable averages of the examined values for given conditions, and always consider that in specific instances the actually obtained values can deviate to one side or another from what was expected.

The sharp reduction in time which control bodies possess for collecting, transmitting, processing, displaying, and documenting information and for making calculations is still another particular feature of troop control under modern conditions.

Time has always played an important role in combat. At present, due to the development of new weapons, time has come to play not simply an important but rather a decisive role in the development and outcome of combat.

The rapidity of those processes which must be controlled by military bodies has caused the exceptionally acute nature of the struggle by both sides to gain time. For precisely this reason, in the process of training military personnel, a conviction is instilled that success comes to the side which is able to collect the necessary information and take the decision in the shorter time, to set the mission and organize the actions of troops, to prepare and make strikes against targets, and to promptly bring up and commit the reserves to combat.

In order in each specific instance to make sound quantitative demands upon the proficiency of control, a careful analysis is essential and this can be aided by the concept of critical time.

Critical time (T_{crit}) can be defined as the time at the end of which obtained information is obsolete, and for this reason the actions of troops will not lead to the set goal generally or to that effectiveness which was expected and planned.

If by T_{con} we designate the time spent on the control cycle (for receiving, processing, and transmitting information), and by T_{act} the time necessary for the troops to act in carrying out the obtained command, then the condition of control proficiency can be written thus: $T_{con} + T_{act} < T_{crit}$. This means that the total time spent on the control cycle and the time necessary for carrying out the command should be less than the critical time.

Due to the high speed of modern weapons, the increased maneuverability of troops and abrupt changes in the situation, critical time shows a tendency to be reduced. In other words, the obtained information concerning the situation is rapidly obsolete. For this reason, for a prompt response to a change in the situation, it is essential to reduce the time of action of the troops (for example, by raising their combat readiness) and reduce the time expenditures on the control cycle. The pace at which control bodies should work can be expressed in a fraction, the numerator of which shows the amount of work and the denominator the time allocated for the work. From what has been stated it follows that the numerator (the amount of work) has greatly increased. This circumstance alone requires an acceleration in the pace of the work. But this is not all. From what has been stated it also follows that time allocated for the work under modern conditions has been greatly reduced. And this requires an abrupt shift toward increasing the work pace of the staff. In

other words, under present conditions the staffs should work not merely more rapidly but many times more rapidly than they worked in the past.

In addition to this, in organizing troop control it is essential to consider the demands placed upon troops from the standpoint of continuity, concealment, survival, and reliability of all the elements in the control system.

All these circumstances, taken together, have determined the greater role played by troop control under the conditions of modern war, and at the same time have posed a number of complex problems which are based upon the necessity of bringing the possibilities of man to control combat into accord with the requirements placed on command.

2. Principles of Troop Control in the Combat Process

A most important condition for success of military operations as a whole, and troop control in a combat situation in particular, is a thorough knowledge on the part of commanders and staffs of the objective laws of modern war as well as the basic principles of military art and the principles of control.

In a similar manner to how the principles of military art provide recommendations on the methods of combat, the principles of control represent general leading ideas and rules for controlling the troops. Among these principles we must put the following: *sole responsibility and collectivism, centralization, initiative and independence, foresight and constant knowledge of the situation, firmness and flexibility of control, continuity, concealment, high proficiency,* and others.

The application of one or another principle of military art in practice makes it necessary to use the appropriate principle of control. For example, the concentrating of efforts on the direction of the main thrust for the cooperation of all the forces and means on this axis can be achieved only with the presence of firm centralized control over all the forces and means participating in combat or the operation. Moreover, the principles of control, in essence, represent a group of principles in military art relating directly to the area of activity of the control bodies. Let us examine the most important of these principles.

The principle of *sole responsibility* in terms of control must be understood as concentrating the rights of leadership over subordinate troops in the hands of one commander. These rights are given him by state laws which determine the basic principles for development of the armed forces and are regulated by the regulations and orders of superior chiefs.

The necessity of using the principle of sole responsibility derives from the very nature of armed combat in which enormous collectives of men are involved. The uniting of efforts of these collectives for achieving a common goal requires the unconditional and strictest unity of will. This thesis was well established in the work of V. I. Lenin "The Next Tasks

of Soviet Power." In it, Lenin with particular force emphasized the need for an unfailing subordination of the will of thousands to the will of one person in any process in which masses of people are involved.

Sole responsibility in the Soviet Army is based upon the high political awareness of each superior who in his activities follows the decisions of the CPSU, as well as upon the monolithic political and moral unity of all personnel. The principle of sole responsibility presupposes not only the sole taking of decisions by the commander, but also his complete personal responsibility for the taken decision, for controlling subordinate troops and for successful execution of their missions.

At the same time, under modern conditions, due to the significant increase in the range of tasks related to troop control, the complexity of the entire control process and the sharp rise in responsibility, particularly for using nuclear weapons, it is beyond the capacity of a single person to control troops in combat, let alone major operations on a strategic scale. For this reason the principle of *collectivism* in control is assuming ever greater significance. This is manifested in the fact that the settling of the most important and crucial questions, particularly in the tactical and strategic elements, is done not by a single person but rather by a group of responsible individuals. Moreover, in the process of working out the decision, as in the process of troop control as a whole, the commander receives great help from his staff. However, the principle of collectivism in decision taking is not contradictory to the principle of sole responsibility. The taking of the final decision as well as the right of sole leadership and responsibility remain for the commander.

The principle of *centralism* is one of the most important ones of control. Its essence can be reduced to the fact that the superior level must unify the efforts of all subordinate forces and means, and coordinate and direct their actions for achieving the overall goal of the battle (operation). Here only the senior commander is given the right to alter the methods and directions of the subordinates' actions in the course of their execution of the missions. When necessary, in the interests of more efficient use of forces and means he may also adjust the decisions and the plan of actions for subordinate commanders. Rigid centralization is particularly advisable on the questions of using nuclear weapons and other powerful means of destruction, since here their most effective and efficient use is achieved. Moreover, centralization in the use of these means makes it possible to better coordinate the actions of all the forces and means on the spot and in terms of time. This is of primary significance in modern combat and an operation.

At first glance it may seem that the significance of the principle of centralization gradually declines as there is an increase in combat capabilities of units and formations and in line with the changing character of combat and an operation. Certainly this is not the case. The use of this principle (of course, within reasonable limits) has not only lost its

significance, but has increased even more in certain instances, for example, in the use of nuclear weapons.

The apparent reduction in the significance of centralization is explained by the fact that under present conditioins, another principle of control, *independence and initiative* in the actions of subordinates, is assuming ever greater importance. The increased fire and strike power of units and formations, and consequently, their independence in carrying out the set missions, the wide use of operations along axes, and the great dynamism and unevenness in the development of combat and the operation require a closer combination of centralized control with the providing of greater independence to subordinates and the manifesting of greater initiative and creativity by them in choosing the methods of actions. This is all the more essential due to the fact that in line with the rapid and frequent change in the situation, a prompt response to a change in it by the senior chiefs becomes more and more difficult.

The encouraging of independence and initiative is also advisable due to the fact that excessive supervision of subordinates, as a rule, develops passivity in their actions and, equally dangerous, undermines their confidence in themselves. Moreover, with such a situation, any basis is lost to demand complete responsibility from them for carrying out the mission. At the same time it must be pointed out that any independence and initiative should have reasonable limits. They can be permitted only within the framework of the set task and should conform to the overall intention by the superior chief.

The ability to foresee the development of combat and an operation holds an important place in the theory and practice of troop control. The essence of this ability is sufficiently understood and does not require analysis. In this regard we would merely point out that the ability to foresee possible changes in the situation and the probable course of combat is inherent only to a person who possesses a dialectical method of thinking, who is able to analyze the data of the situation profoundly, thoroughly, and objectively, and find the main thing in it.

Under present-day conditions, foresight is inconceivable without a profound knowledge of the organization, equipment, and tactics of the enemy, as well as without precise and detailed calculations. Thus, the ability to foresee is inherent only to a well-rounded and experienced officer who possesses a broad strategic and tactical viewpoint.

Being in and of itself a very difficut matter, foresight is based primarily upon *constant knowledge of the situation*. Although we say that a lack of information concerning the situation does not release the commander from the duty to take a decision promptly, it must be said that without knowledge of the situation it is impossible to take a sound decision, to organize combat and achieve victory over the enemy. Profound and complete knowledge of the situation is the sacred duty of the commander and his staff, and for this reason is one of the most important principles of troop control.

The reasonable tenacity and will of the commander, and his conviction and confidence of sucess have always been of enormous significance in achieving victory. The firm will of the commander, being one of his positive qualities, should be manifested primarily in his ability to organize firm control of the troops. *Firmness of control*, as one of the most important principles, consists in taking a bold decision and carrying it out steadfastly. On the part of the commander this requires a strong will, courage, self-possession, decisiveness, and boldness, as well as the ability to instill these qualities in all the personnel.

However, firmness of control has nothing in common with obstinacy. Unsound obstinacy, particularly under modern conditions when the situation can change frequently and fundamentally, is untenable, since it inevitably leads to defeat.

Firm control in no way means that the commander should blindly adhere to a previously taken position. Combat under modern conditions will never develop precisely in accord with the set plan. For this reason, in working constantly to carry out the taken decision, the commander at the same time should respond to all changes in the situation, consider them and in accord with this adjust the decision and missions for the troops, and if need be, fundamentally alter the plan of combat or the operation. This is a manifestation of *the flexibility of control.*

The continuity of control presupposes constant leadership by the commander over the actions of his subordinates and his influence on the course of combat. This places great responsibility on the commander and his control bodies for maintaining uninterrupted communications with the troops and constant knowledge of the situation.

The importance of the principle of continuity of control has increased by many times in the era of nuclear weapons, the effective and massed use of which makes it possible almost instantaneously to fundamentally alter the balance of forces, and as a whole, the situation in one or another area. In this regard, ignorance of the situation due to absence of communications with subordinates or even brief breaks in receiving information can lead to the taking of unsound decisions, and consequently, to the setting of missions for troops which no longer correspond to the situation. All of this, certainly, as a rule, threatens the execution of missions with failure.

But, on the other hand, under the conditions of using nuclear weapons, it is difficult to count on maintaining continuous contact with the troops, even with the integrated use of all the forces and means. For this reason, the necessity of observing the principle of continuity of control places increased demands upon the subordinates as well. First of all they must show constant concern for maintaining contact with the superior chief,

and "seek contact" with him, if for some reason it should be lost. Moreover, each commander should be constantly up on the overall situation, and know and thoroughly understand the overall intention of the superior chief. This will not only give him an opportunity to show reasonable initiative within the overall intention, but also will make it possible in the event that the command post of the superior level is knocked out, to assume leadership of all the troops and carry out the overall mission.

The arming of the opposing sides with such powerful means of destruction as nuclear weapons makes the possibility of thwarting the enemy's intentions completely realistic. For this purpose, each of the sides will endeavor by all ways and means to discover the essence of the enemy's maneuver. In this regard, in modern combat and operations, the role of surprise in actions rose significantly. Surprise can be achieved only by the strictest concealment of the measures being prepared, that is, by observing *the principle of concealment of control.*

Finally, let us take up one other extremely important principle of control, that is, *high proficiency*. High proficiency in the work of the commanders and the staffs must be understood above all as a prompt response to all changes in the situation, that is, the prompt taking of decisions and the assigning of missions to the troops. Such a demand on the work of the control bodies existed previously, however, under modern conditions its importance has grown incomparably. Again the reason for this has been the arming of troops with nuclear weapons, the increase in their mobility and maneuverability, the great dynamism in the development of combat, as well as frequent and abrupt changes in the situation.

However, it must be pointed out that high proficiency in work has nothing in common with hurrying. Any hurried decision taken without sufficient analysis of the situation and execution of necessary calculations, under modern conditions, can cause irreparable harm. For this reason, proficiency and hurrying are completely incompatible concepts.

As we can see, the significance of observing the above-indicated basic principles in troop control has greatly increased under modern conditions. At the same time, their observance requires creativity and precise organization in the work of the commander and his subordinate control bodies considering the new conditions for conducting combat and the specifically existing situation.

These high demands, in turn, necessitate further improvement in the organizational structure of the control bodies, the equipping of them with more advanced technical devices, as well as an improvement in the work methods of commanders and staffs.

3. The Use of Technical Control Devices

Contradictions arising between the demands placed on troop control

and the opportunities of the staffs to satisfy them cannot be resolved by merely increasing the size of the troop control bodies, for in a number of instances the capabilities of man himself are the "bottleneck." The physical capabilities of man are limited by his muscular strength. The possibilities for carrying out mental types of labor (and troop control is precisely such a type) are limited by the range of the sensitivity of human organs of perception, by the capacity of his memory, by the reaction time, by the speed of the thought process, and by the quantity and quality of knowledge acquired as a result of training and experience in life.

The extensive use of mechanical, electrical, chemical, and nuclear energy, in being a consequence of scientific-technical progress, has substantially broadened the physical possibilities of man. A man of our times is capable of activating enormous energy potentials which surpass by billions of times the energy which he himself can develop with his given innate capabilities.

As for broadening the possibilities for man to perform mental types of labor, here scientific-technical progress in this area has begun to be markedly apparent only in recent years.

For this reason, in any process of controlling troops and weapons, there are elements the execution of which with required proficiency and quality often goes beyond the limits of human capabilities. For example, in air defense, according to the data of the foreign press, among such elements are target tracking, the differentiating of "one's own" and "foreign," the isolating of actual target signals against the background of interference, and the calculating of target trajectories and determining of those points of prediction where enemy antiaircraft missiles should be launched.

An improvement in the style and methods of work by the control bodies, an improvement in their organizational structure, a reduction in the quantity and volume of analyzed documentation, a rise in the maneuverability of the control posts and other similar measures, although helping to raise proficiency and the quality of control, do not solve the problems fundamentally.

Revolutionary changes in the processes of troop control should also correspond to revolutionary changes in the development of the forces and means of armed combat. The necessity arises of facilitating the solution to the problems confronting the officers and generals through the means of mechanization and automation.

The mechanization and automation of troop control processes can be carried out by two basic paths. First of all, by using highly productive technical devices in the individual most labor-intensive areas of the control processes. Secondly, by developing and using comprehensive automated control systems.

Depending upon the degree of saturating the control processes with

technical devices and systems, control can be manual, mechanized, automated, and automatic.

If no area of the control process has been mechanized, then it is usually said that this is manual control. If labor-easing mechanisms are employed on one, several, or all areas of the control process, then control is considered to be mechanized to one or another degree, partially or completely. If individual areas have been automated, that is, the process in these areas can occur without the direct involvement of man, we call the control automated. Finally, when the entire process consists of automated sections, control is considered to be automatic.

The most labor-consuming processes in the work of the troop control bodies are: collection and processing of intelligence information on the enemy, on one's own troops, and on the radiation and hydrometeorological situation; execution of complexes of calculations for assessing the situation, decision taking, planning combat and support actions, setting of missions for the troops for using various weapons; formulation, multiplication, and issuing of documents relating to control, including graphic ones, to the troops and superior staffs, in observing complete secrecy.

In accord with these labor-intensive processes, highly productive technical control devices can be divided into five groups.

The first group includes the means of collecting information. They help the staffs to collect data on the situation, on enemy troops, and one's own troops, as well as on the coordinates and characteristics of strikes.

The means for receiving and transmitting information, in being placed in *the second group*, makes it possible to organize the exchange of graphic and textual documents between the command posts and within them; to give warning signals; to automatically record oral instructions, signals, and telephone calls.

The third group which includes information display devices makes it possible visually and over time to present to the command basic information characterizing the situation, in substantially supplementing the relatively static data plotted on a chart.

Copying and duplicating equipment which is *a fourth group* of devices accelerates the processes of formulating and multiplying graphic documents and texts, and makes it possible to rapidly obtain photo-, thermo- and photostat copies of any documents.

The fifth group of calculating devices includes slide rules, tables, graphs, and nomograms; various types of keyed calculators; accounting and punch machines for processing large blocks of information and carrying out simple logical operations; finally, electronic computers designed both for controlling military equipment as well as for solving logical information and calculation problems in the process of troop control.

The rational use of the listed groups of technical devices to a significant degree eliminates contradictions between the demands placed upon control and its possibilities. But an even more prospective way for raising proficiency and quality in the work of control bodies is to create and use integrated automated systems. The necessity of using them in the interests of improving economic control was pointed out by the 24th CPSU Congress. In the Accountability Report of the CPSU Central Committee to the Congress it was stated that it was essential "to more rapidly create sectorial automated control systems, bearing in mind that over the future we must create a statewide automated system for information collecting and processing." [1]

The technical control devices which have been created and are being created due to scientific-technical progress, in turn themselves become one of the driving forces of this progress. They serve as the material base for automating and mechanizing the control processes.

But, as is known, the path to practice should be shown by theory. Military cybernetics is the theoretical basis for automating and mechanizing troop control. Its basic areas are information theory which studies questions related to transmitting messages over communications channels; the theory of algorithms which studies the rules of information processing; the theory of control devices which studies questions related to the design and operation of machines and mechanisms used for automatic information processing, as well as the questions of the interaction of man with these machines.

From this it can be seen that information, the algorithm, and the control device are the most important concepts of cybernetics. Let us take them up in somewhat more detail.

Information is the aggregate of intelligence concerning the processes occurring in nature, society, and technical devices. In military control systems, information can be divided into strategic and tactical.

Non-uniformity either in space or in time is the primary source of any information. For example, the stars in space, aircraft in the airspace, and the hot exhaust released from the nozzle of a jet aircraft or a launching missile create a definite non-uniformity in the distribution of matter, and for this reason can serve as a source of information for our eyes for the radar beam, or the infrared receiver.

A telegraph cable without the sendings of current or with a continuous uniform sending does not carry information. But if the sending changes either in terms of strength or in terms of duration, that is, there is a non-uniformity, then information travels over the cable and we can perceive it if we know the code. For example, in the Baudot code the sendings and pauses alternate. In the Morse code, there are dots and dashes.

The establishing of a quantitative measure for information is the most important achievement of information theory. Here, as the unit for the quantity of information, the bit has been used or the quantity of informa-

[1] *Materialy XXIV S"yezda KPSS*, pp 67–68.

tion which we obtain as a result of conducting an experiment having two equally probable outcomes. Thus, in tossing a coin and seeing one side of it, we receive one bit of information. The greater the number of equally probable outcomes in the experiment, the greater the uncertainty which is eliminated as a result of this experiment, and consequently, the more information we obtain.

The bits make it possible to assess the capacity of communications channels and the required volume of memory devices. For example, a TV channel is capable of transmitting millions of bits per second, the phototelegraph and radio channels can handle thousands of bits, and telegraph lines can carry hundreds of bits. Billions of units of information per cubic decimeter can be recorded on photoscopic memories due to their great resolution.

One of the most important problems of information theory is the finding of such methods for transforming messages so that the given quantity of information is transmitted in a minimum number of signals. To a significant degree the efficiency of control depends upon the solution to the given problem, for this leads to a reduction in time for transmitting and receiving messages.

A rather limited number of pulses per second (bauds) is transmitted over the actually existing communications channels. For example, wire communications lines transmit 75 bauds, the radiotelegraph channels handle 300 bauds, and the telephone lines 1,200 bauds. But it has been shown theoretically that the same communications channels are capable of transmitting significantly more units of information (bits) per second. For this reason, for more fully utilizing the communications channels, it is essential to see to it that as much information as possible is contained in a few pulses, and this is achieved by the rational transformation of information. In particular, by breaking down the message for transmission not into letters and numbers, but rather into multiple-digit units.

However, in a transformation which leads to the compacting of information, the danger increases of having a greater effect of interference on the transmission. Conversational language (Russian and Western European) possesses a redundancy of 50 percent, that is, the choice of each following letter of the text is already one-half determined by the very structure of the language. This redundancy makes it possible for us to understand speech even when we have not heard all of it sufficiently well. The redundancy makes it possible for us to understand the text of a telegram, even if individual words have been omitted and individual letters distorted.

In military language the redundancy is even higher due to the smaller vocabulary. Thus, in talking with an aircraft, redundancy approaches 100 percent.

In concentrating the information in order to transmit it more rapidly, we thereby are forced to encounter another problem, and that is the problem of resistance to interference, or finding methods for isolating the

useful signals against the interference. Certainly interference leads to a misconprehension and requires repetitions, and this involves a loss of time.

In order to visually grasp the effect of the concentration of information on the resistance of transmission interference, let us assume that using the Morse code we were to transmit the word "revolution" over the communications channel with one mistake. Instead of the "e" (one dot) we obtain "i" (two dots). Obviously, it would be no difficulty to determine that the received word "rivolution" should be "revolution." But the situation is different if the word is transmitted in a condensed form using predominantly consonants, that is, in the form "rvltion." If in this instance the second letter "v" (a dot and two dashes) is received as a "y" (a dot and three dashes), it will be quite difficult to understand the transmitted word "ryltion."

The communications lines can distort one and more signs per 100 transmitted. And for solving problems using electronic computers it is essential that the distortions be significantly reduced.

The algorithm is the second most important concept of cybernetics.

The algorithm is an aggregate of rules, the following of which inevitably must lead to the solving of one or another problem.

The initial data of any problem are information. The final result is new information. For this reason the algorithm can be defined as a rule for processing information in accord with the set goal. The control device receives informative information and processes it into instructional information.

This processing can be carried out rapidly or slowly. The time spent on processing directly influences the proficiency of control.

In order that good decisions be made quickly, it is essential ahead of time, in peacetime, to elaborate the best algorithm and the most rational system of rules for working out solutions for basic military situations in order that later on, when the need arises, all the calculations necessary for taking the decision can be carried out on an electronic computer at a speed of tens and hundreds of thousands of operations per second.

Algorithm theory is concerned with studying the process of decision taking and searches for the most rational rules and procedures for information processing.

It has turned out that no matter how diverse the information might be (in figures, letters, signs, and so forth), any processes of transforming it can be represented in the form of a sequence of a comparatively small number of rules and symbols. These rules consist of arithmetical and logical operations. By using these rules it is possible to compile whole programs for the most diverse processing of information, as the most diverse edifices can be built from a small number of standard units.

In having simple information or one type of information, by using these operations it is possible to obtain complex information or informa-

tion of another sort. Just as we store electric energy in a battery, we store mental labor in the algorithm.

The actual broadening of the capabilities of computers depends upon the ability to compile the corresponding algorithms and rules for information processing. And for this it is essential to profoundly study how the human brain works.

Mathematicians are at work on algorithms. Before this, the military specialists describe in detail both orally and in writing how a commander and his staff act in a similar situation.

When the algorithm is ready, it is transferred to a machine language, that is, the program for the machine's work is compiled. Different computers use a different machine language (a different system of commands). For this reason a program for one type of computer is not suitable for another type of computer, and vice versa. This circumstance does not aid the wide use of computers in practical work. Months are required for compiling a new program and adjusting it, as well as significant expenditures. In this regard, special algorithmic languages have been worked out. An algorithm written in such a language does not require programing and can be immediately put into any type of computer. The machine itself compiles the calculation program using this algorithm. For this it is necessary to equip the computer with just one additional program, that is, the program for translating from the algorithmic language into the language of the given machine (this program is called a translator).

Now we approach the third area of cybernetics, that is, *the theory of control devices* or devices designed for automatic information processing. The electronic computer is the basic type of control devices in automated troop control systems. The universal computer consists of a device for receiving information, the working memory, the long-term memory, the arithmetic unit, the information output unit, and the control panel.

If we want to instruct the machine to solve a certain problem, the initial information and the program for solving the problem (if the algorithm has been written into a special language, the algorithm and the translator must be introduced directly) must be fed into the computer and entered in the long-term memory. Here the information is automatically distributed to the memory cells. If the initial data contain a certain mistake (for example, they go beyond the limits of the program), the machine stops automatically and the mistaken parameter is printed out.

The arithmetic unit transforms the initial information in accord with the program. Here the working memory is used for reporting the intermediate results.

In the process of solution, there is automatic and repeated monitoring in terms of the purpose of the problem or by using the double counting method.

The final results are produced either on a tape on which the answer

is printed by letters and figures, or on a screen, on a light board, or in the form of a printed diagram, and so forth.

The result can also be transmitted directly to an operating device over the communications channel (to the airfield, to the antiaircraft missile complex, on board a submarine, and so forth).

In conclusion, let us take up the problem of man and machine in the troop control system.

In principle the machine can do everything that man can do. But this does not mean in all areas of human activity, just in one, in the area of transforming information in accord with the set goal.

If man does not supply the machine with information, and does not set the goal of its processing (in the form of an algorithm and program), the machine is powerless. The results obtained from the machine are only as dependable as the people who prepare the algorithm, the program, and the initial data for the calculations are dependable. If man does not use the results of the machine's work, the work is useless.

A tube electronic computer with a storage capacity equal to the memory of man would be as large as the buildings of Moscow University and would require the capacity of a large power station for operating it and the same capacity for cooling it. But the brain occupies a volume of 1.5 liters, it weighs 1.5–2 kilograms, and consumes just 25 watts of power. How can the computer compare with the brain!

But a machine is a rapid and indefatigable device capable of operating 20 and more hours per day, and it is not troubled by emotions, fears, or a bad mood.

While a man can receive information simultaneously from one source, assimilating consciously not more than 25 bits per second, a machine can receive information from hundreds of sources and at any speed. Here simultaneously with the receiving of information the machine can process it and produce the results. Man is incapable of doing this.

At present in many nations they are beginning to use the so-called third generation computers. While initially the computers used vacuum tubes with a memory on magnetic tapes, magnetic drums, and cathode ray tubes, the second generation was manufactured using semiconductors with a memory on ferrite cores. The third generation is being developed using integral circuits, and due to this the machines are assuming microminiature dimensions. This makes it possible to better solve the problem of transporting them. The machines of the next generation based on lasers will possess a colossal speed.

The logical and creative activity of command lies and will always lie at the basis of troop control. But the combining of human logic with the work of machines (under the leadership of man) is the most effective logic.

In other words, a good staff armed with an automated control system is the most advanced troop control body which can be imagined today.

4. Methods of Troop Control

The volume of tasks carried out by the commanders and the control bodies in the course of military operations is extremely great and diverse. The organization of combat and its leadership in the interests of achieving the final goal require that control codies carry out a whole range of complex measures, and it is not possible to determine them ahead of time, since their quantity and character each time will depend upon the specifically existing situation.

Nevertheless, a careful study of the multifaceted experience of history as well as the rich experience of combat and operational training makes it possible with sufficient reason to divide into two basic groups all the problems to be solved in the process of troop leadership in any type of combat activity.

The first group is comprised of the problems directly related to organizing combat and comprising the basic essence of the control process. These include: a continuous study of the situation, decision taking, and the giving of missions to the executors.

The second group of problems is made up of organizing measures related to the all-round support of combat operations aimed at carrying out the commander's decision. These include: political and morale preparation and the organization of rear support (material, technical, and medical); the organization of all types of reconnaissance and protection against weapons of mass destruction, the countering of enemy radio-electronic devices, camouflage, security, the traffic control service, engineer, topogeodetic, and hydrometeorological support; the organization of command and communications posts; constant supervision and help for the troops in carrying out the posed missions.

This group of problems does not determine the essence of the control process, but without fulfilling it, the functions of organizing control would be limited and incomplete.

It must be pointed out that fulfillment of each of the listed tasks presupposes, in turn, the parallel execution of a number of measures, the nature of which will depend upon the specific situation. In this regard, both the very process of control as a whole as well as the carrying out of the individual tasks of control, in turn, should be controlled, and consequently, organized.

Effective organization in carrying out the tasks related to troop control is one of the important requirements made under present conditions upon all levels of commanders and staffs. The meeting of this requirement should be achieved by using the most rational methods of control, that is, the procedures and methods of the work of commanders and staffs in the area of troop leadership. The methods of troop control cannot be constant, since they should correspond to the means and methods of conducting military operations.

The revolution in military affairs which has occurred as a result of the appearance of qualitatively new weapons, means, above all, fundamental changes in the very nature of armed combat. The changes in means and methods of conducting a battle and an operation, the increase in volume and content of measures related to troop command, and a reduction in the time of executing them as a consequence of the great dynamism of combat have significantly increased the demands placed upon control, and, in particular, upon the work methods of the control bodies. The most important of these demands is a rise in the proficiency and accuracy of calculations. Above mention was already made of high proficiency as one of the basic principles of control. From the standpoint of the methods and organization of the work of control bodies, a rise in proficiency has no limit. On the other hand, the possibilities of raising proficiency in work are limited by the physical capabilities of personnel in the control bodies and by the technical capabilities of the control devices used by them.

The nature of measures relating to control depends upon the specifically existing situation. Consequently, in order to correctly and promptly outline and execute measures relating to control, it is essential to know the situation constantly. The continuous collecting and studying of the situation data should be a matter of constant concern for commanders.

However, the range of data on the situation under present-day conditions is so great that it is completely beyond the power of one commander or a limited group of persons to collect and process the data in a short period of time. For this reason, as in carrying out any job, here there should be a definite organization based upon the clear distribution of functional duties and a rational approach. Data on the situation must not be collected without a specific goal. Knowledge of it is essential in order to bring out conditions for carrying out the task at the given stage and correctly determining the methods of action. But not all the situation data will always be equally valid, and for this reason each time particular attention must be given to those data which at the given moment are most essential for determining the nature of one's actions. Intelligence on the means for using enemy nuclear weapons and on the radiation situation will always be of primary importance.

Aside from the commander, the acquiring of data on the situation should be the concern of all staff officers and other officials in accord with the specialty of their job, while these data are usually generalized in that section of the staff which is in charge of operational questions. The chief of staff should be the basic organizer of all the work, since precisely he, more than any of the others, is informed as to the intention of the commander and can determine precisely what data he can use and at what time.

The basic demand relating to the work of acquiring situation data is the promptness, continuity, and reliability of the data. The prompt obtaining of data is of particularly important significance. Under conditions of

a rapidly changing situation, late information not only will not help in responding promptly to the occurring events on behalf of the commander, but also may cause delayed, unsound, and even wrong decisions.

For achieving the greatest completeness, accuracy, and reliability of the received information, it is essential to work for the coordinated use of all sources of receiving information. Here the most important information, as a rule, should be substantiated by several sources. Immediately upon receipt, the information should be reported to the commander and also transmitted to the superior and subordinate staffs.

Before reporting to the commander or the chief of staff, all received information ordinarily is plotted on a map or is brought into a form suitable for their evaluation. Along with this, depending upon the nature of the mission to be carried out and the specific conditions of the situation, the staff should prepare the calculations needed by the commander for decision taking. Ordinarily this will involve a calculation of the time for making nuclear strikes or preparing combat operations, calculating the balance of forces and means, calculations related to the results of using one's own nuclear weapons and forecasting of the radiation situation, calculations for moving up forces, and so forth.

It is particularly important to have an accurate calculation of the time required for preparing combat operations. Since under present conditions this time, as a rule, will be limited, it is essential to always endeavor to give the troops as much time as possible. This fundamentally important demand upon the organization of combat assumes particular significance under modern conditions. This is why the missions for the troops must be issued as quickly as possible, without waiting for the drawing up of the battle documents. For accelerating calculations in the staffs wide use should be made of pre-prepared forms, various rules, tables, nomograms, graphs, as well as diverse computer equipment.

On the basis of a thorough study of the situation data, the commander takes a decision, that is, works out a definite plan of combat under specific conditions. This plan or decision should contain all the essential initial data for working out control measures. The content of the decision can be diverse, depending upon the specific situation and the nature of the mission to be carried out. For this reason here we would like to focus attention only on the most important aspects concerning mainly the role and place of the commander, the methods of decision taking, and certain demands made upon the commander's work.

A commander is obliged to take a decision personally and bear full responsibility for it. In decision taking the listening to numerous reports, proposals, and information from one's closest assistants has long been condemned both in theory and practice, since, as a rule, it usually leads to the unjustified spending of a large amount of time and proves only the commander's uncertainty.

However, observing the principle of sole responsibility in decision

taking in no way means that the commander may disregard the opinion of the people working with him. Even V. I. Lenin repeatedly cautioned us against a one-sided understanding of this principle, and always demanded reliance on the creativity and initiative of the collective. This Leninist demand is particularly urgent under contemporary conditions when the armed forces possess powerful means of destruction and most complex military equipment, and when the time for preparing for combat will always be limited. In line with this, the commander objectively will be able to solve personally only the most important problems, for example, set the general goal of combat and the missions for the troops, allocate the forces and means and determine the order for coordination among the troops. As for the numerous questions of combat support, the commander may give brief instructions on several of the most important of them, while the remainder must be settled by his immediate assistants, his deputies, the chief of staff, and the chiefs of the branches of arms (services).

Here each chief should bear complete responsibility for the questions settled by him and for the conformity of these decisions with the overall purpose of the commander.

The commander must develop and encourage in every possible way the initiative of his subordinates as manifested on this level. Only such an understanding of the principle of sole responsibility, both in the preparations for and in the course of combat, can provide dependable and uninterrupted troop control. In no instance does this reduce the role and responsibility of the commander. The commander's desire to determine everything himself in the old fashion way inevitably leads to a disruption or even to a loss of control. Moreover, such a position by the commander undermines the subordinates' confidence in themselves and teaches them to wait passively for instructions.

It must be pointed out furthermore that even the most correct, or, as we say, the soundest decision cannot guarantee the success of combat if it is not taken promptly or has been given to the executors late. A characteristic feature of modern combat and operation is above all the complexity and speed of development, and the frequent and abrupt changes in the situation which abounds in moments of crisis for both warring sides. In this regard, a very quick reaction by the commander is essential to all changes in the situation, and decisions must be taken in a maximum short time. Hence the most important demand placed upon the commander of mastering the most rational methods of decision taking.

A study of the experience of the best commanders indicates that the decision taking method should be simple and clear, universal and flexible, that is, be suitable for any situation and for taking a decision for any type of combat. The work in the area of decision taking is a complex mental process in the course of which the commander, in analyzing the

situation, that is, in learning the objective truth, reaches sound conclusions which comprise the decision.

However, the decision taking method cannot be viewed as a perpetually mastered method of mental work which in all conditions provides a sound decision. To master a rational method means to be able, under specific conditions, to determine the rational sequence and organization of work in the process of which the commander could manifest broad creativity, a flexibility of mind, and perspicacity in order to detect the enemy's intention and find the best method for carrying out one's mission.

From this it follows that a profound knowledge of Marxist-Leninist dialectics, as the logic and theory of cognition, should lie at the basis of the commander's work method in decision taking. In the process of decision taking, the commander should utilize a combination of all the known methods of logical thought, including: analysis and synthesis, induction and deduction, hypotheses, comparisons, and so forth. For example, in the process of analysis, the commander breaks down the situation into its individual elements, examines them separately, and thereby achieves a more profound elucidation of them. But in order to elucidate the situation as a whole, it is essential to synthesize the conclusions drawn from the individual elements, to combine them into a single whole and arrive at a general correct conclusion.

Thus, the process of analysis and synthesis should be a single one. As F. Engels wrote, "thinking consists as much of breaking down the subjects of cognition into their elements as in uniting related elements into a certain unity. There is no synthesis without analysis." [2]

In the decision taking process it is very important to be able to eliminate secondary considerations and concentrate attention on the main, most essential and decisive elements of the situation. The correct mental activity of the commander should lead to a reflection of a specific plan and even of the nature of the forthcoming action in his mind. In using the words of the great Russian military leader A. V. Suvorov, the commander should conquer the enemy twice: at first mentally (that is, in the decision taking process), and then in reality.

The decision made by the commander is the basis for all the activities of his subordinates in the area of troop control and the basis of the combat of the troops themselves. The activities of the troops and the control bodies, consequently, cannot be conceived without a knowledge of the general decision and one's mission. For this reason, the general goal of the commander should be immediately given to the subordinates.

The giving of the decision to the troops is a third, very important aspect in the control process. The methods of giving the missions can be the most diverse. They should be chosen in accord with the specific situation and provide the necessary concealment and proficiency from the standpoint of the prompt receipt of the missions by the subordinates.

[2] K. Marx and F. Engels, *Soch.*, Vol 20, p 41.

Time should be the basic criterion in selecting the method for giving the missions.

It must be kept in mind that the promptness of receiving a mission by subordinates to a significant degree determines the success of the execution of the mission. Above we have already pointed out that the most correct but late decision (that is, late in being given to the executors) loses any sense as it remains unfulfilled. Consequently, the work of the commander and the staff in taking a decision and giving the mission to the troops should be so organized that the troops are able to prepare completely for carrying out the missions. In considering, as a rule, the limited time available for preparing for combat, in the aim of saving time, the missions should be given to subordinates immediately upon defining them in the commander's decision, and even before their complete formulation on a chart and the preparation of written instructions or orders.

Practice indicates that such a procedure for issuing missions provides a significant gain in time and achieves almost parallel work in preparing for combat on all levels. Certainly any mission in accord with the requirements of our regulations should be substantiated by the corresponding document.

In issuing missions it is very important to see to it that subordinates understand the mission in precisely the same manner as the commander who has taken the decision perceives it. The formulation of missions in no instance should allow a varying interpretation. In this regard it is essential to stress the importance of clear and precise formulations in orders and instructions. In any of them, it should be specifically designated as to who should do what, where, and when. Here it is essential to bear in mind that the more tersely the idea is expressed, the clearer it is. Every effort should be made to avoid stating in the orders any general provisions and requirements of the regulations and instructions which the subordinates know equally well and are obliged to carry out without additional reminders.

But in the desire for brevity, the order must not be shortened at the expense of its major points. The subordinate should always receive from a superior command sufficiently complete data on assessing the enemy grouping and the nature of its actions, on the mission of the superior level and the use of nuclear weapons by it, as well as on his mission and the missions of adjacent units, and the readiness time. The presence of these data makes it possible to prepare for combat in accord with the intention of the superior commander.

The recommendations stated by us do not exhaust the entire diversity of the procedures and methods of troop control, since they will depend above all on the developing situation, and it is virtually impossible to anticipate all variations of this situation. For this reason, in choosing the methods of control, the most important criterion should be their con-

formity to the specific conditions of the situation. In this regard it is essential to point out a number of features, or, more accurately, a number of additional demands which are placed upon troop control from the outset of military operations.

Since a surprise attack is considered to be the most probable method for commencing military operations by the aggressor, consequently, the time for carrying out control measures (the time for readying the troops for combat) will be greatly limited.

From this follows the indisputable conclusion that for the troops which are destined for combat immediately after the enemy attack, all control measures should be prepared ahead of time. Under this condition troop control with the onset of combat can be successfully carried out with brief signals. In the event of a break in communications with the superior chief, the subordinate commanders can begin to carry out the mission upon their own initiative, since they will be informed as to the overall purpose of the battle or operation.

Effective and efficient troop control in combat requires from the commander a knowledge of the patterns of combat, an objective assessment of the situation as well as high organizational capabilities.

Chapter VII. The Role of Spiritual Forces of the People and Army in Modern War

In any war, not only material forces but also spiritual ones are at work. Wars are waged by people. Their attitude toward war, their thoughts and feelings to a great degree determine the effective use of the military equipment and the weapons, and consequently, the possibility of achieving victory. But what is the relationship of the material and spiritual forces in war, and how do the latter change under the influence of the former? This question which has long attracted the attention of military theoreticians and leaders has acquired a particularly urgent ring in our days, when the unprecedented rapid technical progress has led to fundamental transformations in all military affairs.

Powerful equipment has not only sharply broadened the limits of the land and sea theaters for conducting war, but has also made possible the use of the depth of the sea and the airspace as spheres of combat. Man has created such powerful military equipment that at times the impression is created of his weakness and impotence before it. Some bourgeois ideologists in line with this have spoken of technology as a demon who has bent the development of human society to his will and determines the outcome of war independently or almost independently of will, reason, and efforts of the millions of its participants.

In truth, the experience of World War II as well as subsequent local wars has forced the ideologists and politicians of imperialism to abandon such one-sided views, and to recognize the great role of man and his spiritual forces in modern war. And this is reflected in the official provisions and in military doctrines of the imperialist states. At present even the most obdurate and doubled-dyed reactionaries understand that support of the masses is essential for successful waging of a war. But the egoistic class interests and the absence of a scientific methodology prevent the ideologists of imperialism from solving the problem of the role of spiritual forces of the people and the army in modern war on a truly scientific basis.

It is possible to answer the question of the role of man and his spiritual forces in modern war only on the basis of understanding objective patterns

which determine the development of social life, on the basis of Marxist ideology. Similar to how man remains the chief productive force in the processing of producing material goods, no matter how powerful the machines he might use, so in military affairs any technical devices, no matter how "independent," autonomous, and separate from man they might seem, merely amplify by many fold the natural organs of man, and hence his opportunities for achieving the goals of military operations and war as a whole. Man has always been and remains the decisive force of war.

But nevertheless definite changes are occurring in the balance of the means of combat and the spiritual forces. This balance is not moribund or ossified, and the task is to discover the trend of these changes, and on this basis draw the necessary conclusions for troop training practices and for strengthening the defense capability of the socialist nations.

1. The Spiritual Forces of Society and the Increase of Their Role in Modern War

A war develops from the actions of armed persons. Without their intense and self-sacrificing struggle, victory in a modern war against a strong enemy is impossible. Human muscle power has long ceased to play the decisive role in defeating enemy troops and achieving victory, and on the other hand the spiritual forces of the people and the armies of the warring nations have acquired enormous significance.

Victory in a modern war will be on the side of that state or coalition where the peoples and personnel of the armed forces will have an advantage in tenacity and endurance, in the ability to keep the will for victory under conditions of the most severe tribulations, as well as in culture and scientific-technical preparation.

In our times, the tendency for an increase in the role of spiritual forces in a war is particularly apparent. The reasons for this tendency lie primarily in the character of the present era, in the development of the world revolutionary process, and in the clash of the two world social systems.

The role of spiritual forces in achieving victory in war also rises in line with the scientific-technical revolution. The appearance of new weapons, having altered the entire appearance of war, has made it much more so than was the case previously a competition between the spiritual forces of the warring sides and a clash of their reason, ideology, and psychology. The revolution in military affairs has led to a qualitative change in the role of the spiritual forces of the people, and their effect on the methods of conducting war, its course, and outcome.

The spiritual forces of a society are an involved concept expressing the ideological-political, moral-psychological, and intellectual readiness

and ability of all the basic classes and social strata of a society to solve various problems of a social character. In terms of a war, the spiritual forces of a society are nothing more than the readiness and ability of the masses to waging war, without consideration of the difficulties, hardships and losses, the moral strength, the will for combat and victory, the ability to resist the pressure of a hostile ideology and psychology, and a level of education and culture among the mases necessary for waging war. The spiritual forces of society, from the standpoint of their structures, are the reason, ideology, and psychology of the classes and strata comprising it, national self-awareness and will viewed on the level of society's ability to mobilize its forces and reserves, and to focus them on solving military problems. In the structure of spiritual forces a decisive place is held by the predominant ideology and social psychology which comprise the morale and political potential in their relationship to the war.

The spiritual world of the people is a reflection of an objective world which can be correct or false. Under present conditions, the spiritual forces of society to a great degree depend upon the nature of the dominant ideology, the degree of its scientificness and the ability to rely on scientific knowledge in determining the development trends of social life and the tasks of the practical activities of people. The scientific Marxist-Leninist ideology which expresses the fundamental interests of the working masses and the requirements of the progressive development of society gives a uniform direction and strength to all basic components of the spiritual forces. Under the influence of a scientific ideology, ideological convictions and social feelings are formed able to withstand the severest testing, and a fusion of progressive convictions and advanced morality is forged. The dialectical materialistic ideology serves as a methodological basis for the development of scientific knowledge concerning nature and society and presently comprising one of the most important elements in the spiritual forces of each nation and each state. Under the effect of a scientific ideology, there are formed the dialetical materialistic thinking of the soviet, party, state, and military cadres, as well as their ability to correctly assess the situation and settle questions of practical activities.

Spiritual forces of the army in a socialist state are organically linked with the spiritual forces of society, and express the readiness of the armed forces to unstintingly carry out combat missions set by the state, to manifest moral strength under the difficult conditions of modern war and the ability to gain from equipment all that it can produce. The morale of troops is the chief content and the basic component of the spiritual forces of the army. This morale fuses together the ideological conviction of the rightness of one's concern, social feelings, and psychologic conditioning. All these aspects of spiritual forces are manifested in the political morale and fighting qualities of the personnel needed for successful actions in modern war.

The spiritual forces of society and the armed forces are not something

unfixed and set once and for all. They develop and are formed under the determining influence of the social system and the related nature of the political goals of the war. The revolutionary traditions of the people, the traditions of the armed forces, the particular features of national character, the cultural level, the situation of the nation in the system of states, and many other factors have their imprint on the spiritual forces of society and the army.

The dependency of spiritual forces upon the social system leads to fundamental differences in the processes of their formation in antagonistic and socialist societies. The spiritual forces of modern bourgeois society are a unique resultant of ideas, views, aspirations, and incentives which are contradictory and even opposite in terms of their direction. The attitude of the different classes to the same war can vary. This depends upon the interests of the given class, upon the nature of the war, upon the level of the class awareness of the workers, and upon the acuteness of class contradictions and the intensity of class clashes.

Objectively the working masses are not interested in waging aggressive wars which are needed by the monopolistic bourgeoisie. Its ability to lead all of society into an aggressive war is sharply weakened by the absence of a sound base in the form of a unity of fundamental interests among all classes. The political and ideological lackeys of the monopolistic bourgeoisie are experiencing insurmountable difficulties, in clashing with the necessity of achieving support of the masses in unjust wars. The system of brainwashing the masses, the anti-communist slanders, lies, and misinformation, of course, produce definite results, but they cannot equal those results which are achieved by the weapon of truth used by socialism in preparing the peoples of socialist nations to repel imperialist aggression.

The workers of capitalist nations can be deceived or confused since they are under the strong influence of the bourgeois state and bourgeois ideology. The weakness of spiritual forces of the people can be manifested in this and this immediately is used by the ruling exploiting class for achieving its goals in the unjust war started by it.

The dominant ideology of a capitalist society does not reflect the fundamental, class interests of the workers. More and more it is actively resisted by the spiritual forces of the proletariat and the nonproletarian strata of the workers, in being formed on the basis of Marxist ideology. The spiritual forces of the revolutionary proletariat cannot be a weapon of imperialism in its aggressive, reactionary wars. The bourgeosie is able to deceive the masses of people mainly in those instances when class self-awareness of the proletarian masses has not been sufficiently developed. The situation changes if, under the effect of objective conditions and the activities of the communist and workers' parties, the proletariat is penetrated by a Marxist ideology, and assimilates an ideological weapon by which it can resist the ideological weapon of the bourgeoisie.

The monopolistic bourgeoisie finds it easier to deceive the masses and lead them into an aggressive war the lower their cultural and general educational level, and the greater the influence of religion, obscurantism, and superstitions. The ruling circles of imperialist states keep the masses on starvation rations of culture which is the necessary minimum for modern production and using equipment in a war. The imperialists see their strength in the ignorance and downtrodden state of the broad masses.

Powerful spiritual forces of the people develop in a socialist society where maximum satisfaction of the interests of people becomes the goal of leadership over society by the Communist Party and is based upon an understanding and use of the laws of social life. The deepest roots of heroism, self-sacrifice, and the solidarity of the people and their armed forces reside in the socio-political unity of society and the just goals of a war. The multinational Soviet people forged into an ideological and socio-political unity, in the wars in defense of the socialist fatherland, have manifested heroism, courage, valor, and solidarity never known before in history.

There is a complex relationship and interaction between spiritual forces and technical progress in military affairs. Without being the basic cause of technical progress in the military area, the spiritual forces of society do influence its course, in contributing to its acceleration, both in peacetime in predicting a possible war as well as in the course of it. The loyalty to the people and the patriotic enthusiasm of Soviet designers, engineers, technicians, and workers have been a powerful incentive in their activities to create weapons and equipment by which our people defeated Nazi Germany in the Great Patriotic War. The spiritual forces of the people and their army taken in their entire aggregate (ideological conviction, social feelings, and psychological qualities, scientific and technical knowledge) are an obligatory condition for successfully developing production and for using miiltary equipment and weapons. One must not forget the enormous influence which spiritual forces have on the prompt elaboration and creation of methods for conducting war. As F. Engels pointed out at one time, troop personnel with the new spiritual makeup created by the revolution can form new methods for waging war even on the basis of old military equipment and weapons. Of equal necessity is the interest of the masses, their morale and enthusiasm in working out new methods for waging war and military operations in corresponding to new weapons and military equipment.

On the other hand, scientific-technical progress has a strong influence on the spiritual forces of society and the army and navy personnel. New weapons are developed by each side preparing for a war and participating in it for the purpose of destroying the enemy and suppressing in it for the purpose of destroying the enemy and suppressing his will to resist. In the course of military operations, the goals of destroying the enemy are always combined with the goals of intimidating him. The more powerful

the weapons, the stronger the intimidating effect they may have on the enemy, and the stronger, consequently, the political morale and volitional qualities of the people and the army should be in order to resist when confronted with danger and to maintain the will for victory and be victorious.

Consequently, new weapons, the appearance of which is related to technical progress, impose new higher demands on the spiritual forces of the people and the army since these weapons create more complex and difficult conditions for conducting combat, as well as a higher degree of danger and hardship for the population and troop personnel.

But this is not the end of the matter. Technical progress in military affairs, the appearance of new means of attack and defense, and their use in the process of military operations by necessity require from all participants in the war, be they the civilian population or troop personnel, a higher level of general culture, technical knowledge, moral strength, and volitional efforts. We have merely to recall what demands are made from the standpoint of knowledge, skills, and will upon the pilots of modern combat aircraft, the commanders and drivers of modern tanks, upon the personnel of the missile troops and upon the representatives of many other military specialties in our times in order to be convinced of the enormous influence of technical progress in military affairs on the fighting qualities of personnel of the armed forces. The present organization of civil defense places great demands upon the civilian population and its spiritual qualities.

Under these conditions, the harmonious development of the material and spiritual sides of social life assumes particular significance, as well as the growth of political awareness, of culture, and the material well-being of the working masses on the basis of the development of productive forces, science, and technology. Precisely such development is characteristic for a socialist society. The decisions of the 24th Party Congress outline an extensive program of socio-political development for the Soviet nation, including the development of the material and technical base of society, a rise in the standard of living of the people, the strengthening of the socio-political unity of society, and the formation of a new man.

All that has been said makes it possible to conclude that scientific-technical progress in military affairs, in leading to the appearance of nuclear missile weapons, has introduced substantial changes in the process of the interaction of the material and spiritual forces in the period of a war. The greater might of the weapons and military equipment, as well as the unprecedented increase in their destructive properties and range to an enormous degree increase the spiritual forces of society and the troop personnel, and make new demands upon them. These demands are dictated particularly clearly by the appearance and development of nuclear, chemical, bacteriological, and other weapons by the enemy. They

essentially involve all aspects of the spiritual forces, and to a certain degree require a new approach to assessing the role of political-morale and psychological factors in modern war.

2. The Revolution in Military Affairs and the Political Morale Factor

The revolution in military affairs has fundamentally altered the appearance of war, having sharply strengthened its effect upon all aspects of social life. A war using the most modern types of weapons and military equipment, if the imperialists should start such a war, will fully manifest a pattern discovered by V. I. Lenin even at the beginning of the 20th century, namely, that wars are now waged by peoples. A nuclear war will be a complete testing of all the economic, morale, and military forces and capabilities of the warring states and a testing of the strength of their social system.

The Effect of Modern War on the Awareness of the Population and the Troops

Any major war (and in certain instances a minor one) entails for the entire population of the warring nation substantial changes in the way of life, in the level of material prosperity, in everyday conditions, and so forth. At the same time, for a majority of the population, a war creates an additional psychological stress which will be greater and broader by the scale and destructive character assumed by military operations.

A war involving nuclear missile weapons will make fundamental changes in the entire way of life of the people, and will create for them a a psychological stress of unprecedented strength and intensity. This is determined by a number of circumstances.

In the first place, an awareness of the immediate threat to life (as is known, the threat has long been considered a vicissitude of war) ultimately loses its local frontline character. While in World War II the population of large industrial centers could not feel safe even a significant distance away from the regions of combat, in a nuclear war there will not be any regions beyond the reach of strikes of enormous strength. The psychological stress related to a constant threat of a nuclear strike will have a suppressing effect on the mentality of the people and lessen the will to struggle in those who are not sufficiently strong in psychological and ideological terms.

The effect of nuclear strikes and the related great destruction and losses on the awareness of the people will be even stronger. In many instances this effect, apparently, will exceed the tolerable limit and lead to temporary shock and mental disturbance in many people. It must also be kept in mind that the occurrence of panics is possible in a portion of the population and the troop personnel both in regions subject to

nuclear attack as well as the adjacent ones. The awareness of the people will be extremely negatively influenced by the fact that in a modern war, one must be concerned not only with the immediately tangible effect of the weapons, but also with an invisible enemy, penetrating radiation, the effect of which will strengthen the influence of the war on the mind of man.

Secondly, the fierce ideological struggle will have a definite effect on the population and troop personnel. This will be carried out by both warring sides using the most modern technical devices. The imperialist bourgeoisie even now is waging a full-scale "psychological" war against the socialist nations, using in it the most vile methods of ideological subversion. The entire enormous apparatus of anti-communist propaganda is now focused on weakening the unity of the socialist nations and the international communist movement, on splitting the advanced forces of the modern world, and on attempting to subvert a socialist society from within. The November Plenum of the CPSU Central Committee (1971) pointed to the necessity of "waging a decisive struggle against bourgeois ideology." [1] The pitch of this struggle with the start of a war will increase by many times. The weapons of the enemy will be slanderous rumors, methods of intimidation, bribery, slander, and blackmail. Our weapons will be the truth about the war and the persons guilty of it.

Thirdly, it is essential to bear in mind the psychological effect of the material difficulties and hardships related to modern war on the population and the troops. In one way or another they will involve the entire population of the warring nations and can have an effect on morale.

One of the most important factors determining the unusually involved ideological and psychological atmosphere of modern war will be the course of combat and victory and defeats on the battlefields. The successful actions of troops more than ever before will strengthen the will for victory throughout the people waging a just war.

The organic unity of the front and the rear in modern war is manifested not only in their material ties but also in the fact that the morale of the rear ultimately determines the morale of the armed forces. The armed forces of a warring state will experience basically the same ideological and psychological influences as the population of the rear areas. Even concern for the life of dear ones, found in recent wars mainly among the rear population, in a future war will be of no less concern for the soldiers and officers on the front.

But in the armed forces special influences related to direct participation in combat will be added to these ideological and psychological influences which are basically common for the front and the rear. The unsettled frontline life has always required great nervous strain. At present the psychological situation of combat will be even more complex due to the increased might of weapons, to the creation of constant danger,

[1] *Pravda*, 27 November 1971.

to the sharp increase in the maneuverability of combat, to strengthening the role of nighttime actions, to camouflage difficulties, and many other particular features of modern combat. In this regard, the role of political-morale and fighting qualities of the armed forces personnel, their ideological conviction and tenacity increases substantially.

The circumstance that technical progress in military affairs leads to complicating the psychological situation during a war, in comparison with previous wars, changes the demands made upon ideology as a whole and the political ideological qualities of the people. The human mind which perceives the effect of the external world represents an organic unity of ideology and psychology, and social problems find their most complete and consistent expression in ideology. It rightfully holds the leading place in the spiritual forces of society. It assumes, it can be said, the lion's share of the psychological effect of the war and military operations on the awareness of man.

This effect always falls on a definite basis, and in the awareness of the man engaged in war clashes with various ideas, views, and social theories, with various social feelings and moods, and depending upon their character and strength, emerges in certain practical actions and a certain type of conduct. The same effect on different people can lead to different and at times contradictory results.

Consequently, an examination of the question of the effect of technical progress in military affairs on the role of the political-morale factor should not be restricted to ascertaining the new objective demands upon spiritual forces. It should include the corresponding analysis of that ideological and political basis on which these demands fall, in evoking a certain reaction. This basis is, in essence, nothing more than social awareness. The spiritual forces of a society depend upon the particular features and content of this awareness to an equal degree as upon those new demands which modern war makes on people.

In a world war, if the imperialists start it, two types of social awareness —bourgeois and socialist—will clash. What spiritual weapons will be representative of the two opposite systems in the event of a military conflict between them?

The Problem of United Will and Moral Strength in Modern War

In the event of a war, there emerges a particularly crucial problem of providing ideological unity of the entire people, their solidarity, monolithicness, or in other terms, the problem of the united will necessary for mobilizing all the forces of the people. Without such unity it is difficult to carry out both the economic and the political tasks which arise due to the war. This problem arose even during World War II. Technical progress in military affairs has posed it much more acutely, because the testings for each of the warring sides will be harsher.

In modern bourgeois society, there is no main objective basis for ideological unity of the nation, that is, a unity of the fundamental economic interests of the basic classes and social groups. Moreover, there cannot be an objective basis for unity of the nation in an aggressive war which is to the interests of only the ruling classes and above all the monopolistic bourgeoisie. Under certain conditions, the interests of the working class and the nonproletarian strata of the workers can correspond solely to a just war.

The ruling classes of the imperialist states for maintaining unity of the nation in aggressive wars are forced to use basically false ideas, and resort to deceit and misinformation. The main emphasis of the imperialists in the struggle for the masses to wage aggressive wars being prepared by them, including a war against the world socialist system, is an emphasis on anti-communism, and fanning hostility and hate for the socialist nations, in being reinforced with the most merciless violent pressures on dissenters. The monopolistic bourgeoisie is endeavoring to impose its ideology and will on the entire society.

The experience of Nazi Germany shows that these means can produce a significant effect. Unbridled demagoguery, the fanning of national feelings, and the promoting of base instincts combined with a system of physical extermination of the progressive elements and total surveillance —all of this helped the Nazis to keep the masses of the German people in profound bewilderment and to force them along the path of catastrophe. But the walls of the gigantic prison into which Germany had been turned under fascism began to show cracks and split apart as soon as the Nazi Reich began to suffer serious military defeats. Lies and coercion cannot provide a strong moral basis for conducting a modern war, and they cannot heal the fundamental failings of imperialism which are apparent, in particular, in the fundamental opposition of the interests of the people and the monopolies.

On the other hand, the historical experience of wars which the Soviet state had to wage substantiates that the unity of will among the Soviet people has a sound objective basis in the unity of fundamental interests of all the classes and social strata in a socialist society. Socialism creates decisive conditions for the unshakable solidarity of the people and their leading force, the Communist Party. These conditions are realized in the process of the activities of the CPSU in the area of communist indoctrination of the people, and in the course of struggling against the remnants of capitalism in the awareness and behavior of people. Thus, in a socialist society solving the problem of unity of will and solidarity of the people in a war against imperialist aggressors does not encounter any insurmountable obstacles, and conforms to the nature of socialism.

Technical progress in military affairs with equal acuteness poses the problem of the moral strength of people and the armed forces of a warring nation. As a result of the use of nuclear missile weapons in a number of

instances, situations may arise which threaten the very existence of individual states and entire peoples. In the course of a modern war, combat by the units and formations away from the basic forces and in an encirclement become customary. The use of many types of military equipment (aircraft or tanks) entails more or less simultaneous operations by individual men or small groups in a complex situation. Each of the participants in combat may be in a situation when the conscientious, self-sacrificing execution of duty or, on the contrary, a formal attitude toward it will depend upon the moral strength of the soldier and upon his loyalty to the common cause. All of this brings the task of raising the moral strength of the people and the army to one of the leading places.

The moral strength of the people and the armed forces in the socialist nations is formed on the basis of socialist patriotism which is devoid of national exclusiveness, and on a basis of loyalty to the socialist system. This loyalty derives primarily from the true conformity of the system to the interests of the working classes. The feeling inherent to the Soviet people of being the master of their nation is clearly manifested in the concern for its security and defense in the event of imperialist aggression. Communist morality which is being established in the USSR and the other socialist nations is a morality of collectivism, humanism, and total loyalty to the people. This can be seen from the millions of heroic deeds by the Soviet people on the front and in the rear during the Great Patriotic War of the USSR. The rejection of the capitalist system by the Soviet people and moral strength in defense of the victories of socialism reside not on a hate for other peoples, but on the experience of life which has clearly shown the great advantage of socialism.

Modern War and the Problem of Coalitions

Due to the political situation which has formed in the world, a new world war, if the imperialists start it, inevitably will be a coalition war. The presently existing aggressive NATO bloc, in all probability, will be the core of the imperialist coalition. It will be opposed by the community of socialist nations united by the Warsaw Pact.

The political principles of each of these coalitions are contradictory in their character. The NATO bloc is an alliance of imperialist states created for the purpose of preparing for and waging aggressive wars, primarily against the Soviet Union and the other socialist nations. The Warsaw Pact nations have united for the purposes of repelling possible imperialist aggression. The relationships within the Atlantic Alliance are organized on an unequal basis as the United States, the chief force of modern imperialism, plays a decisive role in it, using its partners as an implement for its aggressive policy. The Warsaw Pact participants are united by a noble and just goal, that is, to resist the aggressive drives of

the imperialists by the united efforts of the socialist nations, and in the event of the start of a war by the imperialists, to defeat the aggressors, and to defend the socialist victories of their peoples.

War involving nuclear missile weapons will require a readiness by all the participants in the coalition to endure serious sacrifices. For the nuclear powers, membership in the coalition means a commitment to defend the remaining nations of the coalition with all its might. For all the members of the coalition, the war will entail a risk of being subjected to nuclear strikes and exposed to other types of modern weapons. Entry into the coalition and participation in it under modern conditions require, particularly for comparatively small nations, a definite unification of weapons, and reciprocal cooperation in the production of various types of military equipment. This makes the nations of the coalition definitely dependent on one another. For successful joint combat, there must be the mutual confidence of the coalition members, a consistent and unselfish execution of one's allied commitments, and a readiness to always come to the aid of one another at a difficult moment.

The capitalist system does not create conditions for such reciprocal confidence and for such unselfish reciprocal collaboration which are essential for waging modern coalition warfare. Within the imperialist coalitions, as in all relationships between the capitalist states, the rule of the strong predominates, and the interests of the largest sharks of the capitalist world are always in the forefront, while the interests of the smaller nations are sacrificed to them.

The major imperialist powers do not consider the national sovereignty of their allies, and would not be at all against putting an end to this "obsolete" concept. The former U.S. President Johnson directly stated in one of his speeches that "the development of military equipment makes the old and narrow concepts of sovereignty more untenable."

The alliances of imperialist powers created for waging aggressive war are never alliances of peoples, but rather represent the alliances of governments made up of the ruling upper clique behind the backs of the people by deceiving them. This is a weakness of the imperialist blocs which in a nuclear war can be the cause of their instability and collapse. With reason the aggressive imperialist blocs, including NATO, are beset by internal contradictions.

A strong military coalition within which relationships correspond to the requirements of modern war can be created solely on the basis of the unity of fundamental economic and political interests and on the basis of a unity of ideology. Socialism creates such conditions. The community of states and armed forces of the Warsaw Pact nations is an alliance of peoples concluded for the sake of noble and just goals. This community is based upon socialist relationships which exclude the exploitation of man by man and nation by nation. The relationships of confidence and consistent collaboration between the states are supplemented

by relationships of profound and true friendship between personnel of the armed forces in the nations comprising the Warsaw Pact.

A vivid illustration of the relationships between nations based upon socialist internationalism is the enormous and effective aid which the Soviet Union and the other socialist nations provided to North Vietnam and the other nations of the Indochinese Peninsula in their self-sacrificing struggle against American aggression.

Of course, what has been said does not mean that we should underestimate the danger of the imperialist blocs and their capabilities for waging modern war. They represent a powerful weapon of aggression, and this must be considered. At the same time, it is essential to see their innate failings and their weak points, and on the basis of a sober analysis of the balance of material and spiritual forces in the opposing coalitions to organize the practical activities of repelling imperialist aggression.

On the other hand, it must not be felt that difficulties and obstacles cannot occur on the path of developing the military coalition of socialist states. Here nationalism is the chief danger. The neglect of common interests of the world socialist system in the name of narrow nationalistic interests ultimately causes harm to all the socialist nations.

Any retreat from the principles of proletarian internationalism weakens the unity and military might of the socialist community, and objectively serves imperialism in carrying out its aggressive policy.

Difficulties in the relations between the socialist nations are surmounted on the firm basis of common interests and common aspirations deriving from the nature of the socialist system and the character of Marxist-Leninist ideology. Socialist internationalism, as the ideological basis of relationships between peoples who are building socialism and communism, makes it possible to achieve allied relationships the character of which conforms to the requirements of modern war.

Organization and Discipline Under the Conditions of Technical Progress in Military Affairs

One of the most acute problems in preparing for a war with the use of nuclear missile weapons is the problem of providing high organization and discipline during the war on the part of the entire population of the state participating in the war and the personnel of its armed forces. This is not a new problem, since in one way or another it arose and was resolved in all the wars of the past, and particularly in the world wars. The criteria for the organization and discipline of the population and the armed forces as suggested by World War II are basically suitable for modern local wars in which conventional weapons are employed. But these criteria are insufficient for a nuclear war. The fundamentally new weapons require an equally different approach to this question.

Technical progress in military affairs has led primarily to a situation where the highest discipline, tenacity, and readiness for unstinting action have become inexorable demands not only for the armed forces but also for the broadest masses of the people who are waging a just, liberation war. Since in a modern war the entire population of the nation can be subject to nuclear strikes from the very outset of the war, this war dictates its own laws for everyone. The slightest disorganization at any point of the rear, without even mentioning the front, can end in panic, by a violation of civil defense requirements, and by great losses and failures. While even in peacetime the precise work of all the elements of a modern complex economy requires high discipline by all workers, with the start of a war, double accuracy is required, that is, for converting the economy to a war footing without a break in production, for establishing new economic ties literally in a few hours and days, and for closing the breaches in production which may arise as a consequence of losses of manpower and materiel.

The discipline and organization of a society during the war depend greatly upon the work of the state apparatus and upon the system of state administration. The situation of a modern war requires great teamwork in the functioning of the state apparatus, its flexibility and ability to organize masses of the population under difficult conditions.

Technical progress in military affairs has placed new, higher demands on military discipline, as without this the use of the new equipment and the achieving of victory in modern combat are inconceivable. The operating of equipment does not tolerate a lack of discipline. The slightest deviation from the operating and maintenance rules can lead to its failure. A radar set quickly fails if all the necessary repairs are not performed on it. The life of the pilot and the execution of his mission depend upon the conscientious work of the technicians and mechanics on the ground.

Modern military discipline is the discipline of struggling for hours, minutes, and seconds. The new equipment has raised the value of time unprecedentedly. Just several tens of minutes are required for a missile to travel 10,000–12,000 kilometers, and a delay in repelling a nuclear attack can cost great losses. The delay in decision taking and in executing the order can be lethal for the troop units and formations. The struggle for speed and for reducing the time standards in executing various actions has become a most important element in the struggle for military superiority. And this struggle to an enormous degree depends upon the organization of the entire military personnel.

Modern military equipment requires the conscious fulfillment of duty by each man. No matter how attentive the commander is, he is not able to supervise the execution of each operation and each requirement by his subordinates. The conditions of combat activity are such that very often the only monitor of a soldier's actions is his own conscience and his aware attitude toward the cause.

What are the specific possibilities for carrying out all these high demands placed upon discipline under the conditions of capitalism and under the conditions of socialism?

The bourgeoisie in the developed capitalist nations during the many decades of its rule has created a social discipline based upon economic coercion and reinforced by direct violence against the working masses and by their spiritual degeneration. Basically the discipline in the armed forces of the imperialist states rests on the same thing. The soldiers of the imperialist armies are, in essence, well-paid hirelings who are constantly instructed not to think about "major policy", but merely to blindly carry out orders. In this sense there is no essential difference between the soldiers of the Nazi Wehrmacht and the soldiers of the American Army which besmirched itself with the infamy of the barbarian war in Vietnam. Certainly, the ruling classes of the imperialist nations spare no efforts for the "ideological", "moral", and any other basis for their aggressive actions.

The bourgeoisie has also developed an ordered system of state administration which conforms to the interests of monopolistic capital. In the developed capitalist nations, the organization of production and marketing on a level of monopolistic associations and in a number of instances, on a statewide scale, has reached a high level. All of this must be seen and realistically evaluated from the standpoint of modern war. The organization and discipline of a modern bourgeois society is a real force of imperialism on which it relies in preparing for a new world war and which it is still able to mantain by the methods of economic and extra-economic coercion and spiritual enslavement of the workers. In the event of imperialist aggression against the world socialist system, we will be faced with a sufficiently organized and disciplined enemy.

At the same time it must be seen that there is an insurmountable contradiction between the bases of discipline in a bourgeois society and its armed forces and those demands made by modern war on discipline. The bourgeoisie has based the formation of discipline in the population and army upon means which in the event of serious trials could become the means for undermining social and military discipline, that is, be turned into their opposite. Hired soldiers who have been bought for money in their mass have never excelled in self-sacrifice, and they have neverd shown true heroism, while the falsified ideas, when they are unmasked by life, give rise to bewilderment, mistrust in the leadership and ultimately lead to a decline in discipline.

Socialism creates a different type of social discipline and hence, military discipline. Modern war is the most serious and the strictest testing of the strength of social discipline and its bases. The historical experience of the wars of the socialist state shows that the most important particular feature of socialist discipline is its ability to be tempered and strengthened in the first of difficulties and hardships. A war which threatens the

very existence of the people helps to alert absolutely all strata of the population of the social advisibility and vital necessity of firm discipline and high organization.

The situation of modern warfare is so complex that the strongest and stablest relationships of organization and discipline in society and in the armed forces will be subjected to severe testing. A growing strengthening of social discipline, and including military discipline, as well as a rise in the organization of all social life and activity can be achieved by consistently observing a number of conditions.

The first and most important of these conditions is the scientific leadership of society by the Communist Party. This is achieved by its Marxist-Leninist conditioning, by its ideological commitment, by its solidarity and organization. Marx-Leninist convicton among all members of the party, their devotion to communism, endurance, self-sacrifice and heroism, the ability of the party to come close to and fuse with the working masses, and the correctness of political leadership carried out by the party and tested by the experience of the masses—these are the Leninist demands underlying the formation of the unshakable discipline in the party, in a socialist society as a whole and its armed forces. The meeting of these requirements is the purpose of the decisions of the 24th CPSU Congress concerning the improvement of scientific leadership over social processes and economic management, and the further development of socialist democracy and a rise in the leading role of the party in socialist construction.

The second condition for further strengthening discipline and organization in our Soviet society is constant attention to the carrying out of this task in peacetime, as well as a correct combination of methods of conviction and methods of coercion in the indoctrination of people. It must be kept in mind that ideological work and the all-around and patient conviction are the chief means for the party's influence on the masses, and they constantly produce remarkable results. But the means of conviction are clearly insufficient for influencing the anti-social elements, those who do not want to obey and be convinced, those who violate Soviet laws and the rules of the socialist community and thereby encroach on the interetss of society. Socialist humanism requires a decisive struggle against those who disorganize social life and thereby prevent the strengthening of the defense capability of socialism under conditions of a serious military threat.

The third condition for further strengthening social and particularly military discipline is constant and unflagging attention to our Armed Forces, to their life, indoctrination, and to their material support on behalf of the party. In the decisions of the 24th CPSU Congress, concern for the Armed Forces is viewed as one of the most important tasks of the party and the state. This concern is expressed not only in the arming

of the Armed Forces with the most recent powerful technology, but also in indoctrinating in the people a love and respect for the difficult work of Soviet soldiers, as well as in the extensive work to train worthy replacements for the army and navy. The concern of the party, soviet and economic bodies for the Armed Forces is repaid a hundred fold, since it contributes to the political, cultural, and physical indoctrination of all the people. It must not be forgotten that service in the Armed Forces provides remarkable schooling in indoctrinating a significant portion of our youth who then, in returning to the national economy, in a worthy manner add to the ranks of the builders of communism.

As can be seen, technical progress in military affairs places very high demands upon the various aspects of the spiritual makeup of society, and forces each warring state to mobilize and utilize its capabilities in this area. In a war between two social systems, if the imperialists start it, the advantage in spiritual forces will be on the side of the socialist coalition. The nature of the socialist system provides a real opportunity for forming the ideological and psychological qualities and the cultural level of the masses which conform most to the objective requirements of modern war.

Technical Progress in Military Affairs and the Development of Combat Morale Qualities of Soviet Military Personnel

The spiritual forces of army and navy personnel are expressed in political morale and fighting qualities, and without them it is impossible to successfully conduct modern military operations.

In terms of their content, the political morale and fighting qualities of Soviet military personnel are definite social ideas, feelings, knowledge, skills and habits rooted in their awareness and expressing various aspects of social relationships. We have this in mind when we speak about such qualities as moral strength, ideological conviction, devotion to the people and the Communist Party, patriotism and internationalism, discipline, the ability for courageous and heroic deeds, vigilance, concern for the military equipment and the ability to utilize it fully, loyalty to military traditions, and so forth. The entire system of indoctrination for Soviet military personnel is aimed at developing these qualities, and each of them should be manifested in a modern war with much greater intensity than in past wars.

However, let us view morale fighting qualities from another aspect. In each of them we can detect several structural elements which determine the particular features of the human cognition of nature and social relationships. Such elements are ideology, social psychology, and, finally, military-type knowledge and skills. Obviously the development of the entire complex of political morale and fighting qualities in Soviet military

personnel should be carried out through effective ideological indoctrination, socio-psychological influence, and military training. These inseparably linked processes comprise, in their aggregate, the indoctrination of military personnel.

Technical progress in military affairs has raised the role and significance of these processes, and has led to certain changes in their relationship. The role of ideological stimuli has increased in the conduct of a soldier, since without aware loyalty to duty and a readiness to fight in the name of the just goals and interests of one's people, one can scarcely expect that selfless risk and even self-immolation which are required in modern combat. The ideological conditioning of the soldier, his loyalty to the people, and his profound understanding of the greatness and justice of the mission of the Soviet Armed Forces will be one of the most important means for developing the socio-psychological qualities of the soldier, including patriotic and internationalist feelings and hate for the enemies of socialism. A Soviet soldier is loyal to his motherland not only out of reason but also with all his heart and all his thoughts. Ideological tempering plays a major role also in developing the volitional qualities of a soldier such as his decisiveness, endurance, and the ability to go into the most dangerous areas, if military duty necessitates this. Finally, the ideological training of a soldier serves as an important incentive in his mastery of military knowledge and skills. All of this makes it possible to say that the ideological and political indoctrination which M. V. Frunze called an additional weapon of Soviet soldiers plays a leading role in military indoctrination of personnel of the Soviet Armed Forces at present.

This in no way reduces the importance of training soldiers or their instruction in military skills. A Soviet soldier must have firm will and firm knowledge and skills in order to fully utilize the complex equipment under the most difficult situation of modern combat.

The indoctrination of fighting morale qualities of a soldier is a multifaceted process. The commander indoctrinator should see its basic aspects and effectively develop a harmonious personality of the soldier, that is, an ideologically conditioned patriot of his nation, an able and strong-willed fighter, and a master of his job who has excellent knowledge of military equipment and is able to make full use of all its capabilities.

3. The Essence and Basic Directions of Psychological Training for Soviet Military Personnel

Military technical progress has a profound effect upon all aspects of the life and military activities of the Armed Forces. The entire system of troop training is becoming more and more complex. The USSR Minister of Defense has said that under modern conditions "the readiness of the personnel to conduct combat should be all-round, and be made up not only of military technical and physical training, but also, without fail, political morale and psychological training." [2]

At present psychological training of military personnel has become one of the most important conditions for raising the combat capability of the personnel. For successfully carrying it out, it is essential to understand the influence which the use of modern weapons can have on the mentality of a soldier, as well as the possibilities for reducing the negative effect of them on the mental state and combat activeness of the personnel. On this basis it is also possible to determine procedures for the psychological readying of personnel for active combat under conditions of modern war.

The Effect of the Conditions of Modern War on the Mental State and Combat of Personnel

The conditions of modern combat which are full of diverse weapons and characterized by a complexity and variability in the situation, and most importantly, by the destructive factors of nuclear missile weapons, are exceptionally difficult, tense, and dangerous for the soldier both in physical as well as psychological terms.

A sensed or experienced danger ordinarily is a reflection of a situation which objectively threatens man. An objective danger arises as an obstacle for the achieving of the set goals by a man, or as a threat to thwart his plans, or a physical threat to his health or very life. This danger evokes in man a state of internal tension which tells on his efficiency and mental state. A state of internal tension can suppress or, on the contrary, activate the occurrence of mental processes, contribute to the intensive manifestation of the soldier's existing knowledge, abilities, and skills, sharpen and focus the appearance of personal qualities of the soldier or, on the contrary, hinder, restrain, and dull them.

For the purpose of bringing out the effect of tension on the mental state and actions of miliatry personnel, a number of special experimental research projects were carried out in motorized rifle, airborne, missile, and other subunits, as well as in the border troops. Analysis of the results of these experiments makes it possible to draw the following conclusions: 1) experiencing of danger in a number of men causes a tension manifested in a change in a number of physiological functions, including blood pressure and pulse; 2) a state of tension influences the occurrence of mental processes in a soldier, that is, the quality of attention, thought, memory, and so forth change under the conditions of tension; 3) change in the efficiency of the mind under the effect of tension tells also on the results of the practical activities of the men; 4) tension can also influence the mental state and actions of military personnel in a depressing manner and, on the contrary, in a mobilizing one; 5) the

[2] A. A. Grechko, *Na Strazhe Mira i Stroitel'stva Kommunizma*, p 68.

different effect of tension on the mental state and thus on the actions of the men depends upon their personal qualities (ideological conviction, preparedness, experience, and attitude toward military service).

Analysis of materials from experimental research and observations of actions under involved conditions has shown that in soldiers which have a perfect knowledge of their weapons, and who possess high morale qualities and strong will, a state of tension has a less substantial effect on overall combat activeness, and in some has an activating effect on the occurrence of their mental processes and increases the activeness of their work. On the contrary, in men who have not completely mastered these qualities, a state of tension more often tells negatively on the occurrence of mental processes, and reduces the activeness of work.

The morale and political qualities of a soldier which provide a rise in his strength under difficult situations are based upon his ideological convictions, the development of which is the main goal of political indoctrination.

The development of ideological convictions is carried out primarily by explanation, demonstration, and personal example. Any other procedural solution for the problems of developing ideological convictions is impossible. Each indoctrinator in the Armed Forces should constantly remember this obligation.

However, there are instances in practice when, regardless of the existing conviction, an excessive stress, a danger, or other circumstances cause such a great overstress that it for some time takes possession of the man. In such instances, the soldier literally is "taken in hand" by his professional skills. These skills make it possible, in spite of the confusion, to maintain a correct direction and rhythm of actions. And this is not only important for carrying out the mission and achieving the goal, but is also a prerequisite for the quick return of the necessary self-control.

As is known, military professional knowledge, abilities, and skills lie at the basis of this mastery. Training and instruction with an increase in the quantitative and qualitative indicators are the way to develop them. And it is also important to consider that where the appropriate training is organized and conducted considering psychological patterns, the development of the required skills will come about.

Thus, the basis for the psychological strength of a soldier is his ideological conviction and military professional mastery.

This means that for successful actions in modern combat and for overcoming the negative effect of the state of tension, the soldier must show high political morale readiness, an excellent knowledge of the equipment and weapons as well as of the methods of combat, high physical endurance, and the ability to quickly orient himself, to judge the situation and take decisions. In this instance conditions of combat will evoke an active combat response in the soldier, a positive tension and excitement helping him to collect his forces and focus them on carrying

out the mission. But a soldier who does not possess the necessary political morale readiness and military mastery will behave quite differently in a situation of modern combat. The insufficiency firm ideological conviction or the absence of proper military professional preparedness reduce the combat capability of the soldier. For this reason political morale and combat readiness are rightly considered to be the basis of psychological strength of military personnel.

However, all-round readiness for combat is not achieved automatically by political morale and combat training. The situation of modern combat can have a depressing effect on the soldier in the instance that his mental state is not trained for perceiving tension. The human brain is so organized that it responds to any unexpected stimulus by excitation. The mental state becomes active in accord with this, and this is expressed in focusing attention on the stimulus, by emotional excitement, and by an activating of thought. All of this, of course, is a positive reaction. But if a person is affected by an unusual stimulus or an extremely strong stimulus, or if a person is under the protracted effect of an ordinary stimulus, then the excitation of the brain will have, respectively, a greater intensity. The presence of a locus of superintensive excitation in one area of the brain, by induction, leads to inhibition in the remaining areas. In this instance, a person's mental state enters a condition of depression. He experiences negative feelings (terror and fear), his attention is distracted, thinking is paralyzed, and actions become uncontrolled and impulsive.

In modern war, very strong stimuli will affect the soldier. And among them, certainly, one would mention first a nuclear explosion with its light and sound effects and strong shock wave. Protracted waiting for a nuclear strike can also reduce the mental stability of a person, and evoke passivity in him, if he is not appropriately (psychologically) prepared for what occurs on the battlefield.

The Content of the Psychological Training of Military Personnel

In order to determine the content of psychological training and its means, the following is essential. In the first place, to disclose the possibilities of completely eliminating tension in a person under a dangerous situation; secondly, to establish whether or not it is possible to alter the nature of the effect of tension on the mental state and conduct of a man.

For the purpose of solving this problem, a study was made on a group of tank troops during the driving of tanks under water. As the indicator of a state of tension, they used pulse and arterial pressure. The nature of the effect of tension on the mental state and actions was established in terms of the time and accuracy of solving a specially given intellectual problem. In the first stage for several days the pulse and pressure were measured

in all the soldiers to be studied under ordinary conditions. At the same time measurements were taken for the quality of solving intellectual problems by these men under the same conditions. From the obtained data, average indicators were obtained for pulse rate, pressure level, and the level of the psychological activeness of each man.

In the second stage of the experiment, a dangerous situation was created for its participants, causing a state of tension in them. The nature of its effect on the mental state and activity of the men was disclosed simultaneously by measuring pulse and pressure. An increase in the pulse and a change in pressure showed the occurrence of stress, while an increase in time for the appearance of mistakes in solving intellectual problems showed a negative effect on the mental state. In this manner they were able to establish the fact of insufficient psychological stability and psychological unpreparedness. In the third stage, after the tankmen had made several underwater crossings, the measurements of pulse, pressure, and the results of solving intellectual problems showed that the psychological effect of the dangerous situation and the change in the nature of tension caused by it on the mental state of the men remained.

The experimental data indicated that an objectively dangerous situation maintains its effect on the personality, causing a state of tension. This tension, under the condition of conducting indoctrinational measures and training, can be somewhat reduced, but not completely eliminated. From this derives the very important conclusion that any activity under a dangerous situation entails tension, and no healthy person can avoid it. The commander or political worker should consider that both they and their subordinates will be in such a state. For this reason, the commander must know specifically to what degree each subordinate will be subject to the effect of a dangerous situation, and how this tells on his work efficiency and acuteness of response.

In the third stage of the experiment, the tension (to a somewhat lesser degree) remained, but here the nature of the psychological responses changed. In many persons, the tension caused a disruption of accuracy and an increase in the time of psychological responses, and later its effect on mental work efficiency disappeared and then stimulated it.

All of this shows the possibility of using special measures to develop a positive active response to danger in people. A soldier should be prepared not to lose presence of mind in a combat situation or in mortal danger, not to forget his knowledge and not to lose his skills, but, on the contrary, to mobilize himself, and to use tension to raise the quality, accuracy, and speed of all responses, decisions, judgments, and actions which form the fulfillment of the mission.

Preparation of the soldier's mental state for a positive response to unexpected stimuli of excessive strength and for productive work under conditions of modern combat comprises a most important part of psychological training. It also includes the corresponding conditioning of

attention, memory, thinking, thoughts, and will in spite of the effect of strong stimuli and danger and the tension and extreme fatigue caused by them. Psychological conditioning, as was already noted, will be successful if it is carried out on the basis of political morale and professional military training. But it does not come down to just this. If definite ideological and moral qualities are formed in a soldier as a result of political morale conditioning, and military skill is formed in the course of combat training, psychological conditioning develops volitional qualities in the soldier and provides for their manifestation in combat.

In this sense psychological training can be viewed as a complex process, as a result of which the personality is conditioned, and self-possession, resourcefulness, and a desire to sustain victory over the enemy are developed. In practical terms this is achieved by realizing the principle "teach the troops what is necessary for victory in modern war" in the process of combat training, when in accord with this principle, the situation is as close as possible to actual combat.

Analysis shows that psychological conditioning, depending upon the goals and tasks, can be conditionally divided into several directions comprising it. First of all it includes the overall psychological conditioning for war which develops a readiness for the surprise start of combat, and for a transition of a peaceful state to a state of war. In this work the leading role is played by developing ideological conviction, a feeling of patriotism, the ability to correctly orient oneself in the political situation, vigilance, confidence of success, and the desire to conquer the aggressor, that is, a definite direction, purposefulness, and motivation. Here an important role is played by acquainting the soldiers with the nature of a future war, with the particular features of the theaters of military operations, the appearance of the aggressor, his capabilities, and the performance of our military equipment. On the level of this general training, an exceptionally great role is played by the major exercises and maneuvers of the Yug (South), Sever (North), Okean (Ocean), Dvina, and others where an atmosphere close to real combat is created.

Special training for conducting combat under conditions of modern war comprises the next direction. Mental stability and strength are developed in the course of it. This is achieved by measures and procedures which ascribe a stimulating character to the arising situation of tension. Presence in dangerous situations, the taking of crucial decisions, and work under conditions of a shortage of time—all of this provides psychological conditioning of the soldier. Special psychological training should be specific in each type of armed forces and branches of arms, and should consider the particular features and nature of tasks confronting the various subunits and units.

Still another direction is work in the area of special-purpose psychological conditioning carried out for a forthcoming specific battle, sea voyage, combat duty, and so forth. It is conducted for the purpose of

raising functional activeness, and encouraging a good mood and working state for a specific segment of time. This is carried out by raising the feeling of responsibility, by developing a clear set for activities to carry out the forthcoming missions, by practicing on trainers, mockups, models, and on the terrain, and so forth. Here a substantial role is played by the improvement and retraining of skills and the acquiring of physical strength. Rest, the exclusion of distracting influences in the preparatory period, personal hygiene, and a normal diet are also factors contributing to the successful execution of the mission.

Also in the area of psychological training are measures carried out in the course of executing a mission and helping to maintain physical and psychological forces. These measures introduce a psychological relaxation in a tense situation, they eliminate excessive overtension and cause a sthenic state. This is achieved by strict adherence to plans, by optimum working conditions, by alternating work and rest, by regular moral incentives, by material support, and by informative contacts. Here the decisive role is played by the continuity of personnel leadership and a constant party influence. This is also contributed by a correct placement of personnel.

Finally, those measures which are carried out after executing the mission are also a direction of psychological conditioning. They should help in quickly restoring mental forces, stability, and strength, eliminate the depressing influence of failures, prevent excesses under the influence of success, and so forth. And here the commanders and political workers have the first word.

In terms of the nature of the effect on the personnel, the very work and measures in psychological conditioning can be divided into active (including all which has a formative effect on personnel) and passive (providing the prevention of negative degenerative influences). In the latter instance, it is a question of preventing encounters with morally unstable or demoralized persons, gradually introducing personnel to conditions of mass losses and destruction, thwarting rumors, combating subversive propaganda, preventing the development of unstable groups, shifting personnel for preventing friction, and so forth.

The specific content of such training is most fully expressed in special psychological training. This direction in indoctrinating fighting morale qualities develops stability for a dangerous situation.

The Possibilities of Reducing the Negative Effect of Combat Situation Factors

Enemy firing, the use of powerful weapons, and above all nuclear ones, will have the strongest effect on the mental state of a soldier in modern combat. The possibilities of troop psychological training must be determined considering this.

In certain psychologically untrained men, anxious tension and, as a consequence of it, a feeling of a lack of confidence in one's forces can arise long before the appearance of the actual danger. This cannot help but be considered. The USSR Minister of Defense has commented that in "a situation where nuclear weapons are used, one cannot exclude the possibility of temporary shocks, and the appearance of the feeling of fear and uncertainty." [3] At the same time, the consequences of such stress should not be absolutized. A state of great psychological stress and the lack of confidence caused by it, as well as the anxiety in awaiting danger can be overcome by active work, including: work on equipping positions if on a defensive, and energetic pursuit if on an offensive, and so forth. Due to active work, the men shift their attention from what is or seems to be dangerous to the carrying out of practical missions. Also of great significance in overcoming a feeling of anxiety is an understanding by each man that the actions being carried out by him will provide protection against destruction on the defensive, and on an offensive will make it difficult for the enemy to use nuclear weapons and certain other means due to the danger of hitting his own forces. A firm knowledge of functional duties, high combat skill, a feeling of mutual aid and mutual help, and an understanding of the tactical procedures of the enemy and the capabilities of his weapons—all of this is an internal psychological support for the soldier helping him to maintain self-possession, and the ability to correctly judge the situation, to take decisions and control his conduct, to maintain a clarity of thought in anticipating the use of nuclear weapons by the enemy as well as other powerful means of destruction.

Undoubtedly, the actual use of modern weapons by the enemy will have an even stronger effect on the soldier's mental state. Untrained soldiers even when beyond the reach of the destructive factors of a nuclear explosion can lose their self-control and thereby prevent the execution of the mission. But to a significant degree this can be avoided if the appropriate preparation of the soldier for actions under a similar situation is carried out. The USSR Minister of Defense has pointed out that each "soldier should be so trained in political, morale, and psychological terms that under any conditions he will be able to quickly overcome the effect of negative fears." [4]

For this our personnel should be able from the external features to determine the character and type of weapons used by the enemy, to correctly judge the degree of danger, and to act most efficiently. For example, a blinding flash is one of the indications of a nuclear explosion. The effect of light and thermal radiation is sharply reduced by any obstacle and will serve as a signal for taking shelter against the shock wave. The rapidly rising mushroom-shaped cloud at the site of the explosion is also

[3] *Ibid.*, p 70.
[4] *Ibid.*

proof of a nuclear explosion. The type of explosion can be determined from its color, and the corresponding actions undertaken.

For responding quickly to the use of nuclear weapons and for taking prompt measures for protection against their destructive factors, the soldier must: 1) have an understanding of the range and degree of destruction for the types of weapons used on the battlefield, including nuclear ones; 2) know the protective capabilities of natural and artificial shelters; 3) possess skills of protection against modern means of attack (the use of shelters, individual protective gear).

The soldiers must master first that information which makes it possible to correctly assess the degree of danger and to draw necessary conclusions on the most rational actions making it possible to avoid it. This is greatly aided by a knowledge of the standard stereotypes which help the soldier without delay to take the correct decision. Such stereotypes are developed in the personnel by the complete mental "playing through" of various combat situations even in peacetime. For example, an understanding that a rapid second nuclear strike in the same area is improbable makes it possible for the soldier to begin to eliminate the consequences of the first strike in a more decisive and efficient manner, and to continue to carry out the mission.

The ability to orient oneself in a difficult situation, to show reasonable initiative and to act energetically is achieved by the soldier on the basis of a profound knowledge of tactics and weapons and in the course of constant exercises and training. A soldier can conscientiously study the assigned material and answer questions correctly in a classroom, but at the same time become muddled and confused in receiving an unexpected input during tactical exercises in the field, let alone in a real combat situation. But if he has trained for different versions of actions under a tense situation, then in combat there will be fewer surprises for him, for to a certain degree he has been psychologically prepared for them.

The development of stable skills of action under conditions of modern combat and the formation of the necessary psychological stability in the men occur when their required knowledge is reinforced by exercises. A. S. Makarenko has said that the repetition of practical knowledge without the accompanying "gymnastics of behavior" will not produce the proper educational results. The commander will achieve much better results if he will create conditions requiring active efforts from subordinates in the process of training and indoctrination.

The negative psychological effect of the factors of the situation is reduced when men have a specific image of modern combat, including the use of nuclear weapons. It is very important that soldiers, even before entering battle, have a sufficiently complete understanding of the external picture of modern combat and a nuclear explosion including its dimensions, color, brightness of the flash, shape and dimensions of the mushroom cloud, the particular sounds, the picture of the explosion from

different distances, and so forth. The more specific the understanding of the explosion, the less stunning an impression it will make on the battlefield. For reproducing the external appearance of an explosion, it is possible to use various mockups, colored posters, and stimulators.

The radioactive radiation at the moment of the explosion (the penetrating radiation) and the radioactive contamination of the terrain are a new specific destructive factor of nuclear weapons.

This destructive factor possesses a very strong psychological effect on people, and this makes their preparation for actions under the conditions of a radiation danger a very complex task. The difficulty of this task is caused, in the first place, by the fact that everyone knows the severe consequences of radioactive radiation and radiation sickness, as well as the complexity of its radical therapy, and, secondly, by the fact that radioactive radiation is not detected by the sense organs of man. These circumstances lead to a situation where, in the words of one bourgeois military psychologist, "the threat of radioactive contamination can cause a universal feeling of anxiety and evoke neurotic responses in troop personnel to a much greater degree than the nuclear explosion itself." [5] Certain people experience this threat so acutely that in them, even with the absence of radioactive radiation, indications of contamination (nausea, vomiting, headache, and so forth) appear. In others, the absence of the external indications of a radiological effect gives rise to an underestimation of the danger, to carelessness, and a neglecting of protective equipment and radiation reconnaissance.

The formation of a readiness to act correctly under conditions of radiation danger is aided by the men's study of the physical nature of radioactive radiation, and by a firm confidence in the reliability in the means and methods for defense against it. Without the corresponding instruments, a soldier is not able to detect and determine the degree of radioactive contamination of the terrain, weapons, military equipment, and himself, and he must follow the data of radiation reconnaissance which he learns from his commander. For this reason, it is essential, even in peacetime, that each soldier is convinced of the dependability of equipment as well as the skill of the men in the radiation and chemical reconnaissance subunits, and of the profound knowledge and high responsibility of his commander for his safety. Without a feeling of confidence in one's comrades and in the equipment which one uses, a soldier does not develop the necessary psychological stability on the battlefield.

The presence of personnel in a situation close, in terms of its effect on the mental state, to real radioactive contamination of the terrain aids in the psychological preparation of troops for actions under conditions of radiation danger. Of course, it is difficult to create such a situation. It is essential to rely on the imagination of the men. In order to develop

[5] *Sovremennaya Burzhuaznaya Voyennaya Psikhologiya* (Modern Bourgeois Military Psychology), Moscow, Voyenizdat, 1964, p 262.

the necessary concepts, usually visual aids are employed, as well as simulation devices, "fumigation," and so forth.

The systematic use of inputs which reflect a change in the "radiation danger" in the process of field exercises and training is of great significance for developing a correct response to radiation danger. This teaches the men the idea that radiation reconnaissance is conducted constantly and that they will be notified promptly of the danger.

A decisive factor in psychological training is the strengthening of the obtained knowledge by constant training using individual protective gear and by carrying out "special processing" and "decontamination".

An important measure in a combat situation which helps to reduce the negative effect of combat factors on the mental state of the men and their correct response to what has occurred is the countering of false rumors spread by enemy agents on the contamination of various objects, areas of terrain, and so forth. Such rumors, as is apparent from the American "instructions on psychological warfare," affect people with a greater nervousness and weak will, and can cause fear or even panic in them. This is why it is important that each soldier be fully aware that his duty in all instances, regardless of the radiological contamination of the terrain, is to continue execution of the mission, being confident that his commander will not permit the personnel to be subjected to radiation in dangerous doses.

Of course, in the interests of psychological preparation for modern combat, a soldier should be well acquainted with the other means of waging war which the enemy has, including: napalm, chemical and bacteriological weapons. He should be able to stand the psychological pressure of a tank attack, artillery-mortar shelling, air and missile strikes, and so forth. Of important significance is also a familiarization with the situation in the various theaters of military operations.

Certain Methods of Psychological Troop Training

The real situation of war and combat conditions a man most rapidly and profoundly and develops in him a psychological readiness to act energetically, disdaining danger and difficulties. On this question M. I. Kalinin wrote that the months, weeks, and even the days spent in combat in terms of their indoctrinational results, are equal to years, and for this reason "in a war a man so quickly is turned from a callow youth into a mature man and into a fighter." [6]

In the process of combat training, it is difficult, and there is even no need, to create a situation which in terms of the degree of danger would be close to modern combat. At the same time, each commander, in a

[6] M. I. Kalinin, *O Kommunisticheskom Vospitanii i Voinskom Dolge* (On Communist Indoctrination and Military Duty), Moscow, Voyenizdat, 1967, p 487.

creative approach to training his subordinates, can always find numerous different ways for bringing training conditions closer to combat ones. And it is not essential to do this by a detailed copying of the external picture of a combat situation during exercises. The main thing is that psychological conditions close to combat be created and maintained. This is the question of the psychological model of combat.

The commander develops in his subordinates a proper psychological stability if he is able to organize training and indoctrination in such a manner as to cause high tension in them and mobilize them to manifest quickness of orientation, activeness of thought, daring, decisiveness, self-control, and initiative, that is, those qualities which are needed for action under the conditions of modern combat. Then the soldier will feel the indoctrinating effect of the situation, gradually a lack of confidence, nervousness, and fear will disappear in him, and a psychological stability and readiness for active work in modern combat will be formed.

Stress in exercises and training can be created having confronted the soldier with the necessity of solving a problem in a limited time, or choosing the best method of action out of several possible ones.

Many types of combat training and service are characterized by great complexity. These include field exercises, comprehensive exercises, tactical exercises, and so forth. In carrying them out a state of tension develops in the men. This state provides an opportunity to psychologically prepare them for active combat actions under wartime conditions. For this reason in training the personnel preference is to be given to these forms of combat training.

Peacetime life, service, and training of troops should be full of all sorts of experiences. They should be carried out at night and at day, at any time of the year, on different roads, on varying terrain, on different equipment, and with different loads. The strict observance of all the rules for moving complex military equipment creates definite difficulties the overcoming of which creates tension in the men. This also can serve as an indoctrinational factor in their training.

Tension helps the indoctrination of the necessary qualities in the men when the danger causing it or the complexity of the situation is correctly appraised, planned, and consciously used by the commander. But if the actions of the men in dangerous situations are not supervised, but are let to drift, and if explanatory work is not done, then in certain men a tendency can appear to avoid the difficulties and search for the easy way out. As a result in these persons such negative qualities as dishonesty, cowardice, selfishness, and laziness will develop.

Control over the actions of personnel and constant explanatory work with them by the commander comprise an important condition providing for the turning of the intensity of combat training into a factor instilling the necessary psychological qualities in the men.

In the interests of psychological preparation of personnel for energetic

actions under tense, rapidly changing conditions of modern combat, the situations, or more accurately, the situation in which the personnel is trained should not be repeated often or turned into mere routine. Otherwise the men will not develop a psychological readiness for actions under a state of tenseness, but rather the rigid stereotypes of simple responses which will not provide the proper mastery of the situation. In this regard, we might bring out the following fact. The personnel of a squad systematically fulfilled the field firing exercises successfully using a stereotype target setup. But when the situation was changed and the firing of an inspection exercise was carried out on an unfamiliar firing range, the results were significantly lower. Routine actions did not develop in the men the ability to orient themselves quickly, to find independent decisions, and to change the character of actions in accord with a change in the situation.

The confronting of the men with the necessity of solving complex problems independently is a very effective way of psychological training. A difficult situation on the path to the posed goal is recognized by a man as a problem. Its solving (at first the mental finding of the forms of action and then the actual achieving of the goal) requires a stress on the mind, feelings, and will, that is, the entire human mind. Here this tension is proportional to the complexity of the task and the situation. For example, the complexity of a tactical situation is formed from the particular features of the combat objectives of the "enemy," the presence of undetected targets, the overall intention of the "enemy," the formation of one's own battle order, movements, and the limit of time. Naturally, a tactical mission will serve not only to develop tactical thinking, but also the goals of psychological training of personnel only in the instance when the designated elements will pose specific demands upon the person solving the problem, or if their ignoring actually will not make it possible to solve it correctly. Unfortunately, often in exercises and tactical training, the conditionally designated elements of the situation "do not work," and do not put demands upon the person solving the problem. Unconditionally this reduces the tension of the situation and the indoctrinating effect of such exercises.

Elements of danger and risk can introduce tension into the combat training of the men. The elements of danger and risk allowed in exercises and training should be controlled.

However, danger and risk in the process of combat training in no instance should be deliberate or artificial. For example, there was an instance when during exercises the field engineers put up a crossing in a very short period of time but with obvious flaws. It would have taken a great deal of time to redo it. And instead of thoroughly analyzing the situation and correctly assessing the possibility of the crossing, they decided to test it to see whether it would hold. The men were told that the danger of crossing it was great but also that in combat they would encounter such a situation. The first vehicle immediately plunged into

the water, and a new crossing had to be built. The educational effect of this artificial danger was a negative one. The men began to doubt the reliability of the structures erected by the combat engineers, and mistrust appeared for the words and actions of the commander who subjected the men and equipment to unnecessary risk.

There are instances when a certain danger or risk are created by using those conditionalities which must be resorted to in combat training. Under such circumstances, explanatory work with personnel aimed at overcoming the feeling of conditionality in the men will be an indispensable prerequisite for the proper educational result. Ordinarily this is achieved by explaining the purpose and importance of the actions to be carried out, as well as by activating a sense of duty and an awareness of responsibility. Thus, the commander of one of the subunits during the exercises decided to cross a river on a raft, although several score meters further downstream there was a ford. The men understood the sense of the taken decision, and acted with all seriousness. In such instances it is very important to see to it that the actions of the personnel do not cause any unforeseen consequences. Otherwise in some a doubt may arise as to the advisability of the taken risk. With good reason the commander decided to cross the river close to the ford, just a little higher upstream, and this guaranteed the subunit against any unforeseen mishaps.

The elements of danger and risk used in combat training of the men should not be stereotyped in terms of content, form, strength, and duration. Only their diversity can form the psychological strength to encounter unexpected situations. Remaining in a dangerous situation should be repeated.

Our officer's possesses a whole system of exercises, studies, as well as types and forms of training which entail elements of danger and which, with correct organization, provide the psychological preparation of personnel for combat. This frees one from the need to introduce any special type of psychological training. But at the same time it is important that each officer be aware of the significance of psychological training, and wherever it is possible to do so, consciously introduce and implement it. It is advisable to plan the tasks of psychological training more specifically and to utilize the possibilities of all types of combat training for this. Without this, it remains merely a good intention. The pernicious consequences of neglecting psychological training are known from the experience of the past (the fear of tanks and aircraft, the fear of encirclement, and so forth).

The psychological preparation of personnel for active combat under the conditions of modern war is an important component in the training and indoctrination of our personnel and in forming the qualities necessary for combat in them. It is carried out simultaneously with the formation of high political morale, fighting, and physical qualities in the men by bringing the psychological situation of combat training in peacetime close

to the situation of modern war and combat. For this special procedural methods and means are used (tank roll-overs, being under the trajectories of shells and bullets, and so forth), and special training fields, compounds, and areas are set up. In this work there is broad scope for creativity. The chief of the Main Political Administration of the Soviet Army and Navy has said: "More attention must be paid to scientific research on the problems of psychological training, these questions must be solved comprehensively, by the forces of military scientists, psychologists, medics, experienced commanders, political workers, and engineers from the various services of the Armed Forces, and the efforts of a number of higher military institutions of learning must be united." [7]

[7] A. A. Yepishev, *Kommunisty Armii i Flota* (Army and Navy Communists), Moscow, Voyenizdat, 1971, p 91.

Chapter VIII. The Revolution in Military Affairs and the Increased Role of Science in Troop Leadership

Collective activity always necessitates organization and a concentrating of the efforts of all members in the given collective on solving certain problems. A unity of action on the basis of a unity of goals is an indispensable condition for success in any job. For achieving the unity of actions of one or another collective, leaders are required to determine the goal of the activity, to find ways for achieving it, to mobilize the people, and to unify their efforts, energy, and will. The higher the level of leadership, the greater the successes in the practical activities of each collective.

The role of the leader is particularly great in military affairs, in strengthening the defense capability of the nation, and in conducting military operations. Combat activity to a greater degree than any other requires the strictest organization, a unity of will, and a unity of action. Here, in keeping with the development of miliatry affairs, the growth of the technical outfitting of armies, the increase in scope of combat and its complications, the role of the commander grows as well as the significance of the level of combat leadership. Technical progress and the related revolution in military affairs have posed with great urgency the problem of scientific leadership both for training the armed forces as well as for conducting combat on the strategic and tactical scale.

One of the particular features of the development of military affairs under modern conditions is that at present, as never before, the significance of military science and military theory has risen. While in the wars of the past the commander, in a number of instances, could successfully carry out the missions relying on personal experience and empirical knowledge, under present conditions this is clearly insufficient. Without theoretical knowledge and without mastering the most recent achievements of military science, a commander is now unable to sucessfully carry out his duties. At present, as never before, there is a timeliness to the words of V. I. Lenin that it is impossible to build a modern army without science.

Mar SU A. A. Grechko has pointed out: "Military science plays an important role in the successful implementing of the tasks of military construction, as well as in the training and use of the army and navy. In relying on the Marxist-Leninist teachings concerning war and the army and on Leninist methodology, Soviet military science examines the nature of military operations in a future war, the laws inherent to its subject, the methods of conducting military operations, and the principles of military arts. Military science elaborates the theoretical bases and the practical recommendations on the questions of organizing the Armed Forces and their preparation for a possible war." [1]

Complicating processes of military operations and the specific features of the cognitive and practical activities of a commander under present conditions have led to a greater role for theoretical thinking, and have required an improvement in the methods of understanding military affairs and military scientific research. Quite understandably, without a profound explanation of the essence of the problems mentioned above, the characteristics of the revolution which has occurred in military affairs would be incomplete and unfinished.

1. Scientific Leadership—One of the Most Important Conditions for the Success of Military Activities

The activities of a leader are comprised of two inseparably interrelated aspects. *The first* is the preparing of people to carry out definite tasks, as well as their daily training and indoctrination. *The second* is the control of people and the uniting of efforts of the entire collective on carrying out the set task. Decision taking by the leader is the basis of these activities. The elaboration and taking of a decision on the basis of which the activities of both the leader as well as the entire collective are carried out is the most important element of leadership.

The quality and level of leadership are determined by the end results of the practical activities of the led collective. Practice is not only the criterion of the truthfulness and correctness of various views or theoretical concepts, but also an indicator of the leadership level. For this reason, the nature of leadership can be judged only from the results achieved in the process of practical actitivities.

However, in and of itself the success of practical activities still does not provide a right to judge the degree of leadership qualifications. Here it is also essential to establish at what price the success was achieved. The party condemns those leaders who endeavor to fulfill a plan at any price. The same thing is true in combat and military activities. The achieving of victory in one or another combat still does not describe the leadership level. There is the well-known expression "Pyrrhic victory,"

[1] A. A. Grechko, *Na Strazhe Mira i Stroitel'stva Kommunizma*, p 54.

that is, a victory which is achieved at the price of unjustified losses. Such a victory does not show a high level of military leadership or its scientificness.

Scientific leadership should provide the fullest utilization of the existing capabilities, and an achieving of maximum results from the practical activities with the least expenditure of forces and means. V. I. Lenin pointed out that in the leadership of social processes it is essential to work for "a conscious choice of the means, procedures, and methods of combat able, with the least expenditure of forces, to provide the greatest and most lasting results." [2]

The Necessity of Scientific Troop Leadership

The revolution in military affairs has required not merely a rise in the level of troop leadership. The revolution has acutely raised the question of the scientificness of leadership over all types of practical and theoretical activities in all areas of military affairs.

The development of the armed forces and the conducting of combat operations are a strictly centralized and planned process. Planning and centralization are inherent to all areas of communist construction, but they are particularly essential in military affairs. Without the strictest centralization and unity of will and action, there can be no modern army and victory in war is impossible. In many ways the character, direction, and the result of practical activities of personnel of the units and subunits will depend upon the level of leadership, the degree of correctness and soundness of missions set by the commander, as well as his determining of the methods and ways for carrying them out. Such a notion has always been characteristic for military activities. However, under present conditions this assumes a qualitatively new content.

Under present conditions the development of weapons and military equipment is occurring, as was already stated, at an exceptionally rapid rate. The new models of weapons and equipment in a number of instances are obsolete even before they are in mass use. Clearly under these conditions, mistakes in determining the direction of military and technical progress can have undesirable consequences, and reduce the possibilities for making maximum use of scientific and technical achievements.

All the generals and officers of our Armed Forces to one degree or another participate in solving the problem of improving weapons and equipment. The commanders of the subunits and units under whose leadership the new equipment is operated are the first to feel the positive aspects for shortcomings of one or another type of combat weapon. With good reason, therefore, rationalization and invention have assumed a broad scope. But this is not all of the matter. It is also essential to more

[2] V. I. Lenin, *Poln. Sobr. Soch.*, Vol. 9, p 208.

boldly provide concrete practical and theoretical advice on the ways to further improve the weapons and military equipment. This, in turn, requires from the commanders a broad technical and scientific viewpoint and a knowledge of the prospects of military technical progress.

The rapid development of weapons and equipment has also required their accelerated introduction into troop practices. It must be said that under present conditions there have been frequent instances when the development and improvement of new types of weapons and equipment have occurred more rapidly than their use on a mass scale.

At present when our Armed Forces are receiving intelligent recruits, solving the problem of the most rapid introduction of new equipment depends greatly upon training methods.

Clearly, under these conditions mistakes in the choice of training methods can impede the introduction and reduce the effective use of new equipment. The commander must have not only a good knowledge of the equipment but also an ability to pass on his knowledge to subordinates in a maximum short period of time.

As a rule, the comander has at his disposal a large amount of equipment which at times is diverse in terms of its purpose. It is essential for him to be able to use it most efficiently. As is known, "technology determines tactics," in other words, the commissioning of new equipment on a mass scale requires a constant improvement in the methods of conducting combat.

Previously, when the change in the means of waging war occurred slowly, one could count on the haphazard development of new methods of combat. The history of wars knows many examples when the soldiers in a number of instances, in spite of the commanders, adapted their actions to the new weapons. At one time this was how the open formation arose. During the period of the Russo-Japanese War, for example, the practice of conducting artillery fire from a concealed position developed unintentionally.

Under modern conditions, it would be extremely dangerous to count upon the spontaneous development of methods for waging combat. The new methods of waging combat should be worked out and introduced into the troop training practices even in peacetime. Quite understandably, mistakes in solving this problem can have an exeremely negative effect on the course and outcome of the war. While in the period of a more or less extended war these mistakes could be rectified in the course of combat, at present, under the conditions of a possible quick war, one cannot rely on this. The difficulty of solving this problem is now that we do not have experience in conducting combat with the mass use of modern weapons.

As was already said, war involving nuclear weapons inevitably will have a great effect upon the psychological and morale state of a man and upon the degree of his combat capability. It would be dangerous not

to consider this circumstance. It is essential to prepare personnel of the Armed Forces for effective actions under the worst conditions. This, probably, is one of the most complex problems of troop training.

Of course, war with its dangerous chances has always required the corresponding morale and psychological training of the troop personnel. The solving of this mission was also the purpose of the so-called "penetration attacks" used even by A. V. Suvorov. Having tanks roll over soldiers in trenches, an attack behind a rolling barrage, and the use of pyrotechnic equipment—all these are methods for psychologically preparing the troops for combat.

Under modern conditions the preparation of a man for combat has become significantly more complex. This, in turn, has required a scientific definition of the ways of psychological and morale training of personnel. Upon how properly and scientifically it is carried out will depend the readiness for combat, the degree of using the combat capabilities and characteristics of weapons, the ability to quickly carry out one or another mission, and ultimately, victory over the enemy. Even in peacetime necessary qualities must be developed in the men, and they must be taught to overcome fear and strong stimuli.

Up to now we have spoken about the necessity of scientific leadership for preparing the armed forces for waging modern war. To an even greater degree it is essential to have scientific leadership under the conditions of troop combat itself.

Combat is a specific and most crucial type of activity for the armed forces under the conditions of modern war. Under these conditions, any mistake, even the most insignificant one, can lead to extremely severe consequences, particularly if the rapid nature of combat is considered. Victory in a war, in an engagement, or in a battle always entails great material and human losses. These are inevitable. This is beyond dispute. But it is also beyond dispute that excessive losses and unjustified sacrifices always follow any mistake by the commander or any incorrect decision. Armed combat and military operations are characterized by a unique irreversibility or nonreproduceability in their initial form. If, for example, we have built a plant and then discovered certain structural defects, we can eliminate them, certainly at a price of additional expenditures, but still this is feasible. Equally it is always possible to redo something in the course of construction. But in combat any mistake by the commander can be used by the enemy. The waged battle cannot be replayed.

A knowledge of the principles of scientific leadership and a mastery of its methods by all the commanders of our Armed Forces are an indispensable condition for success in strengthening the defense might of the socialist state and achieving victory in a modern war. This is particularly essential since it is an issue of combatting a strong enemy the armed forces of which are armed with all types of modern weapons and military equipment. Scientific troop leadership under these conditions is one of

the decisive factors for achieving victory. This is why it is essential to continue the elaboration of scientific principles for leadership of the armed forces considering the development prospects of technical means of war.

The Principles of Scientific Troop Leadership Under Modern Conditions

Success in troop combat is determined by the feasibility of the set goal, by the choice of the most effective ways for achieving it, as well as by the ability and desire of the entire military collective to carry out the mission, and by the ability of the leader to unite the collective actions of subordinates in the desired direction.

The carrying out of these tasks is possible only in the instance where the leadership of practical combat activities is carried out on a scientific basis. Scientific leadership means the conforming of the practical activities to the development patterns of objective reality. If one speaks about combat activities, then scientific leadership is the conformity of the goals, missions, character, and direction of activities to the objective patterns of combat and their manifestations in the given specific situation.

Subjectivism and its extreme expression, voluntarism, are the direct opposite to scientific leadership. Subjectivism in leadership is nothing else than the ignoring of scientific data and acquired practical experience, as well as the underestimating of a knowledge of the laws of development for objective reality. It is harmful in any type of practical activity, but particularly so in military activity.

Success in understanding and discovering the objective laws of military actions depends upon the nature of the used methods of cognition and the approach to analysis of objective reality. The method of dialectical materialism is the scientific method of cognition. For this reason, *the basis for scientific leadership in military affairs is the mastery and conscious use of the method of Marxism-Leninism, as a universal method of cognition and practical activity, by each commander and military leader.*

For military leadership, this is all the more essential since military actions are a very complex object of cognition, while the development of military theory is one of the difficult types of research activity. And if we, at present, have a developing scientific military theory which correctly reflects the modern state of military affairs, this is only because our military cadres are led in their activities by Marxist-Leninist teachings which serve as a dependable guide in military scientific research.

War is a process which is inseparably intertwined with all aspects of social life. During the period of a war it would be difficult to name any area of practical or theoretical activities which in one way or another is not involved with the demands of achieving victory. A military leader will be able to correctly analyze the processes of armed combat and successfully direct them only in the instance that he will possess a knowledge of the laws of social development and the entire aggregate of the relationships of social life which in one way or another influence the course and outcome of a war. From this it follows that *one of the principles of scientific troop leadership is a knowledge on the part of the commander or the military leader of the patterns of social development, and their precise consideration in the course of the practical activities of the troops both in peacetime and in war.*

Marxism-Leninism is a science which analyzes the general patterns of the historical process, the construction of socialism and communism, and the relationship of war and the various aspects of social life. Marxism-Leninism, being the methodological basis of Soviet military science, "provides it with a profound penetration into the essence of the phenomena of war, and gives great strength in resolving the most complex problems of military affairs." [3]

Moreover, a knowledge of Marxist-Leninist theory forms communist awareness, conviction, and profound loyalty to the ideals of communism. These are inseparable qualities of a military leader.

Under modern conditions, when the military leader is involved with the most diverse and complex military equipment, the solving of the posed problems will be determined greatly by the degree of effective use of the forces and technical means available to him for conducting military operations. For this reason, *one of the most important principles of scientific leadership is the commander's knowledge of combat capabilities of weapons and equipment as well as the methods of their most effective use.*

A particular feature of modern military equipment is that mere practical skills or empirical knowledge is not sufficient for using it, as was the case basically in the past. At present, as never before, there must be a knowledge of physical, mathematical, chemical, and other sciences. Anyone involved in military equipment knows, for example, that a missile cannot be launched successfully without a knowledge of the principles of radio engineering, radio-electronics, and mathematics. Of course, this does not mean that each commander should simultaneously be a highly skilled engineer, but a definite military technical training for the modern commander is completely essential.

The achieving of victory in the course of modern war significantly is determined by the degree of realism of the missions to be carried out, and by the choice of the most effective methods of activity. The realism of the set goal, like the correctness of the choice of ways and methods for achieving it, is determined by their conformity to the objective patterns of combat. From this it follows that *one of the most important principles for scientific leadership over the combat activity of armed forces personnel is a knowledge and conscious use of military science* which analyzes the objective laws of waging war and combat.

[3] A. A. Grechko, *Na Strazhe Mira i Stroitel'stva Kommunizma*, p 55.

On the eve of the Great October Socialist Revolution, V. I. Lenin, having heard the report of N. I. Podvoyskiy on the state of the forces of the revolution, commented: "How strong the revolution is! . . . Now the main thing is to guide it to victory, but victory is impossible without the use of military science." [4] It must be stressed that under modern conditions, when the military might of our state has increased incomparably with 1917, these words of V. I. Lenin ring with particular force.

A war, like the preparations for it, is a directed, organized process. People consciously set the goals of a war, the methods of waging it, the direction and the ways for preparing the armed forces and the nation as a whole for the war. At first glance it may seem that here everything depends upon the will and the desire of the people, and upon the activities of the government and the military leaders. Precisely this circumstance is one of the reasons that for a long period of time the existence of any objective laws of war was denied. And only with the development of Marxism was a scientific understanding of the history of society given, including war as a social process.

War as a whole, like its concrete manifestations (an engagement, operation, or battle) has its internal objective logic of development, objective laws, ties, and relationships which do not depend upon the will and desire of people. Each side participating in a war endeavors to achieve victory, but one of the sides wins it, or the war ends as a mutual compromise. Nazi Germany, in starting the war, set the goal of winning world conquest. According to the Barbarossa Plan, the armed forces of the Soviet Union were to be destroyed quickly, the Soviet state was to be abolished and the peoples of our nation enslaved. However, the outcome of the war was completely opposite to what the rulers of Nazi Germany wanted.

The change in the methods of waging war also occurs naturally. They change above all depending upon the development of the means of armed combat. The very development of weapons and military equipment is determined by the correponding level of production. In each war, there are both general laws inherent to all wars as well as laws characteristic for the wars of the given epoch. For example, the law expressing the dependency of the methods of waging war upon the state of weapons and military equipment is inherent to all wars. The law expressing the dependency of the outcome of military operations and actions upon the degree of the effective use of nuclear weapons operates only in a war involving the use of these weapons.

It must be said that the discovery of the objective laws of war and the determining of the principles for the most effective practical combat activity are an extremely involved matter, particularly as a consequence

[4] N. I. Podvoyskiy, "On the Military Activity of V. I. Lenin," "*Kommunist*, 1957, No 1, p 36.

of the lack of practical experience in waging war with the use of nuclear missile weapons.

There are also laws which express the dependency of the combat might of the armed forces upon the economic development level, the size of the population, and the nature of the socio-political organization of the given nation. Without the analysis and conscious use of these laws, it is impossible to determine the ways for developing the armed forces or raising their combat might. In developing and improving, for example, the modern means of armed combat, it is essential to strictly consider the economic capabilities of the nation, and the ability of armed forces personnel to utilize new military equipment in a short period of time. This is particularly important at present when the production of weapons and military equipment requires great expenditures, and when they are difficult to introduce.

The training of army and navy personnel for conducting modern combat has also become significantly more complex. Here a number of new factors are at work which did not have such essential importance in the past. For example, these include: the complexity of mastering new equipment on a mass scale, the significant increase in the number of military technical specialties, the greater demands upon psychological and morale qualities of personnel, and the necessity of solving these problems in a short period of time.

It would be wrong to feel that a knowledge of the patterns of armed combat and the training of armed forces is essential only for superior military command. It is essential for each commander and each soldier. The Secretary General of the CPSU Central Committee, L. I. Brezhnev, in a speech at the 15th Komsomol Congress stressed: "It is wrong to feel that only important scientists and leaders are concerned with economic laws. These laws, if they are correctly understood, dictate the logic of conduct not only for the administrator, engineer, scientist, and technician, but also for each rank-and-file worker and kolkhoz member." [5] This applies equally not only to economic activity, but also to military activity, particularly in our times.

Military theory analyzes the patterns, general ties and relationships between the various processes of combat and troop training. For example, take the theory of offensive combat. It analyzes such aspects, ties and relationships as are inherent to all types of an offensive. But these general relationships are manifested differently under various conditions. Thus, an offensive in a forested swampy area will differ from an offensive in the mountains. They will have various forms of manifestation depending upon the balance of forces, the nature of the weapons used in the given offensive, and so forth. Certainly the nature of practical activities also depends upon those specific conditions under which these activities occur.

[5] L. I. Brezhnev, *Rech' na XV S"yezda VLKSM* (Speech at the 15th Komsomol Congress), Izd-vo TsK VLKSM Molodaya Gvardiya, 1966, p 8.

This is why for correctly choosing the goal and determining the method for achieving it, it is essential to proceed from the particular features of the given specific situation.

Consequently, *one of the bases of scientific troop leadership is a precise knowledge of the specific situation under which military and combat activities are carried out, and the ability to anticipate the further course of defense*. A dependable analysis of the specific combat situation is one of the most complex elements of a commander's activities. This is determined primarily by the particular features of the combat situation itself as it develops under conditions of modern war.

Military operations are a two-sided process. Each of the warring sides endeavors to destroy the forces and means of the opposing side, and to disorganize and disrupt their activities. Here each of the sides always conceals its forces, actions, and intentions, and uses all means of camouflaging and misinformation. Einstein at one time said that nature is complex, but not evil, that is, it does not set up obstacles for understanding it. As for military operations, here each side manifests a "maliciousness" vis-a-vis the other. It must be said that under conditions of modern war, in line with the great range and speed of technical devices, opportunities for enemies to conceal their intentions have significantly increased.

The processes of military operations to a greater degree than any others are characterized by exceptional activeness and dynamism. This applies particularly to modern warfare. The combat situation will always be marked by a rapid and sometimes unexpected change of events, and by the presence of a large number of unforeseen events. Under these conditions, a significant portion of the information may be obsolete by the time it is received. Moreover, much information will have not a reliable but only a probable character.

In order that the commander can provide accurate analysis of the situation and draw sound conclusions from it, in addition to theoretical knowledge concerning the nature of modern combat, he must also have a knowledge of the patterns of the cognitive process and strictly observe the requirements of the logic of dialectical thinking.

Our thinking is nothing more than a reflection of the reality surrounding us. However, it can produce both true and distorted knowledge, in other words, we can think correctly, but we are also able to be confused. This is explained by the fact that our thinking possesses relative independence and has its own specific patterns, the ignoring of which is one of the causes for mistakes in cognition.

V. I. Lenin wrote: "In order to actually know a subject, it is essential to encompass and study all its aspects, all the relationships and 'conditioning.' We can never achieve this completely, but the demand of comprehensiveness protects us against mistakes and against ossification." [6]

[6] V. I. Lenin, *Poln. Sobr. Soch.*, Vol 42, p 290.

Here, from the entire aggregate of ties and relationships from which a situation is formed (and they are infinitely numerous), it is always essential to select the most essential and decisive relations. If one speaks about a combat situation, then those decisive relations which must be kept in mind first of all are the balance of forces and primarily the balance of nuclear forces, the actions and intentions of the enemy, and the possible consequences of nuclear strikes.

The discovery of the very essence of a contradiction is a condition for the complete evaluation of the situation. "Per se," wrote V. I. Lenin, "dialectics is the study of contradiction *in the very essence of subjects...*" [7] This demand to discover the contradiction in the very essence of subjects has also been formulated as the necessity of accurately considering all the "pros" and "cons." This is the most important condition for taking a sound decision. In assessing the situation, it is essential to be certain of what factors help to carry out a mission and what obstructs it. Thus, in analyzing, for example, the state of combat training, it is always essential to bring out both the positive aspects and the successes, as well as the shortcomings to be eliminated. A knowledge of one's subordinates also means a knowledge of positive and negative sides. A thorough understanding of strong and weak points of one or another type of military equipment also will provide an opportunity to utilize it most effectively.

In modern war, when a large amount of the most diverse military equipment will be involved in combat, the use of mathematical methods and electronic computers assumes most important significance. Mastery of the method of mathematical analysis provides an opportunity not only to fully consider the quantitative balance of forces, but also formulates the mathematical accuracy and logical sequence of thought.

It is essential to consider one other important circumstance for correctly evaluating a situation. The problem is that a situation is analyzed not in general, but rather from the viewpoint of the mission set by the superior chief. Precisely the nature of the set mission determines the direction of the commander's mental activity in the process of his evaluation of the situation. For example, the commander knows that his subunit will operate on the main axis, and he will evaluate the enemy, the terrain, and other elements from the standpoint of determining the most effective methods for carrying out the set mission. This is why for correctly judging the situation, it is so essential to have the accurate posing of the mission, its conformity to the combat capabilities of the unit or subunit which is to carry it out, as well as a correct elucidation of the set mission by the executor.

The ability to correctly assess the situation and to take the right decision is based also upon a knowledge of the decision taking methods. By the latter we understand the logical sequence of a commander's thinking as

[7] *Ibid.*, Vol 29, p 227.

well as the organizing of the work of his assistants (the staff) in the process of judging the situation and taking the decision.

A scientifically based method of decision taking has been elaborated in our military theory and practice. However, its application must be approached creatively, depending upon the specific conditions of the existing situation. It must be kept in mind that for modern war, the typical features will be the rapid development of events, the extremely abrupt change in the situation, and an abundance of facts to be generalized. In a significant number of cases, the commander will have to take independent and responsible decisions. Clearly, under these conditions, it is particularly important to have the rapid obtaining and transmission of information, and the ability to foresee the development of events and be able at any minute to change the methods of action.

The ability of a commander to judge the situation correctly and in a short period of time is determined also by his personal practical experience. Under peacetime conditions, such experience is acquired in the course of troop and command post exercises and by solving short tactical exercises. For the purposes of rapidly acquiring experience and gaining the habits of a quick and objective judgment of the situation, it is essential that exercises and military games be carried out under a situation as close as possible to combat and under the most diverse conditions.

The taking of a correct decision based upon a knowledge of the theoretical principles of modern combat and on precise consideration of the specific situation is an important but not the only condition for success in practical activities. The decision is carried out through the activity of personnel. Quite understandably, for this reason, its success will be determined by the degree of activity and initiative shown by the executors.

In 1905, V. I. Lenin wrote: "Without an enterprising and aware soldier and sailor, success in modern war is impossible." [8] These instructions of V. I. Lenin apply all the more to modern war when powerful weapons are in the hands of the soldier and sergeant. The outcome of the war will depend upon the degree of ability, initiative, and resourcefulness shown by the troop personnel. If it is considered that in modern war battles having a focal character and actions with small subunits will be rather frequent, then the role of the initiative and activeness of the men in carrying out the set mission becomes all the more understandable. Any operation, no matter how well planned and supported it is, cannot lead to the desired results if the troops do not fight decisively and with initiative.

Hence, *reliance on the creative activeness and initiative of personnel and the greatest possible development of their desire for active and enterprising actions are the basis of scientific leadership.* The activeness and initiative of the men in the units and subunits are determined primarily by the level of political awareness of each soldier, sergeant, and officer,

[8] *Ibid.*, Vol 9, p 155.

by their ideological tempering, and by the readiness to spare no efforts in defending the motherland. The socialist nature of our system and the valid goals of a war form these qualities in the personnel. This is one of the decisive advantages of the armed forces of a socialist society. However, this in no way excludes the necessity of conducting daily indoctrination with the personnel.

The level of combat training and the presence of the corresponding knowledge, abilities, and skills have a substantial effect upon the degree of activeness and initiative shown by the personnel. The absence of sound and profound knowledge and a lack of practical experience inevitably give rise either to routine actions or to the waiting for instructions from the superior commander even in those instances when a rapid and independent decision is essential. Either of these reduces the quality and effectiveness of activity. For this reason, to prepare personnel for active and enterprising actions means to constantly teach each man, acquiring the sound assimilation of knowledge and acquisition of corresponding abilities and skills.

Initiative and activeness among the personnel of units and subunits depend greatly upon the nature of the relationships between superiors and subordinates. Petty interference or a dressing down for any mistake committed in the process of an enterprising action undermine the possibilities for the development of independence, and give rise to irresponsibility and inertia. For this reason, it is essential to instill in personnel a desire to manifest initiative and creativity, and to seek out possible ways for best carrying out the set mission. It is essential to exclude petty interference and encourage enterprising actions even in the instance that a certain but not significant mistake was made in doing so.

Continuous control over the activities of personnel is a most important condition for achieving victory in a modern war and for providing a high level of combat capability and readiness among the troops. Control is a most important aspect of troop leadership. It means constant and effective action by the commander and his staff on all aspects of the activities of subordinate personnel. Hence *a knowledge of the patterns of the control process and use of the most modern technical devices in it are one of the most important bases for scientific troop leadership under modern conditions.*

The complicating of the processes of social development, like the processes of modern war, inevitably leads to a greater role for control over them. Therefore, with good reason, control is becoming the object of research of an independent science, the science of control. V. I. Lenin considered "a knowledge of the principles of the science of control" to be an indispensable demand upon the leadership.[9]

At present, operational control, particularly in military affairs, becomes impossible without using various technical devices for the automatic

[9] *Ibid.*, Vol 45, p 394.

transmission and generalization of information. The commander should have a good knowledge of the operating principles of technical control devices, and be able to use them effectively. This will apply particularly to troop control in the course of military operations.

In analyzing the principles of scientific troop leadership, it is essential to consider one very important circumstance. The problem is that leadership over the combat and training and indoctrination of personnel requires not only scientific knowledge, but also the art of applying it, since war itself and the waging of it is an art. "A revolt," wrote F. Engels, "is an art just as war is . . ." [10]

In bourgeois military theoretical literature, the opinion is sometimes voiced that under modern conditions, due to the saturating of troops with a large amount of equipment and the use of electronic computers, a war and the leadership of it cease to be art. Thus, the West German military writer Krumpelt has written that war involving thermonuclear weapons, in contrast to a classical war, becomes "a process occurring more or less fixedly like the work of a watch mechanism. This process should be defined ahead of time down to the smallest details." The baselessness of such assertions is apparent. Modern war involving thermonuclear weapons cannot be likened to the work of a watch mechanism. In a thermonuclear war, the main role will also be played by people with their individual mental qualities, their varying degree of knowledge, and the varying manifestation of will, courage, and decisiveness. Each battle will be characterized by the presence of unique processes and by a large amount of chance, and it will also be impossible to determine everything ahead of time down to the smallest details.

The complicating of the processes of modern war and the extreme diversity of its specific manifestations determine the increase both in the role of military theory and precise calculations, as well as the military art of the commanders. The commander is required to have great expertise and the ability to employ existing knowledge under the most diverse and unexpected conditions, as well as high political morale and professional qualities.

The Demands of Modern War on the Personal Qualities of a Commander

Any type of social activity requires definite personal qualities from a person. Usually these qualities are divided into political, professional, and moral. And this is quite valid.

V. I. Lenin, in taking an interest in a worker, asked him to define just how much his attitude was "a) from a standpoint of conscientiousness, b) from a political position, c) from a knowledge of his job, and d) from

[10] F. Engels, *Izbrannyye Voyennyye Proizvedeniya* (Selected Military Works), Moscow, Voyenizdat, 1956, p 53.

administrative capabilities. . ." [11] Here it is essential to bear in mind that designated groups of qualities are not something isolated. They represent a single whole. A lack of one of them cannot be compensated for. A leader who possesses the necessary professional qualities (a knowledge of the job and administrative capabilities) but who does not have sufficient political morale qualities cannot and does not have the moral right to lead a collective.

The most important political quality of a Soviet commander is his party loyalty and his total devotion to the cause of the Communist Party, as well as a wholehearted belief in the triumph of its ideals. The convictions of a man are a great driving force and a stimulus for his practical activities. With good reason it is said that a great goal gives rise to great energy.

Party loyalty is manifested in the ability to approach all events both within the nation and abroad from class positions, in an irreconcilable attitude toward all hostile theories and views, as well as in the struggle for the purity of Marxist-Leninist ideology. It finds its concrete embodiment in a party attitude toward one's job and in carrying out one's social duties. "In the behavior of each man and in the activities of each collective and each organization, communist ideas should be organically combined with the communist deeds." [12] To have high party qualities means to be an active fighter for carrying out the ideas of communism and the policy of the CPSU.

The ideological tempering of military personnel and the creative assimilation of the richness of the ideas of Marxism-Leninism are the basis for forming communist party loyalty. A study of Marxist-Leninist theory is the most important condition for formulating a scientific ideology, and for correctly understanding the laws of social development. Under present-day conditions, scientific leadership of a war or combat is inconceivable without this.

The 24th CPSU Congress particularly stressed the role of social sciences in leading the cause of communist construction. This thesis applies also to the leadership of a war and to the matter of training the Armed Forces. Even M. V. Frunze pointed out that "our military leaders should be armed with not only military knowledge but also political and economic, for at present all of this is intermingled in a single whole, and without a knowledge of these aspects, an army cannot be successfully led. The questions of military strategy and political and economic strategy are most closely intertwined in a single whole." [13]

It must also be kept in mind that a commander is not only a military leader but also the indoctrinator of his subordinates. He can successfully

[11] V. I. Lenin, *Poln. Sobr. Soch.*, Vol 53, p 97.

[12] *Programma KPSS*, p 118.

[13] M. V. Frunze, *Sobr. Soch.* (Collected Works), Vol. II, Moscow, Gosizdat, 1926, pp 37–38.

carry out his role only in the instance that he himself is theoretically well equipped and ideologically tempered.

One of the most important professional qualities of a commander is an excellent knowledge of his job and a high level of mental erudition. In speaking about the demands made upon the knowledge of a commander and his erudition, three very important circumstances must be noted.

In the first place, the constant increase in the amount of knowledge which he must master.

Secondly, the constant improvement of knowledge and the ability to promptly abandon obsolete views. The folk saying "learn from the age in which you live" is particularly timely in terms of military personnel.

Thirdly, a military leader must have sound and firm knowledge. In a combat situation it will not always be possible to refresh one's knowledge, turn to reference literature, or gain the required advice.

Knowledge is one of the necessary conditions for the successes of the leadership activity of a commander. But it is equally important to be able to apply this knowledge under specific conditions. Knowledge is the basis of an intellect, but not its quality.

It also must be pointed out that combat activity, as a particular type of human practice, requires a whole number of specific qualities in terms of the commander's thinking. A commander in a combat situation will never possess exhaustive data for a final conclusion. However, the decision must be made promptly, regardless of the incompleteness of the data. The ability to take a risk, daring, and independence of thinking are particularly essential for the commander.

The taking of a sound decision requires the ability on the part of the commander to foresee the course of forthcoming events. It is impossible to fight without foresight. "To control means to foresee," states the old saying. Foresight is not the property of a particular bent of mind, but rather the result of profound penetration into the essence of occurring processes and achieving the main thing determined by the course of events. The ability to foresee is a most important quality of thought, and it is particularly important for a commander.

It is impossible to always anticipate everything in combat. The dynamism of events requires the rapid taking of new decisions. The quickness of orientation and decision taking is a necessary quality for the thought capabilities of a commander. Intuition is close to quickness of thought, and it is nothing more than a unique mental activity reduced to the limit in time. Intuition is possible only as a result of profound knowledge and enormous personal experience.

The role of organizing capabilities of the commander and military leader has increased under modern conditions. The commander's organizing capabilities consist in his ability to unify the activities of a large collective of men, to mobilize their initiative and energy to carry out the set mission, and to constantly control and influence the course of its

execution. In defining the essence of organizing activity, V. I. Lenin stressed that it means, above all, the maximum use of the possibilities of the led collective as a whole and its individual members. And this, in turn, presupposes a knowledge of the capabilities and possibilities of each. Organizing work also means the ability to correctly place personnel, and the ability to select for a certain type of activity those persons who could perform it with maximum efficiency. The problem is that people are not alike in terms of their capabilities. A person unsuited for one type of activity can successfully handle another.

V. I. Lenin in an apt form said that in order to obtain a harmonious orchestra, one person must be given the fierce base, another the sentimental violin, and a third the conductor's baton. Under the conditions of constantly growing specialization, this feature of organizing activity assumes particularly important significance. The ability to correctly organize the activity of a collective of people also means constant concern for improving the professional and political qualities of subordinates.

A check on execution is a most important condition for the success of organizing work. Constant and systematic supervision of execution provides an opportunity not only to establish the suitability of the executor for performing one or another task, but also to determine the degree of correctness of the taken decision or the given instruction. One of the most important manifestations of organizing activity by a commander is his ability to constantly rely on the Party and Komsomol organizations in carrying out the tasks confronting him.

Firm will and courage are an important psychological morale quality of a commander. Will is essential for a person in any type of activity. But it is particularly essential in carrying out missions in the course of military actions, since the activity of a person in war is a continuous chain of surmountable difficulties related to a mortal danger. The will of a commander under combat conditions is manifested above all in his ability to take a responsible position in accord with the nature of the set mission. Of course, the taking of any decision to one degree or another requires definite volitional effort. The specifics of the commander's decision consist in the fact that he assumes all responsibility for the life of many people, and constantly risks his own life. Decision taking under these conditions requires great volitional effort. An equally important indication of the commander's will is his stability and decisiveness in achieving the set goal. Reasonable tenacity is essential in carrying out any decision.

Modern combat requires from a commander the greatest self-control, the ability for clear thinking, and an objective assessment of the situation, and an unswerving will for victory manifested in effective actions. Without these qualities, the commander will not be able to carry out the set mission or achieve victory.

It is also important to consider that the courage and intrepidness of a commander, his self-control and will for victory have a decisive effect

on the behavior and activity of subordinates as well. In such instances the will and intrepidness of a commander are like a battery which supplies these qualities to all the personnel. A brave commander cannot have cowardly soldiers.

In terms of his subordinates, the commander is the responsible leader, and his demands and orders are the law. The role of sole responsibility or personal responsibility increases to an even greater degree under modern conditions. This, in turn, presupposes greater authority for the commander among his subordinates. Of course, even the very legal status of the commander determines his professional authority, since he is empowered to demand the execution of his orders by subordinates. However, professional authority alone is not sufficient for successfully leading a collective. There must also be the personal moral authority of the commander.

The personal authority of a commander is completely determined by his political, professional, and moral qualities. D. M. Karbyshev has said that the authority of a commander rests on three bases: confidence, respect, and affection. Confidence is won by a good knowledge of one's job, respect is achieved by honesty, by high party loyalty and adherence to principles, while affection is won by exactingness and paternal concern for subordinates.

Sole responsibility combined with high and merited personal authority for a commander to the greatest degree provides the unity of actions of the entire collective, as well as the initiative and activeness of each man in carrying out the missions confronting our Armed Forces.

2. Particular Features and Methods of Developing Soviet Military Science Under Modern Conditions

Particular Features of the Development of Military Science

The achievements in the development of theoretical thought greatly determine the success of practical activities, and, conversely, theoretical mistakes tell negatively on practice.

As is known, in the prewar years and particularly during the Great Patriotic War, our military theoretical thought was able as a whole to correctly reflect the changes which had occurred by that time in miiltary affairs, and to create a scientific theory for conducting combat. Victory in the Great Patriotic War was also a victory for Soviet military theoretical thought. At the same time, the incomplete elaboration of individual military theory problems and the incomplete consideration of new aspects which the experience of World War II had already produced, of course, could not help but tell negatively on the actions of our forces at the outset of the war.

It must be kept in mind that the success of practical activities is influenced not only by the scientific elaboration of major strategic problems, but also by the theoretical solution to various tactical questions. The experience of the Great Patriotic War has shown that the incomplete elaboration or mistakes in determining the methods of conducting combat on the tactical level told negatively on the course of military operations. In particular, our prewar regulations pointed to the necessity of dividing a battle formation on the offensive into assault and holding groups. But actual combat soon showed the inadvisability of such a battle formation. It also required the creation of a trench defensive system which was not envisaged by the prewar manuals.

All the generals and officers of our Armed Forces, no matter what position they hold, should be involved to one degree or another in elaborating the questions of military theory. M. V. Frunze at one time pointed to the urgent need for involving a large group of commanders of units and formations in scientific work. It is essential, he said, to encourage those who systematically and constantly have been concerned with scientific research.

Scientifically elaborated military theory and the mastery of it are also a most important condition for developing the tactical thinking of our commanders. The problem is that our thinking is always carried out on the basis of formed concepts, categories, and judgments. But the tactical thinking of a commander is nothing more than the manipulating of concepts and categories worked out by military science. Moreover, military theory instills in military personnel a feeling of confidence in the decision taking process and troop control. This is a manifestation precisely of its mobilizing role.

Under the conditions of the revolution in military affairs which has necessitated a fundamental break with the previously existing views concerning the nature of combat, the role of theory and its effect on practical activities have grown as never before. At present it can be said with complete confidence that *without a scientifically elaborated military theory and its introduction into troop training practices, a victory in modern war is impossible.*

This increase in the role of military science has been caused by a whole series of objective circumstances, of which the following should be mentioned. In the modern era, the nature of war has become extremely complex. It immediately can assume an enormous spatial scope, it can be fast-occurring, encompass the deep rear, and lead to great human losses. While in the past failings and mistakes in military theory made before the start of military actions could be rectified in the course of the war, although at a price of extra losses, at present it is extremely dangerous to count on this possibility.

It is also essential to consider that the abrupt change in military affairs caused by the appearance of nuclear missile weapons immediately encom-

passed the higher level of military art, grand strategy. Previously strategic successes developed out of the total of tactical successes, while mistakes in strategy could to a certain degree be compensated for by successes in conducting operations. At present, strategic failures can tell very substantially on the course and even the outcome of the war.

The increased role of the theoretical elaboration of the problems of modern war is also determined by the fact that military practice has not provided experience in the mass use of nuclear missile weapons and other modern means of combat. Hence, one can fully understand the role of scientific forecasting and the basing of ways to strengthen the defense capability of the nation, and the methods of conducting combat.

It must also be kept in mind that military affairs develop and improve continuously. Military theory, if it does not want to lag behind life, should constantly and daily consider these occurring changes, and in accord with them change or substitute the obsolete views with new ones.

A particular feature in the present stage of military science is that along with raising the role of military theory, the complexity of its development and improvement has also grown. The latter is determined by the specific relationship of military theoretical and practical activities under conditions of the occurring revolution in military affairs.

As is known, practice is the basis of cogition and the criterion for the correctness of our knowledge. This thesis applies fully in analyzing the relationship of military-theory and practical activities. However, here it is always essential to consider two specific features.

The conduct of combat is the basic content of military practice. Military theory develops and improves on the basis of its experience. But in contrast to other types of practice, military actions are not conducted continuously. Peace comes after war. In this instance, the immediate basis for improving and developing military theory disappears. However, in this period as well, its development and improvement do not halt.

Until recently the theoretical generalization of experience from the past war was the main basis on which military theoretical research relied. This was possible because the development of weapons occurred comparatively slowly. A new war began, as a rule, with the same weapons and basically the same methods with which the preceding war ended. Of course, here military theory also considered those changes in the nature of weapons which had occurred in the intervening period.

Under present conditions, the given situation has fundamentally changed. The mass introduction of fundamentally new weapons and military equipment in the troops even in peacetime has required a revision of both the organizational structure of the troops as well as the methods of conducting combat. Clearly, in such an instance, the experience of the last war could not be a decisive factor in the development of modern scientific military theory. Of course, this does not mean ignoring the experience of the last war, since many of its patterns and the principles

of military art elaborated on the basis of combat practice maintain their validity for modern war. Generalizing the experience of previous wars is an important condition for the development of theory. In the given instance borrowing of past experience should not be the mechanical copying of it. In using various theoretical provisions tested and proven by the practice of previous wars, it is essential to constantly consider the particular features of war under contemporary conditions, as well as the characteristics of modern weapons and military equipment.

This means that military scientific thought at present should elaborate a theory for a future nuclear missile world war under conditions where there is as yet no practical experience in conducting it. This is one of the most important features in the relationship of military-theory and practical activities.

Furthermore, the development of modern military theory is based mainly on peacetime military practices which would also include certain types of military experiments. Precisely these types of practice make it possible at present to create a military theory conforming to the existing historical situation, to the development level of weapons and military equipment, and to the state of the military, political, and psychological training of the troops.

However, in this regard it is essential to consider one important circumstance. Peacetime military practices, with all our desire to bring them closer to the conditions of combat reality, do not provide a complete picture of modern war using nuclear missile weapons. Nor can military practice serve as a sufficient criterion for a whole series of theoretical concepts. This is one of the particular features in the relationship of military-theory and practical activities.

Precisely these features in the relationship of practical and cognitive activities, in causing the complexity of creating a modern scientific military theory, where one of the gnosiological reasons for assertions concerning the incognoscibility of war. The well-known English military theoretician Liddell Hart has directly asserted that he does not believe in the possibility of creating a modern military scientific theory. Analogous ideas have also been posed by such bourgeois military theoreticians as B. Brodie in his book *Strategy in the Missile Age*, by F. McShay in the work *Atomic Weapons in the Army*, and others. This also is a manifestation of the fear of the imperialist bourgeoisie for the inexorable downfall of capitalism in the course of the war being prepared by it against the socialist nations.

Of course, this does not mean that the bourgeois military theoreticians have abandoned the creation and development of military theory or are not concerned with the problems of modern war. They do this, in carrying out the instructions of the imperialist bourgeoisie, and have achieved certain successes in the area concerning the military-technical aspects of modern war. As for the social aspect of a war, here they encounter

insurmountable difficulties, since the creation of a truly scientific theory is impossible from the positions of a reactionary class.

The greater role of military theory in modern war and the complicating of the ways to improve it increase the role and significance of military theoretical thought, the logic of cognition, and the methodology of military scientific research. They also require the constant development and improvement of the very methods and procedures of cognition.

The Empirical and Logical Methods of Military Scientific Research

Success in the cognition of one or another area of objective reality depends upon the employed method. The more correctly the method is chosen, the more rapid and accurate the cognition. With good reason it is said that to find a dependable method of cognition means to be halfway there in determining the result of cognitive activity. Specially elaborated methods are also needed for understanding the processes of modern war and for creating a military scientific theory. The development and improvement of the methods of cognition of military affairs and their mastery is one of the most important conditions for the success of military scientific research and the activities of our military personnel.

The method of cognition and research is determined both by the universal laws of thinking reflecting the universal laws of life (the dialectical method), as well as by the specific patterns of the examined processes (the methods of particular sciences). For this reason, for correctly determining and choosing the methods of military scientific research, it is essential: 1) to know the dialectical method, to master the logic of dialectical thinking, and 2) to explain the particular features of the specific processes of military affairs and the laws of their development, in other words, to master the entire total of achieved military theoretical knowledge.

As is known, the process of cognition occurs from live contemplation to abstract thinking and from it to practice. In accord with this, we distinguish empirical and logical methods of cognition and scientific research.

Empirical methods are methods for disclosing facts and for accumulating experimental material to be generalized. Facts, said I. P. Pavlov, are the air of the scientist. Logical methods are methods for generalizing facts and for their mental processing. The methods of military scientific research are nothing more than the application of the above-mentioned methods considering the specific features of military affairs.

It must first be stipulated that dividing the methods of cognition into empirical and logical has a relative character. There is no sharply defined limit between them. In disclosing and accumulating facts, we already to a certain degree are generalizing them, and mentally separating them

from surrounding reality. At the same time, in logically pondering the observed phenomena, we constantly compare the course of our thought with reality. But, nevertheless, such a classification of methods is essential, since each of them has its own specific features.

Observation and experimentation are among the empirical methods of military scientific research. Observation is the intentional separating of new facts in a naturally occurring process. In order that observation provides the desired results, it is essential to have the following: a) a knowledge of the observed object and a concept of it, and b) a definition of the goal and compiling of a plan of observation. If we first do not know the process which we are to observe, then we cannot derive any new fact from it. To observe a process without having any concept of it is the same as an illiterate reading a book. The purposeless observation of a familiar process also does not provide any new data.

Observation should produce new, previously unknown facts. In observing and selecting these facts, it is essential to bear in mind that not all of them will be of equal significance. Some of them will be typical and others random. And even the typical facts require clarification.

In military scientific research, the objects of observation are:

a) *The actual military operations.* From their experience, the corresponding corrections are made into military theory created before the war. In the course of the Great Patriotic War, our military theory which corresponded to conditions of those times was improved. Modern wars also provide material for improving military theory. It is essential to a maximum degree to consider and generalize the experience of the local wars being waged presently and started by the imperialists.

b) *A previous war.* A study of the experience and documents of a past war makes it possible to detect new, previously unknown facts, and to use the experience of waging it considering the changes which have occurred in military affairs. Here it is very important to observe objectivity in military historical research, in isolating the positive aspects and also considering the negative ones in the conduct of combat.

c) *All types of practical activity of the troops in peacetime.* The processes of military and political training as well as the conducted troop exercises and maneuvers are an important object of observation which provides much new material for theoretical generalization and conclusions. The entire officer personnel and commanders of all levels and ranks should be involved in solving this problem (generalization and theoretical conclusions). Scientific theoretical conferences in the units and formations are an important form for generalizing the experience of the exercises and all other types of troop activity in peacetime.

However, the observing of only these processes cannot provide the necessary quantity of facts, particularly under modern conditions where it is very difficult to bring, for example, exercises close to a real combat situation. This shortcoming is made up by experimentation, the essence

of which is to artificially reproduce one or another process with a previously set research goal. In military scientific research, such types of experimentation are: a) the range testing of various types of military equipment and weapons, b) experimental exercises, and c) command post exercises and military research games.

Experimentation will provide the necessary result when it has been carefully prepared for ahead of time. First of all, it is essential to accurately determine the goal of the experiment. In complex types of experimentation (experimental exercises and scientific research games) usually several goals are set. The creation of the necessary facilities, for example, the forces and means for conducting the experimental exercise, is also an important aspect in preparing the experiment. These types of military scientific experimentation should be conducted under a situation as close as possible to the conditions of combat.

Range testing is carried out to determine in practice the technical specifications and combat capabilities of one or another type of weapon or military equipment. This is preceded by the mathematical preparation of the calculation data. The testing is carried out under different weather conditions, as well as on different terrain. The result of this should be not only the determining of combat capabilities of tested equipment, but also the elaboration of recommendations on its further improvement and most effective use.

Experimental exercises are organized using various types of modern equipment on different scales. As a rule, they pursue not only a research goal, but also solve the problem of training the personnel and unifying the units and subunits. In conducting them, it is not advisable to set very many tasks, since this does not make it possible to study them thoroughly. The experimental data obtained in the course of such exercises should be carefully studied before drawing any theoretical conclusions on the basis of them.

Command post exercises and scientific research games at present are assuming greater and greater significance, and in a number of instances are the chief method of research on strategic missions. In terms of their character, such games can be one-sided as well as two-sided. A two-sided game produces the greatest effect in creating a real balance of forces and means with maximum consideration of the enemy's capabilities and against a background of a real situation without any oversimplification. The use of mathematical methods and computers is a decisive condition for the effectiveness of scientific research games. The significance of the research games consists in the fact that here they use the knowledge and experience of a large collective of people and different opinions are compared. In many regards they are an irreplaceable method for forming modern military thought.

The data obtained in the course of observation and experimentation are mentally processed on the basis of logical methods. The logical

methods of cognition and scientific research are: comparison and analogy, analysis and synthesis, abstraction, mathematical modeling, and others. Each of these methods has a universal character, although its specific content in each individual instance will depend upon the nature of the process being examined and those concrete conditions under which it is employed.

Comparison and analogy are a necessary method for correctly understanding a new process or new phenomenon. The essence of this method is to establish the similarity and differences of the examined process with other already known ones. In analyzing and examining any process, we always search for something already known with which a comparison can be made.

A comparison provides an opportunity to provide, of course, tentatively, certain lacking data in the examined process, and to foresee possible ways for its further development and change. For example, on the basis of comparing indicators for combat training of a unit for different periods with analogous indicators of another unit, we can judge the effectiveness of the employed training forms and methods. We widely use comparison and analogy when we compare the experience of today with the experience of the last war.

Comparison and analogy produce the required result when they meet, at least, two conditions. The first is that it is possible to compare only really homogeneous processes which are close in terms of their essence (an encirclement operation with an analogous encirclement operation, and so forth). Secondly, in comparing we should always consider the differences in conditions under which the compared processes are occurring. For example, in comparing the process of putting the second echelons into combat under the conditions of using nuclear weapons with the experience of solving this problem in the course of the past war, we should always consider the effect of nuclear missile weapons in solving an analogous problem in modern war.

Analysis is the mental breaking down of a process into its component parts the examination of each of them, the determining of the most essential ones, and detecting contradictions in the very essence of the process. *Synthesis* is the mental reconstruction of the process as a whole, its reproduction on the basis of the essence detected in the course of analysis, and the elucidation of ties between the various aspects and elements of the examined process. Analysis and synthesis are two interrelated aspects of the thought process, and each of them supplements the other. Without analysis it is impossible to have a correct understanding of the situation as a whole, that is, synthesis is impossible. At the same time, analysis without synthetic reconstruction of the process does not achieve its goal. In assessing a combat situation under the conditions of modern war, quantitative analysis, and in particular, analysis of the quantitative aspect of the balance of forces, acquires very great significance.

Abstraction is a method of thinking consisting in extracting the main, essential, and decisive thing from the particulars, from the nonessential features of the studied processes. Abstraction is a most important method in the scientific cognition of war and military affairs. Per se, military science began when military thought moved from describing individual specific facts from the history of wars to deriving the basic, necessary, and repeating ties and relationships.

In the process of the development of military theory and the cognition of combat of modern war, the use of *mathematical methods* has assumed great significance. The development and all-round use of these methods in examining the problems of military theory are one of the urgent tasks of our military scientific and command personnel. The increase in their role in examining the problems of military affairs is determined by three circumstances. In the first place, by the complicating of combat itself which consists of an enormous quantity of phenomena, where their complete consideration would be impossible without quantitative analysis. Secondly, by the major successes of mathematical sciences the significance of which is ever growing. Thirdly, by the creation and use of electronic computers, without which it would be impossible to have the mathematical processing of the entire diversity of processes involved in modern war.

The corresponding mathematical calculations have always been carried out by the commander for analyzing combat and taking decisions. Under modern conditions, such mathematical disciplines as probability theory, mathematical statistics, queueing theory, information theory, retrieval theory, game theory, and mathematical modeling have found wide use in military scientific research.

The limits for using mathematical methods in military affairs are broadening in keeping with the advances of mathematical sciences and the ever greater use of computers. Their main goal is to provide the mathematical basis for the most effective methods for conducting combat. Here it is always essential to remember that the quality of many processes of modern war cannot be expressed solely in quantitative indicators or reduced to strict mathematical formulas (the organizational capabilities of the command, troop morale, the degree of training and the psychological state of personnel, and so forth). For this reason, mathematical methods cannot be the only means of military scientific research. Troop control remains a subject of the commander's creativity and of the analyzing and generalizing thought of the staff.

The introduction of mathematical methods into military scientific research and into the process of evaluating a situation and decision taking, aside from their immediate significance (precise calculation is a condition for a correct decision), forms a logical strictness of thought, it disciplines the mind, it helps to form, if it can be so said, mathematical intuition as an ability to produce a quantitative evaluation and to draw a conclusion, without carrying out mathematical calculations in each individual instance.

The creative development of military theory on the basis of using the scientific methods of cognition and research, as well as the sound mastery of military theoretical knowledge by all commanders are at present one of the most important tasks in raising the combat capability and readiness of the Soviet Armed Forces.

Chapter IX. The Effect of Scientific-Technical Progress on the Military Doctrines and Armed Forces of Imperialism

1. Scientific-Technical Progress and the Arms Race Under the Conditions of Modern Imperialism

In his speech at the International Conference of Communist and Workers' Parties in Moscow on 7 June 1969, Comrade L. I. Brezhnev pointed out that "militarism has always been an inseparable feature of imperialism. But at present it has reached truly unprecedented scale. Imperialism is to blame for the fact that the labor of many millions of people, the brilliant achievements of human reason, and the talents of scientists, researchers and engineers are directed not to the benefit of mankind, and do not serve the cause of progress and the transformation of life on earth, but are used for barbarian, reactionary goals, for the needs of war, this greatest calamity for peoples." [1]

Three main factors act as the driving force of technical progress in a capitalist society. In the first place, the achievements of scientific-technical progress are widely used by the monopolies for strengthening their positions, for raising the effectiveness and the development rate of production, and for intensifying the exploitation of the workers and their suppression.

Secondly, scientific-technical progress is the most important condition and the basis for raising the military might of the capitalist states. Thirdly, on the basis of scientific-technical progress, imperialism endeavors to change the relationship of the role of man and technology in a war in such a manner as to be victorious over the socialist nations and the revolutionary movement in the capitalist nations by using armies which surpass the enemy in technical terms and are made up of crack professional mercenaries divorced from the people. The imperialist bourgeoisie is afraid of an army made up of workers, peasants, and the working intelligentsia.

The balance of real strength more and more is changing in favor of the socialist system. Nevertheless, the international imperialist reaction headed by U.S. imperialism has not abandoned its desire to achieve decisive military superiority over the world socialist system. The military theoreticians of imperialism have asserted that, purportedly, modern military technology and nuclear weapons have assumed the only decisive significance in the course and outcome of a war.

Thus, K. Knorr, a professor at Princeton University and a consultant with the State Department and the Pentagon, in his book *The Military Potential of States*, has asserted that "in line with the rapid development of technology and the progressing mechanization of the armed forces, the quantity of weapons in determining military might has begun to play a more important role than such qualitative elements as military leadership, physical endurance, and valor, or even the simple size of the armed forces. As never before, war has become a concern more of machines than of men." [2] Further, Knorr writes: "At present, when weapons production is developing at an unprecedented rate, a predominant superiority in weapons and their tactical application can completely compensate (and perhaps even more than compensate) for any lack in the size of the armed forces or in such qualitative elements of combat might as the morale of the troops or military leadership." [3]

The arms race as the "panacea" against all the socio-political failings of imperialism and as a condition for "eliminating" the world socialist system and restoring the lost dominance of capitalism throughout the world—this is the leitmotif of imperialist military theory since World War II. In full accord with this theory and to an even greater degree with the desire to obtain maximum profits, the monopolistic bourgeoisie in the basic capitalist states have developed a rapid arms race.

With all the changes in the military doctrines in the United States, NATO, and the other aggressive states and blocs, the preparations for a world nuclear war against the socialist system is their main and unswerving goal. This is evidenced both by the military doctrines themselves as well as by the rapidly growing military budgets of the United States, West Germany, England, and Japan. This can also be seen from the directions in which military research, weapons, and military equipment are developing, and the feverish efforts of imperialism to achieve decisive military and technical superiority over the Soviet Union and the military organization of the Warsaw Pact.

Thus, on 1 May 1969, the U.S. National Security Council received a report on the development of U.S. policy for the next 10 years. This

[1] L. I. Brezhnev, *Za Ukrepleniye Splochennosti Kommunistov, za Novyy Pod'yem Antiimperialisticheskoy Bor'by* (For Strengthening the Solidarity of the Communists and for a New Rise in the Anti-Imperialist Struggle), Moscow, Politizdat, 1969, p 9.

[2] Klaus Knorr, *Voyennyy Potentsial Gosudarstv* (The Military Potential of States), Moscow, Voyenizdat, 1960, p 61.

[3] *Ibid.*, p 63.

report was worked out by the Defense Department together with the State Department, the CIA, and the Treasury Department, that is, on the highest state level. *The New York Times* wrote that this report expresses a policy which "emphasizes a broad increase in offensive forces in order to surpass the Soviet Union and maintain the possibility of surprise attack at any time." [4] In 1971, the U.S. military-industrial circles, in relying on the Pentagon, developed a campaign to increase U.S. military expenditures over the next few years by 15 billion dollars annually. The NATO nations alone (minus the United States) in 1970 invested more than 20 billion dollars in preparing for war. In 1971, under U.S. pressure, the expenditures for these purposes rose even more.

Military production under capitalism has its particular features. In developing the production of nonmilitary products, the development and introduction of new technology, production methods, and so forth are first used, as a rule, in the interests of one or another individual monopoly, and are carried out by its comparatively limited possibilities. Only somewhat later do these discoveries and advances become available to other monopolies and are widely introduced into production.

The situation is somewhat different in producing the means for conducting modern war. The development of science and technology for the purposes of producing and improving weapons, military equipment, the means of transport, communications, and control is carried out by an immeasurably more powerful organization than an individual monopoly, that is, by the imperialist state. From the enormous funds allocated for military purposes, the imperialist states support numerous state scientific research institutes, corporations, and design bureaus, and generously subsidize research and design activities in state and private institutions of higher learning, in design bureaus of large monopolies, and so forth. For this reason, the development of those sectors of science and technology which serve the military machine of imperialism occurs significantly more rapidly and with a greater scope than the development of technology in nonmilitary production.

The economically and technically less developed capitalist states ordinarily purchase modern weapons, equipment, and ammunition from the United States, West Germany, England, and France, while the states comprising the imperialist military and political blocs in a number of instances receive "assistance" in the form of military shipments from American imperialism. And although the imperialist states supply relatively obsolete weapons through their "assistance," the technical level of the weapons in these nations is significantly higher than the technical level of production for nonmilitary products.

At the same time, it must be stressed that the capitalist method of production also has an effect on the rate and direction of technical progress

[4] Yu. Zhukov, *SShA na Poroge 70-kh Godov* (The United States on the Threshold of the 1970's), Moscow, Politizdat, 1970, p 244.

not only in producing "peaceful" products, but also in producing weapons. Under the conditions of acute competitive struggle between the monopolies, there is a desire on the part of individual monopolies to take complete control of technical innovations and the production of any type of weapons, military equipment, the means of control and communications, and so forth. Hence a desire to maintain secrecy from the other monopolies and to sell their products more dearly to the military department.

The monopolies which have seized control of the production of various types of military products are directly interested in obtaining a maximum profit, but not in raising the technical specifications and combat capabilities of their products. Of course, in developing a more advanced military product, the monopoly in a number of instances finds it easier to obtain a favorable contract for manufacturing it from the government or military department. But in the capitalist nations the obtaining of a contract to produce military products by one or another monopoly is often determined by the amount of pull or by the close ties of the monopoly with those who allocate military contracts in the government or military department. Thus, a member of the U.S. House of Representatives, Carrol Reese, has pointed out in one of his speeches that "the efforts of the armed forces are directed not only at strengthening the nation's defenses. These efforts are almost completely focused on providing financial gain for certain large corporations . . . . Quite obviously, such a policy has brought or is bringing benefits to certain highly placed military men as well . . ." [5]

The well-known American journalist Fred Cook has also pointed out another circumstance. The monopolies producing military products sell them to the military department at prices which far exceed monopoly prices for articles of non-military consumption. "Of course," he writes, "such enormous amounts are made available only to a few chosen monopolies upon the recommendations of the corresponding officials at the Defense Department. Almost 87 percent of all the contracts have been let without considering market prices. This fact alone inevitably causes doubt as to the unselfishness of those persons who in the Defense Department are responsible for letting the contracts." [6]

American progressive economists have estimated that out of the expenditures under the defense budget for acquiring new equipment, weapons, and so forth, from the monopolies, more than one-half remains as profit in the safes of the monopolies. Under these conditions, one can understand the complaints of certain bourgeois politicians and economists that the production of new types of weapons, military equipment, ammunition, and control devices costs the taxpayers of the capitalist nations often as much as if these aircraft, missiles, and nuclear warheads had been made from pure gold or platinum. Thus, an aircraft carrier with an atomic

[5] Quoted in the journal *Novoye Vremya*, 8 October 1965, No. 41, p 29.

[6] F. Cook, *Gosudarstvo Voyny* (Warfare State), Moscow, Voyenizdat, 1961, p 33.

propulsion unit costs as much as 2.8 million tons of wheat, one jet bomber equals the value of 100,000 tons of sugar, while a missile-carrying submarine is worth 55,000 tons of the best grade of meat. The experimental model of the B-58 bomber cost the American Treasury 26.7 million dollars. For the same money it would have been possible to buy gold ingots which would surpass the weight of this enormous bomber. The U.S. militarists spent more than 1 billion dollars on developing the plans for the B-70 superbomber which as yet has not been realized.

The high cost of modern weapons and military equipment under capitalist conditions sometimes is inversely proportional to their quality. In particular, this can be seen from the scandalous story of the American Starfighter aircraft which were delivered at a very high price to the West German Bundeswehr. By the beginning of 1972, during training and patrol flights, 146 of these aircraft had crashed, and several score West German pilots had lost their lives. An investigation into the reasons for the loss of the American submarine Thresher was not completely carried out since in the course of the investigation the innermost secrets were revealed in the system of machinations in supplying the armed forces with products of the military monopolies.

Typical for imperialism is a situation where the military theoreticians and the leaders in the defense ministries, staffs, and scientific research corporations give a "theoretical basis" for the demand to increase one or another service of the armed forces or branches of arms, or the demand to adopt one or another type of weapon or military equipment, being guided here not by military efficiency but rather by the interests of that monopoly which, as a rule, is secretly represented by the given general or officer in the military department.

The former Chief of Staff of the U.S. Army, Gen. M. Taylor, a person very informed on these questions, was forced to admit that "all military programs, no matter how they differed in terms of their character, in fact competed among themselves for the sake of obtaining a certain number of dollars. . . . Setting ahead of time the amount of the defense budget exacerbated the struggle . . . between the types of armed forces for allocations, and was the main cause of their rivalry which undermined the confidence of the nation in our military programs." [7]

The arms race, the creation of enormous stockpiles of military equipment and weapons, and their continuous replacement with more advanced models are justified by many military leaders and theoreticians in asserting that the course and outcome of a "total" nuclear war will be determined mainly by those armed forces and the stockpiles of weapons, ammunition, and military equipment which will be accumulated by the start of the war. The catastrophic destruction of the productive forces and

[7] Maxwell Taylor, *Nenadezhnaya Strategiya* (Hopeless Strategy), Moscow, Voyenizdat, 1961, p 121.

the disruption of economic ties and communications, even at the start of a nuclear war, will not make it possible, as a rule, to even maintain the prewar level of production for military products.

Thus, the enormous increase in the capitalist nations in the role of military production in the national economy during peacetime and the continuous arms race are one of the vivid manifestations of the deepening of the general crisis in the capitalist system, of the greater aggressiveness of the imperialist states and their desire by armed means to resolve the basic contradiction of the modern area. Imperialism uses the outstanding achievements in the development of science and technology primarily and to the greatest degree for conducting aggressive wars and preparing for a thermonuclear world war.

"In the most developed capitalist nations," stressed Comrade L. I. Brezhnev in a speech at the Conference of Communist and Workers' Parties in June 1969, "there has been the rapid growth of the influence of the so-called military-industrial complex, that is, an alliance of the largest monopolies with the military in the state apparatus. This evil union is having a growing effect on the policy of many imperialist states, and is making policy even more reactionary and aggressive." [8] The creation of the military-industrial complex after World War II has meant that a portion of the monopolies has switched completely or to a significant degree to producing exclusively military products. These monopolies also comprise the economic basis of the unabated arms race, for preparing for and starting a war and military conflicts for "selling" the produced military products, for increasing tension throughout the world, and for supporting adventuristic military dictatorships and fascist regimes.

2. Scientific-Technical Progress and the Military Doctrines of Imperialism

The victory of the Soviet Union in the Great Patriotic War convincingly showed the enormous objective advantages of the socialist social system over capitalism. Under the leadership of the Communist Party, the Soviet people have realized these advantages in all regards, including in providing under wartime conditions, the significantly more effective use of all the available natural, human, and scientific-technical resources than under capitalism. A socialist society per unit of the productive forces produced significantly more weapons which were also more advanced in terms of technical and fighting qualities. The superiority of the people in a socialist society in the political, morale, and technical cultural areas comprised the basis for the rapid mastery and more effective use of complex technical means for waging war by the masses of soldiers in the course of combat.

The historic victory of the Soviet people and their Armed Forces in

[8] L. I. Brezhnev, *Za Ukrepleniye Splochennosti Kommunistov, za Novyy Pod'yem Antiimperialisticheskoy Bor'by*, pp 8–9.

the Great Patriotic War created favorable conditions for accelerating the natural process of broadening and strengthening the socialist system. The victory of socialist revolutions in a number of European and Asian nations, the rapid development of the economy, culture, and military might of the Soviet Union and the People's Democracies in the postwar period, and the formation of the military community of socialist states and armies led to a fundamental qualitative change in the balance of forces in favor of the world socialist system. After World War II, imperialism could no longer count on a victory in a war against the Soviet Union and the other socialist nations, in using conventional weapons.

With the development of nuclear weapons, in the United States there began a stage where American imperialism elaborated a new doctrine of war against the Soviet Union and the other socialist nations using weapons of mass destruction. A monopoly on nuclear weapons, in the opinion of American imperialists, created an opportunity to eradicate the socialist social system, having destroyed in several days scores of millions of people using nuclear strikes, and having destroyed the political, administrative, and economic centers as well as a significant portion of the defense industry. The remaining population, according to these views, was doomed to extinction under a situation of radioactive contamination, starvation, and epidemics.

Facts indicate that American imperialism endeavored to carry out this monstrous plan, if the nuclear monopoly would have remained in its hands. Merely to intimidate the Soviet people and their government, the American imperialists dropped atomic bombs on two cities in Japan, and destroyed and doomed hundreds of thousands of peaceful inhabitants to severe suffering from radioactive contamination.

When, in the opinion of the U.S. political and military leadership, a sufficient quantity of nuclear weapons had been stockpiled in order to have a decisive effect on the course and outcome of a war, the American government in January 1954 announced that its military doctrine was a strategy of "massive nuclear retaliation," that is, the use of massed nuclear strikes against the USSR in a war. By an overt threat to use nuclear weapons, American imperialism hoped to subject the Soviet people to its dictatorship, to abandon the defense of the People's Democracies and the support of the socialist and national liberation revolutions, and ultimately to impose on the Soviet people a restoration of capitalism under the threat of physical extermination.

The "new course" in the military doctrine of American imperialism envisaged the use of weapons of mass destruction against the peoples in the People's Democracies as well as against other peoples who had begun a socialist and national liberation revolution. As is known, during the Korean War in 1950–1953, the American imperialists used bacteriological weapons, and had worked out plans to use nuclear weapons, but, according to the information of Kingston-McClorey, did not do this because

"the United States, although possessing tactical nuclear weapons, had a very limited quantity of them, and kept them in reserve in the event that war might break out in Europe," [9] that is, saved these weapons for a war against the Soviet Union.

In practical terms the strategy of "massive nuclear retaliation" was unsound both before and after its official proclamation. The political, economic, and military leaders and theoreticians of imperialism again made flagrant mistakes in determining the scientific-technical production, and military-economic capabilities of the socialist social system. As is known, the Soviet Union tested an atomic weapon several years after the Great Patriotic War. Then the USSR created and tested very powerful nuclear ammunition. The Soviet Union further strengthened its victory in the competition forced on us to produce nuclear weapons and delivery systems when intercontinental ballistic missiles were developed and an artificial satellite was launched.

The achievement of superiority by the Soviet Union over the imperialist aggressors in the might of nuclear ammunition and the possibility of the inexorable and accurate delivery of them to the designated target forced the military and political leadership of the imperialist states to openly recognize the need to "reassess values." During the first half of the 1960's, the leading military theoreticians of imperialism one after another began to seek a way out of the situation which had developed. These included M. Taylor, B. Brodie, and others in the United States, E. Kingston-McClorey and B. Liddell-Hart in England, P. Gallois in France, and others. In essence, they all arrived at the conclusion of the need to replace the strategy of "massive nuclear retaliation" with a strategy of a "flexible response." The author of the "new doctrine," M. Taylor, in his book *Hopeless Strategy* published in New York in 1960, stated with bitterness: "We have lost our former atomic monopoly. We, evidently, are behind the USSR in terms of the number of ballistic missiles. We do not have a defensive weapon such as guided antimissile missiles which would make it possible to compensate for the superior offensive might of the Soviet Union." [10] In this regard, M. Taylor reached the conclusion that "massive retaliation (the concept of "retaliation" was used as justification for the aggressors and to represent their policy as an "enforced necessity," and this, of course, did not correspond to reality. Editor's note), as the leading strategic concept, has led into a blind alley and . . . the necessity has arisen of reassessing our strategic needs." [11]

The attempt of American and then all of international imperialism to adapt to the new conditions was reflected in the strategy of "flexible

[9] E. J. Kingston-McClorey, *Aspekty Strategii* (Aspects of Strategy), Moscow, Voyenizdat, 1966, p 145.

[10] Maxwell Taylor, *Nenadezhnaya Strategiya*, pp 35–36.

[11] *Ibid.*, p 35.

response" approved in 1961 by the Kennedy Administration. In December 1967, this strategy was recognized as NATO doctrine.

In contrast to the previous strategy of using all the U.S. nuclear might for attacking the Soviet Union in any military conflict, the strategy of a "flexible response" envisaged a broad range of wars and military conflicts. In this regard, the United States began to intensely prepare its military machine both for starting and waging a nuclear world war as well as for "limited" wars in different regions of the world. But in the 1960's the basic attention in U.S. military development was given to an attempt to achieve decisive superiority over the Soviet Union in strategic nuclear forces, and to cause the Soviet Union "unacceptable losses" under any conditions of nuclear war. According to the statement of the former U.S. Secretary of Defense McNamara, the minimum limit of "unacceptable loss" should be the destruction of one-third of the Soviet population and from one-half to two-thirds of the industrial potential.

At the same time, the strategy of a "flexible response" envisaged a significant increase in the general forces planned mainly for conducting aggressive "limited" and local wars using either only conventional weapons or combining tactical nuclear weapons with them. In Western Europe the stockpiling of tactical nuclear weapons was carried out on a growing scale. In the period from 1961 through 1968, the total number of U.S. Armed Forces increased from 2.5 million to 3.5 million men, while the number of divisions in the land forces and marines rose from 14 to 24. The "Special Forces" (the Green Berets) were created, designed for diversionary actions and antipartisan warfare.

Such a strategy, in the views of the U.S. ruling circles, entailed a maintaining and increase in the profits of the monopolies from the arms race, and a rise in the U.S. strategic nuclear potential as the chief means of putting pressure on the Soviet Union and the decisive means for achieving victory in any "all-out nuclear war." This strategy was also aimed at preventing the transition of the peoples in the young developing nations to a path of non-capitalist development, and at restoring the capitalist system in the socialist nations without involving the United States in a catastrophic thermonuclear war.

The strategy of a "flexible response" was also unsound, since it did not take into account the insurmountable might and rapid growth of the political, economic, scientific-technical, and defense potential of the Soviet Union and the other socialist nations, or the qualitatively new possibilities of the revolutionary forces which relied on support from the world socialist system. The downfall of the colonial system, the failure of attempts by American imperialism to defeat the socialist revolution in Cuba, the failure of the much-advertised plans for victory over the liberation forces of the Vietnamese people, the failure of the sabotage plans against East Germany in 1961, and other events in the 1960's forced the U.S. government

to recognize the need for a new "fundamental revision" of military doctrine.

On the basis of the so-called "Nixon Doctrine" with its three main principles—partnership, the strength of America, and talks—a military doctrine was elaborated and officially approved in 1971, known under the name of a strategy of "realistic restraint." In maintaining basically the former political focus against socialism and the national liberation movement, this strategy envisaged "active initiatives," as well as the holding of talks from a "position of strength." A particular feature of the new doctrine was the desire of the United States to shift a significant portion of the military burden, primarily by increasing military budgets and a further rise in the armed forces, to its European and Asian allies.

At the same time, the U.S. government could not help but consider reality. The present balance of forces between the USSR and the United States was reflected in the agreement concluded in May 1972 on the questions of limiting strategic offensive weapons and antimissile defense systems. The agreements on these questions show the collapse of the Cold War policy conducted by American imperialism for more than a quarter of a century.

The reactionary forces in the United States, in acting against the realistic tendencies in the foreign policy of their government, however, do not intend to change the positions occupied by them. They continue the criminal war against the Vietnamese people and the other peoples of Indochina, and resort to methods of "geophysical" war when the achievements of modern science and technology are employed for the total extermination of the population in this region of the world.

A component of the strategy of "realistic restraint" is the "Vietnamization" of the war. The essence of this is a plan to exterminate the Vietnamese by the hands of the Vietnamese in the interests of Washington. In this regard, there are plans to cut back the size of the U.S. Armed Forces by 1973 to 2.5 million men with a simultaneous significant increase in technical terms. The basic directions for the qualitative development of the land forces are the aerization (the use of organic helicopters and aircraft as transport and combat means instead of wheeled and tracked machines), automation and the introduction of new ECM equipment. The combining of these elements should provide, in the views of the Pentagon, the "greatest mobility" and the ability of the U.S. land forces to make some powerful strikes from U.S. territory and from American bases against the enemy in any nation and on any continent, and against the armed forces of any type.

The defeat of the American aggressors in Indochina convincingly demonstrates the baselessness of attempts by U.S. imperialism to achieve victory over the anti-imperialist forces, in using predominant military and technical superiority. The peoples struggling for their liberation, national independence, and progressive development rely on help from the Soviet

Union and the other socialist nations, and they possess weapons and military equipment which are not inferior in terms of their quality to weapons of the imperialist aggressors. The indisputable superiority of the revolutionary, liberation armies in political morale terms, the mass heroism, the initiative and creativity of personnel in many instances compensate for the difference in the level of the technical training of the personnel in the revolutionary and imperialist armies.

The changes conforming to the strategy of a "flexible response" have occurred and are occurring in the military doctrines and in the armed forces of the imperialist partners of the United States in the military and political blocs. The strategy of "forward lines" and "concealed warfare" which is supported by the representatives of revanchist circles in West Germany is a unique reflection of this strategy. The strategy of "forward lines" is designed to involve the United States in a nuclear war at a moment suitable for West German militarism. The concept of "concealed warfare" proceeds from a desire to organize counterrevolutionary revolts and coups primarily in East Germany and the other socialist nations without formal participation of the NATO armies in these acts during the first stage.

In conducting "concealed warfare" and local wars, without mentioning a nuclear world war, the imperialists of the United States, England, and other nations are planning to use chemical and biological weapons on different scales. The United States has already created a military-industrial basis for the mass production of poisons. During the aggression in Korea and particularly in Vietnam, American troops used agents for the mass destruction of farm crops and forests.

The transition from the strategy of "massive nuclear retaliation" to "flexible response" was caused by the fact that imperialism could not achieve decisive superiority over the Soviet Union. Due to the great advantages of the socialist social system, the Soviet Union achieved a higher rate of scientific-technical progress than the capitalist nations, and surpassed them in military technical terms for a number of most important indicators.

The recognition by the imperialist leaders of the impossibility at present to achieve victory over the Soviet Union and the socialist forces in a nuclear world war in no way means that imperialism has abandoned the attempts to surpass the socialist system in military and technical terms. The imperialist states are allocating enormous amounts of money for scientific-technical and military-technical research, in endeavoring to develop an "absolute weapon" which would make it possible to carry out aggression against the USSR and the other socialist nations with impunity. The policy of starting local wars and escalating them is fraught with the real danger of the local war growing into a world one. For this reason, the constant high combat readiness of the Soviet Armed Forces to completely defeat any aggression and a further rise in the defense capability

of the world socialist system are an important condition for thwarting the imperialist aggressors and preventing a nuclear world war. By the collective efforts of the peoples in the socialist nations led by the Marxist-Leninist parties, "a mighty weapon is being forged to defend the socialist states. At the same time this is a weapon of freedom for those fighting against imperialism." [12]

3. The Training of Personnel in Imperialist Armies Under Conditions of the Fundamental Transformations in Military Affairs

For preparing the armed forces under the new historical conditions to carry out the mission of waging wars against the world socialist system and against socialist revolutions in the capitalist nations, imperialism has made substantial changes in the principles of staffing, ideological indoctrination, and combat training of personnel. At the same time, the problem has been solved of raising the interests of soldiers and junior officers to master the very complex modern military equipment and to keep this personnel in the army for an extended period with the aim of increasing their readiness for a surprise attack at any time.

After the end of World War II, England and the United States actually abandoned the staffing of the armed forces on the basis of universal military obligation. By a system of mercenary staffing, by privileges for personnel to serve a long time in the army, as well as by different incentives for good mastery of military equipment, the U.S. and the English governments were able to create armies consisting of professional mercenaries trained under conditions of rigid discipline and blind obedience and capable of being an instrument of monstrous crimes by imperialism against other peoples and the working masses of their own nations. In the English army recruitment is only by contract for a period from 3 to 22 years. In the U.S. army, a predominant majority of the soldiers and all the junior officers also serve long periods of enlistment. The Japanese "Self-Defense Forces" are completely made up of volunteer mercenaries.

In those nations where the rank and file is recruited on the basis of universal military obligations, the complex and militarily most effective weapons and equipment are entrusted, as a rule, to politically "trustworthy" professional mercenaries.

Inductees called up in these nations for serving their military obligation comprise either the bulk of riflemen or are service personnel in the crews of group weapons and military equipment. For example, in West Germany there is a law for universal military obligations, but in the Navy a predominant majority of the rank and file and junior officers are made up of mercenaries who enlist for from 3 to 12 years.

[12] L. I. Brezhnev, *Za Ukrepleniye Splochennosti, Kommunistov za Novyy Pod'yem Antiimperialisticheskoy Bor'by*, p 14.

As a rule, only professional mercenaries comprise the units stationed at military bases overseas. These units have the job of playing the role of a "Foreign Legion" for suppressing revolutionary movements in those nations where the military bases of the United States, England, and other nations are located.

By staffing the army with professional mercenaries, imperialism also endeavors to limit the number of representatives from the working masses who undergo military training and learn to use modern military equipment. Such a situation limits the opportunities to develop the armed forces in a number of the capitalist nations in the event of an extended war. For this reason imperialism wagers on the decisive role of technical superiority in a war as it, as never before, is afraid to turn over weapons and military equipment to the representatives of the working masses who have undergone the school of class struggle against imperialism. At present in all the imperialist nations there are laws which limit or exclude from induction into the army those persons who do not meet the requirements of "political trustworthiness."

In the ideological indoctrination of personnel of the imperialist armies, the basic content is the indoctrination of the men in a spirit of rabid anticommunism and bestial hate for the world socialist system and for the forces struggling against imperialism for the sake of a socialist transformation of society. In all the bourgeois states, a special extensive staff for the ideological indoctrination of military personnel has been set up. "Indoctrination" in a spirit of anticommunism is the duty of all the commanders and chiefs as well as the clergy. Slandering the socialist system and depicting the Soviet Union as an "aggressor" and the communist parties and communists as "Soviet agents"—this is the main direction in the brainwashing of personnel in the imperialist armies.

In the ideological indoctrination of soldiers, an important place is assigned to justifying and extolling a capitalist society as supposedly a truly democratic one which provides "universal prosperity" and "freedom of the individual." Indicative in this regard is the speech of the former West German Minister of Defense von Hassel in September, 1965, on the event of the first West German Leopard tank to come off the conveyer. Having noted that production of the Leopard marked a beginning to the rearming of the tank formations and the Bundeswehr as a whole according to progress in the military technical area, von Hassel devoted the basic portion of his speech to demagoguery about how the Bundeswehr supposedly represents "the first army of German democracy."

The systematic social demagoguery of the militarists, is being directed at the workers and the scientific and technical intelligentsia of the defense industry is a phenomenon which virtually did not exist previously. The imperialists feel that if they start a nuclear world war, by using material incentives and even repression it is impossible to force the workers, white collar personnel, and scientific intelligentsia to work unstintingly at the

plants, scientific research institutes, and design bureaus. Hence the desire to appeal to the awareness of the working class and the intelligentsia and to attain from them, along with the armed forces personnel, active participation in the nuclear world war being prepared by imperialism. But, as the CPSU Program states, "the bourgeoisie is no longer able to come up with ideas which could attract the masses of people. More and more people in the capitalist nations are breaking with bourgeois ideology." [18] This is one of the sources of weakness in the military-political and military-economic potential of imperialism under the conditions of a nuclear missile war as well as of the low combat morale qualities of the soldiers in the imperialist armies. More and more this alarms the political and military leaders of imperialism.

The absence in the personnel of imperialist armies of ideas inspiring them to mass heroism, to a readiness to self-sacrifice and to manifest initiative in a combat situation is fraught with a sharp decline in the combat effectiveness of the equipment with a sharp decline in the combat effectiveness of the equipment and weapons, no matter how high the degree of automated control for this equipment and weapons. The imperialists have endeavored to compensate for this lack by different measures. Thus, in the system of combat training for personnel of the American Armed Forces, the characteristic features are a desire to force the soldier to carry out his duties, without reflecting as to for whose sake or why he should die, and stress on the psychological training of a murderer and unthinking automation or trained robot which operates one or another weapon or military equipment.

The "psychology of the struggle for life" or the "theory of survival" is the psychological basis for training the personnel of the American Armed Forces. The essence of this theory is that it is essential to anticipate the enemy and destroy him. Such a posing of the question should force the soldiers of the imperialist armies not to reflect about the political goals and tasks of war, and to carry out without flinching orders for the mass annihilation of women, children, and the elderly. The crimes of American mercenaries in Vietnam show that to a certain degree imperialism has been able to turn many soldiers and officers into a weapon of genocide.

The idea is constantly instilled in personnel of the imperialist armies that the weapons and military equipment of the American and other imperialist armies are supposedly more advanced in technical terms than the weapons and military equipment of the socialist armies. Imperialist propaganda in this regard makes skillful use of the fact that in the capitalist nations there has been extensive usually exaggerated publicity of models of combat equipment about to be put in service or are even just undergoing testing. At the same time, the obsolete or even no longer used models of Soviet military equipment are depicted as the "modern combat equipment" of the Soviet Armed Forces.

[18] *Programma KPSS*, p 51.

It must be poined out that in a majority of the imperialist armies, great attention is paid to the technical and tactical training of personnel in order to compensate for the absence of high political morale qualities by excellent skills brought up to the point of being automatic. In particular, often an enormous amount of ammunition, equipment, and explosives is used for training the personnel of many bourgeois armies. The American text *Troop Combat Training* states: use explosives only where possible, and explosions should continue the entire time that training is underway. At the same time, the military monopolies are interested in the maximum consumption of ammunition, explosives, and simulation devices and in the frequent replacement of weapons which have broken down.

The desire of the political and military leadership of the imperialist states to achieve victory in an unjust war by predominant superiority in weapons and military equipment to a goodly degree is caused by the fear of significant losses. This fear is not a manifestation of the humanism of the imperialists, but rather the result of their worry that great losses can cause indignation among the masses and their decisive resistance to aggressive predatory wars in which only the monopolistic bourgeoisie has an interest.

By the means of armed coercion, the international imperialist reaction is endeavoring to obstruct the natural process of mankind's transition from capitalism to socialism and to eliminate the socialist social system. With the development of the means for waging modern war, the military-political and military-strategic concept of imperialism is changing. At the same time, the change in the balance of military might in favor of the Soviet Union and the world socialist system is having a decisive effect on the content, character, and particular features of imperialist military doctrines and military art. A reflection of this contradiction is the struggle between two trends in the military policy of the imperialist states, that is, the trend for a healthy awareness of the insurmountable might of socialism, and the trend toward adventurism, the preparation and unleashing of not only local wars but also a nuclear world war. The supporters of the second trend should consider the warning stated at the 24th CPSU Congress by the General Secretary of the CPSU Central Committee, Comrade L. I. Brezhnev, that any possible aggressor should be well aware that "in the event of an attempt at a nuclear missile attack on our nation, he will receive a devastating retaliatory strike." [14]

[14] *Materialy XXIV S"yezda KPSS*, p 81.

Chapter X. The Sociopolitical Consequences of the Revolution in Military Affairs

The revolution in military affairs has been reflected directly or indirectly in all aspects of social life. In principle this phenomenon is not a new one. In the past, revolutions in military affairs have had a marked influence on the economy, policy, and historical fate of states and peoples, and have been reflected in social awareness. But the difference in the effect on social life between previous and present revolutions in military affairs is incommensurable.

The modern revolution in military affairs entails a particular phenomenon. The weapons have reached such a limit where their use in a war threatens the lives of scores and hundreds of million of people. Of course, in practical terms, in the course of a war, if it breaks out, for various reasons all existing nuclear weapons may not be used. But even in this instance a war involving the use of modern weapons can cause unprecedented calamities for the peoples. And this means that the unprecedented threat of nuclear war hangs constantly over modern mankind as long as imperialism lasts. This threat has assumed the nature of a particular social category which can be called *the nuclear danger*.

The nuclear danger or threat of a nuclear world war is directly related to the greater aggressiveness of imperialism. The deepening of the general crisis of capitalism and the exacerbation of its contradictions intensify the adventurism of imperialism and its danger for the peoples, and for the cause of peace and social progress. "The foreign policy of imperialism," pointed out the Accountability Report of the CPSU Central Committee to the 24th Party Congress, "over the last 5 years has provided new proof of the invariability of its reactionary, aggressive nature." [1]

The rise and growth of nuclear danger have made their impression on all social life, on the policy of states, and on the ideology and psychology of people in different nations and social systems.

The revolution in military affairs has also affected social life in a narrower sense. The revolution in the means and methods of waging war,

[1] *Materialy XXIV S"yezda KPSS*, p 15.

the exceptionally rapid aging of weapons, and the necessity of their mass replacement in peacetime, as well as the complex process of mastering these weapons—all of this has influenced the economic, psychological, and other social processes on a practical level. The consequences of the revolution in military affairs have become part and parcel of the daily life of the peoples and states, requiring from them a certain new orientation and a special evaluation of new phenomena in light of certain class interests.

The sociopolitical consequences of the revolution in military affairs in the socialist and imperialist nations have a directly opposite content. Of course, here there are also certain formally similar traits (for example, the increase in allocations for military purposes, the necessity of using recent scientific achievements for military purposes, and so forth). But, in the first place, they are similar only in form, and secondly, much fewer common traits in the social consequences of the revolution in military affairs are observed than in the revolution itself.

The opposite character of the sociopolitical consequences of the revolution in military affairs in the socialist and imperialist systems is also explained by the oppositeness of their socioeconomic systems, policies, and ideologies.

1. The Revolution in Military Affairs and Imperialism

The revolution in military affairs has had a significant effect upon the economy of the imperialist nations. If one were to give the most general evaluation of this influence, then it might be said that the creation and introduction of modern weapons into the armed forces has helped to strengthen the rottenness and parisitism of the imperialist economy. At the same time it has provided temporary additional sources and incentives for development, and has played the role of a definite "tonic." Both these aspects in a contradictory manner determine one another, for the artificial maintaining of the "tone" of the imperialist economy not only does not eliminate its parasitic nature, but on the contrary, corresponds to it.

The social consequences of the revolution in military affairs further disclose and exacerbate the contradiction between the unusual possibilities opened up by the scientific-technical revolution and the obstacles which capitalism raises on the path to using them in the interests of all society, channeling a large portion of scientific discoveries and enormous material resources into military purposes and squandering the national wealth.

The militarization of the economy which has always been endemic to imperialism, during the era of nuclear and other modern weapons, has grown stronger, and has acquired particular traits. The nature of the method of waging a nuclear missile war is such that it requires high combat readiness of the nation, and not only of its armed forces but also the entire national economy even in peacetime.

While in the past the aggressive imperialist states, in preparing for a war ahead of time put the economy on a wartime footing, under present conditions they do this to an even greater degree.

In threatening the Soviet Union and the other peace-loving nations with a nuclear attack and in endeavoring to undermine the might of their enemies in the arms race, the imperialists, and above all the U.S. monopolists, divert enormous forces and means into the mass production of constantly newer weapons. In the United States, around 30 percent of the entire labor force found in industry, transportation, construction, and public enterprises is employed in the sphere of military production. A very large share of the U.S. federal budget is used for preparing for war. Certain sectors of U.S. industry are completely or to a significant degree military ones, for example: 100 percent for the atomic industry, 95 percent for aviation, 60 percent for shipbuilding, and 50 percent for radio-electronics. The U.S. atomic industry employs more than 200,000 persons. Its fixed capital has been estimated at 8 billion dollars.

The U.S. military outlays remain high. While in the 1963–64 fiscal year, they were 62.2 billion dollars and in 1964–1965 the figure was 60.5 billion, in 1970–1971 they reached a total of more than 80 billion dollars.

At present expenditures on weapons have surpassed the analogous expenditures during the years of World War II, without considering pre-war times. Over the last 5 years, the United States has spent around 400 billion dollars on military purposes.

The parasitism of the modern military economy of the imperialist nations has also been intensified by such a new circumstance created by the scientific-technical revolution as the rapid obsolescence of military equipment and the necessity of replacing it under peacetime conditions. While in the last century the rearming of an army took many years, during the period of preparations for the first and second world wars this was carried out in a shorter time, and in the course of the wars, certainly, was even quicker. Moreover, the old models of weapons served their time in the course of the war on the battlefields.

At present a situation has developed where many models of weapons are often out of date without even having reached series production. And the military equipment which has been in use grows obsolete and is sold for scrap, without serving the "god of war" on the battlefields. All of this occurs because science offers military affairs constantly new improvements which render valueless those means which were just considered the most advanced. A powerful military-industrial apparatus is created and this acquires, no matter how paradoxical it might seem, its own relatively independent economic base. It produces military equipment which is purchased using taxes from the pocket of the masses, and then is sent to the scrap pile (without any war!) and is replaced by newer equipment.

However, for maintaining such a continuously broadening "armament vortex," it is essential to have its political justification. And the magnates of the military-industrial complex, that is, the militarized economy, demand an intensification of the aggressive policy of imperialism, the infamous balancing on the brink of war, military blackmail and threats, the broadening of various military adventures, and other political actions of the Cold War which are constantly fraught with turning it into a real "hot" war.

The new wider opportunities for enrichment which are opened up for the monopolies by the revolution in military affairs help to strengthen the processes of the concentration and centralization of capital which are inherent to a capitalist society, to intertwine the monopolies with the state (and now particularly the military) apparatus, and to further develop state monopolistic capitalism. The monopolies carrying out military contracts grow particularly strongly.

". . . In the postwar years," commented L. I. Brezhnev at the 24th CPSU Congress, "in the capitalist world the growth of militarism has occurred on an unprecedented scale. This tendency has grown even stronger recently. In 1970 alone, the NATO nations invested 103 billion dollars into preparing for war. Militarization has assumed the most dangerous character in the United States." [2]

The revolution in military affairs has had a profound and very contradictory effect on the policy and ideology of imperialist society. It, on the one hand, has strengthened the aggressiveness of its leading circles, and on the other, has exacerbated its numerous contradictions, and led to a new demarcation of forces in society over the questions of war and peace.

The appearance of nuclear missile weapons has been greeted by the ideologists of the imperial bourgeoisie with unconcealed glee. The barbarous nature of these weapons conforms fully to the reactionary goals of imperialist policy and ideology. The first use of these weapons against the peaceful population of Hiroshima and Nagasaki was a demonstration of the force of American imperialism and was not dictated by military necessity.

During the period of the monopolistic or almost monopolistic possession of nuclear weapons (before the beginning of the 1950's), the ideologists of American imperialism with rapture described the vast opportunities for destroying entire nations and peoples. This rapture with the prospects of a total destructive war continued in the first half of the 1950's when Dulles proclaimed the infamous strategy of "massed nuclear retaliation." This doctrine was a direct reflection of the unrestrained growth of militaristic attitudes based on the idea of "nuclear might" and nuclear war. However, the further development of the revolution in military affairs made substantial changes in this process. These changes were determined

[2] *Ibid.*, p 16.

by the rapid development of the revolution in military affairs in the Soviet Union.

While at the end of the 1940's the United States was the leader of the revolution in military affairs, later this role gradually began to shift to the Soviet Union. In 1947, the Soviet government announced that the secret of the atomic bomb did not exist. In August 1949, an atomic explosion was carried out in the USSR. In 1953, a year ahead of the United States, the USSR tested its first hydrogen bomb. After the war, work went on successfully to create missiles of different classes and purposes. The change in the balance of forces in favor of the Soviet Union and its further successes in developing nuclear missile weapons led to a serious crisis in the ideology and policy of militarism.

At the end of the 1950's, in the major imperialist nations, numerous books and articles were published in which the leading military writers proposed the ideas of the unacceptability of nuclear world war as an implement of policy. "The ability of the sides to exchange salvoes with a power of several million tons creates an extremely dangerous situation," wrote, for example, the well-known American military specialist Garthoff, "and necessitates a revision of any strategy based on the use of these weapons . . . The policy of 'massive retaliation' . . . has come to mean nothing more than a bluff . . . It, no matter how paradoxical it might seem, becomes unacceptable as an instrument of national policy."

The further development of the revolution in military affairs in the USSR and the growth of its military might had a sobering influence on a whole series of politicians and ideologists of imperialism.

Some of the most important social consequences of the revolution in military affairs were an awareness by significant masses of people, including representatives of the bourgeoisie, of the essence of the nuclear danger, the strengthening of the antiwar movements in the policy and ideology of the bourgeois society, and the rise of a strong opposition to nuclear militarism among the most different social forces. The international movement of the supporters of peace united in organizational terms by the World Peace Council became a most important force. The representatives of various classes and social forces participate in this movement, with the most active and consistent being the representatives of the communist and workers' parties from different nations.

A significant portion of the leading representatives of bourgeois science and culture supports the peace movement.

The broad uniting of different social forces in the struggle for peace has become possible under conditions dictated by the nature of the modern era, and has become necessary when confronted with the nuclear danger threatening the entire world. The nuclear danger has changed the social role of modern pacifism and its various currents. In the first place, in the modern pacifist movements, active radical currents have split off and gained great development, and the representatives of these currents (J.

Bernal, J. P. Sartre, L. Pauling, and others) work in the ranks of the peace supporters, and undertake effective actions in the struggle for peace, being in this regard allies of the communist movement. Secondly, the representatives of the old abstract bourgeois pacifism, those "dreamers and sighers for peace" who in the past were repeatedly criticized by V. I. Lenin, at present are not as impotent as before. Moreover, even their abstract preaching of peace, with all its unscientific and politically contradictory nature, does definite good. Of course, all their utopian plans for keeping the peace by "reeducating people" and creating a "world government" require serious and constant criticism. However, even these pacifist groups and organizations are now assuming a new social significance.

"All organizations and parties working to prevent war," states the CPSU Program, "the neutral and pacifist movements, and the bourgeois circles in favor of peace and the normalization of relations between nations will find understanding and support from the Soviet Union." [3]

In defining the given line of the attitude toward pacifist organizations, the CPSU Program relies on the well-known thesis of V. I. Lenin that "we are not indifferent to whether we are concerned with those representatives of the bourgeois camp who gravitate toward a military solution of the question or with those representatives of the bourgeois camp who gravitate toward pacifism, although it is the shoddiest and, from the standpoint of communism, does not withstand even a shadow of criticism." [4]

As before, militaristic concepts are strong in the ideology of the imperialist bourgeoisie of the leading capitalist nations. The following theses are characteristic for the militaristic ideology of the American bourgeoisie: a) it is essential to reject the idea of the impossibility of nuclear war and to prepare carefully for it, although starting such a war only under favorable circumstances; b) these favorable circumstances will be prepared for by weakening the Soviet Union in the course of a major arms race which should undermine its economy, and consequently, the ideology of communism; c) at present it is essential to follow a policy of organizing the most diverse local aggressive wars in order to defeat the national liberation movement and, wherever possible, individual socialist nations. These ideas have been formulated in such major works as *Forward Strategy for America* by Strauss-Hupe, Possony, and Kintner, *On Thermonuclear War and On Escalation* by H. Kahn, *Massive Retaliation* by Peters, *Limited War* by R. Osgood, and others. As practice shows, precisely these goals and principles are now being implemented in the policy of world imperialism.

Nuclear weapons under imperialist conditions have played a particular role in the development of aggressive military-political blocs. When the

[3] *Programma KPSS*, p 61.

[4] V. I. Lenin, *Poln. Sobr. Soch.*, Vol 45, p 70.

Western European imperialist nations experienced significant postwar difficulties, American imperialism was able to put together the NATO Alliance, and here the nuclear bomb played the role of a definite bugbear which demonstrated U.S. strength. At present, with an intensification of the aggressiveness of American imperialism and the exacerbation of the adventuristic character of its policy, nuclear weapons are beginning to play the reverse role, since the peoples of a majority of the nations understand that American imperialism can involve them in military adventures with dangerous consequences for them.

More and more people in the world are becoming aware of the obvious fact that the balance of forces on the world scene is constantly moving in favor of socialism. Imperialism has lost once and for all the historical initiative and its possibilities have been greatly reduced. Even in possessing the most destructive weapons, it is not able to turn back the development of the modern world.

A recognition of those new conditions under which modern international relations are developing has led to a situation where, in the ruling circles of the leading capitalist nations, sober and realistic tendencies have begun to appear. They have been expressed in a number of measures undertaken by the French government and aimed at improving relations with the USSR, in the concluding of treaties between West Germany and the USSR and Poland, and the signing of a number of important documents during the Soviet-American talks in Moscow in May 1972.

However, all these phenomena, no matter how they favor an improvement in the international situation and a lessening of the threat of nuclear war, cannot fully localize the action of the source of the military danger residing at the very basis of imperialism and constantly giving rise to its aggressiveness. For this reason, it is wise to recall the words of the basic document of the 1969 Conference of Communist and Workers' Parties: "At the basis of the aggressive policy of imperialism lies a desire by any means to weaken the positions of socialism, to suppress the national liberation movement of the peoples, to obstruct the struggle of the workers in the capitalist nations, and to restrain the irreversible process of the fall of capitalism." [5]

Under the given conditions, the responsibility of communists in all nations grows for unity in the struggle against the reactionary actions of imperialism.

The revolution in military affairs in the imperialist nations has had a particular effect on the proletariat which acts as the basic force of the

[5] *Zadazhi Bor'by Protiv Imperializma na Sovremennom Etape i Yedinstvo Deystviy Kommunisticheskikh i Rabochikh Partiy, Vsekh Antiimperialisticheskikh Sil* (The Tasks of the Struggle Against Imperialism at the Present Stage and the Unity of Actions of the Communist and Workers' Parties and All Anti-Imperialist Forces), Moscow, Politizdat, 1969, p 4.

struggle for peace in bourgeois society. The communist parties of the capitalist nations are in the front ranks of the antiwar movement. Under their influence, many representatives of numerous pacifist currents and groups formed in response to the nuclear danger have begun to fight actively against the threat of a new world war.

2. The Effect of the Revolution in Military Affairs on Socialist Society

In contrast to capitalism, where the invention and production of nuclear missile weapons has been the logical extension of imperialist policy and has organically corresponded to its misanthropic essence, for socialism the revolution in military affairs has been dictated by an external necessity. The Soviet Union was forced to carry it out because of the aggressive policy of imperialism. However, the USSR also had enormous favorable opportunities residing in the high level of scientific and technical development, and in the able leadership of the Communist Party which provided unified and centralized leadership over the organizing and implementing of the enormous changes in military affairs.

The carrying out of the revolution in military affairs in the USSR has been of major significance. It cannot be said that it did not entail additional difficulties for the Soviet national economy. In the economic area, it caused new expenditures for military purposes, and diverted a definite amount of the productive forces from solving the basic task of building the material and technical basis of communism and raising the standard of living of the people. In particular, in 1958–1965, when the most important stage of the revolution in military affairs was carried out, involving the introduction of nuclear missile weapons into the structure of the Armed Forces, defense expenditures had to increase. Understandably, these means, in being used for creative purposes, would have accelerated the solving of national economic problems confronting our nation.

As Comrade A. N. Kosygin pointed out in his report at the 23d CPSU Congress, the necessity of increasing the production of modern and expensive weapons, due to the greater aggressiveness of imperialism, played a definite role in slowing down the growth of real income of the population, and told on the growth rates of light industry, national income, and the material prosperity of the workers.[6]

However, as the course of the historical process shows, the material outlays which our national economy had to bear were inevitable and dictated by the present stage in socialism's struggle against aggressive imperialism. They provide conditions for building communism in our nation. The very revolution in military affairs in our nation has immeasurably increased the might of the forces defending peace throughout

[6] See *Materialy XXIII S"yezda KPSS* (Materials of the 23d CPSU Congress), Moscow, Politizdat, 1967, p 120.

the world. In this regard, its role is diametrically opposite to the role of the revolution in military affairs in the United States and the other imperialist nuclear powers.

During the period of coexistence of socialist and capitalist states, one of the patterns in the construction of socialism is the defense against the aggressive encroachments of the imperialist nations. The revolution in military affairs has made definite changes in carrying out this pattern. There are several such changes. The most significant of them is the fact that the equipping of the Soviet Armed Forces with nuclear missile weapons has made retaliation against an aggressor who has decided to start a nuclear war inevitable.

As is known, in the past no nation could parry the threat of aggression by the retaliatory threat of annihilating the aggressor. Of course, in history instances of preventing war were known when the aggressor nations did not attack, seeing a disadvantageous balance of forces when their intended victim had a powerful ally, and so forth. For example, in 1887, Germany again intended to attack France, not being satisfied with the results achieved in 1870–1871. However, the Russian position in support of France forced the Bismarck government to abandon its aggressive plans. But this instance was one of the exceptions. In the past the aggressor has never encountered circumstances which could threaten him with complete destruction in a short period of time. Moreover, even if a modern aggressor estimates that he will be able to save a certain portion of the population and national wealth, the price of aggression comes too great and does not justify those goals for which it is undertaken.

Thus, the first most important positive sociopolitical consequence of the revolution in military affairs which has occurred in the socialist nations is the appearance of the possibility of inevitable retaliation against the aggressor.

The second sociopolitical consequence is a direct extension of the first. The nuclear missile weapons in the hands of the Soviet state were under modern historical conditions a necessary element guaranteeing the final victory of socialism in the USSR and other socialist nations. If our nation would have lagged behind in developing such weapons for a long period of time, and the imperialists would have had a large quantity of them, then the socialist nations could not be guaranteed against destruction in the event of imperialist aggression. ". . . We do not have the right," said the Chairman of the USSR Council of Ministers, A. N. Kosygin, at the 24th CPSU Congress, "to forget for a minute the necessity of strengthening our Armed Forces and their high combat readiness." [7]

Certainly, in no instance should the significance of the designated political consequence of the revolution being carried out in the USSR in military affairs be reduced merely to the fact of a rise of its military might. The action of our military might as a factor restraining aggression

[7] *Materialy XXIV S"yezda KPSS*, p 186.

is combined with the constant and unswerving peaceful foreign policy of the Soviet state which has actively unmasked the intrigues of the enemies of peace, which has convincingly demonstrated our desire to settle all disputed questions peacefully, and has established broad contacts with all friends of peace throughout the world.

However, attention must be paid to the fact that the military might of the socialist nations is not viewed as a condition or a means for preventing all wars generally, that is, civil, national-liberation, or in the defense of the sovereignty of peoples. The communists have always recognized that along with reactionary and unjust wars, there are also progressive and just ones. At present there are circumstances when the suppressed classes and peoples are forced to fight for there is no other way out. Such wars cannot be "prevented," and they are legitimate and just. The socialist nations and the communist and workers' parties of the entire world actively support the liberation struggle of peoples.

Another particular sociopolitical consequence of the revolution in military affairs is the substantial change in the appearance, role, and strategic content of local wars between states. The constant threat of turning them into a limited nuclear war and then a nuclear world war is a serious feature of such wars. In these wars, the imperialists set limited goals, considering the inevitable dangerous consequences of a total nuclear conflict. However, their strategy constantly considers the possibility of a transition to nuclear war. This circumstance requires particular vigilance on the part of the political and military leadership, the armed forces, and the peoples of the socialist nations.

The revolution in military affairs has posed complex tasks for the political, morale, and psychological preparation of the soldiers and the entire people for a possible nuclear war, as well as raising the readiness to drive off the aggressor's attack and defeat him.

3. The Revolution in Military Affairs and Social Progress

At one time, F. Engels wrote about the revolution in military affairs caused by the appearance of firearms: "The introduction of firearms had a revolutionizing influence not only on the very conduct of war, but also on the political relations of hegemony and enslavement . . . Firearms for this reason from the very start were a weapon of the cities and the ascending monarchy which relied on the cities directed against the feudal nobility." [8] The revolution about which F. Engels wrote helped to establish the bourgeois system which was more progressive for those times.

The present revolution in military affairs has had a much more contradictory effect on social progress. This is explained by the fact that the revolution in military affairs occurred in socialist and in imperialist states.

[8] K. Marx and F. Engels, *Soch.*, Vol 20, p 171.

The new weapons were not only in the hands of the progressive forces but also possessed by the defenders of reaction.

First of all, one must note the negative effect of fundamental changes in military affairs on social progress. Due to the fact that the aggressive policy of the imperialist powers has powerful modern weapons at its disposal, all mankind, including the peoples of the socialist nations, is forced to spend colossal amounts on weapons and on training and maintaining large armies. The efforts of numerous scientists go to military needs, and a significant portion of the economy even in peacetime operates for war preparations. Many new discoveries are kept in strictest secrecy, and are used for military purposes. All these phenomena, of which imperialism is the sole source and guilty party delay the development of human society along the path of progress, and prevent the using of productive forces completely for the good of man.

Furthermore, a nuclear war, if the imperialists are able to start it, will lead to a gigantic waste and to the direct destruction of a significant portion of the productive forces, including the main productive force, the working man. A war can cause enormous damage to the very fundamentals of society's existence, to social progress and all world civilization. For precisely this reason, the advanced forces of the modern world are waging a stubborn and intense struggle for preventing war.

Regardless of the fact that in recent years imperialism has repeatedly provoked acute international crises which have brought mankind to the brink of a thermonuclear clash, as is stated in the final document approved by the 1969 International Conference of Communist and Workers' Parties, ". . . U.S. imperialism has been forced to consider the existing balance of forces on the international scene, the nuclear potential of the Soviet Union, and the possible consequences of a nuclear missile war. It is becoming more and more difficult and dangerous for imperialism to wager on starting a new world war.

"Imperialism is powerless to regain the historic initiative which it has lost, and to turn back the development of the modern world. The world socialist system, the international working class, and all revolutionary forces now determine the main path of mankind's development." [9]

The colossal might of the Soviet Union, as the world's first state building communism, serves the just cause of the struggle against imperialist aggression and the suppression of peoples, as well as the fight for liberty, democracy, and peace. The growth of this might, as well as the greater influence of the USSR on the course of events in the world correspond to the vital interests of the masses in all nations, and to the interests of the revolutionary and liberation movement of the working class and all working people. "The CPSU and the Soviet people," stated L. I. Brezhnev in a speech at the 1969 International Conference of Communist and

[9] *Zadazhi Bor'by Protiv Imperializma na Sovremennom Etape i Yedinstvo Destviy Kommunisticheskikh i Rabochikh Partiy, Vsekh Antiimperialisticheskikh Sil*, pp 6–7.

Workers' Parties, "in the future will multiply their contribution to solving the problems of the anti-imperialist struggle, and they will constantly defend the cause of peace, democracy, national independence, and socialism." [10]

One of the inevitable social consequences from the development of modern weapons is that it causes a strengthening of the antiwar movements. The struggle against the threat of a nuclear war in our times is becoming one of the most important factors which revolutionizes the broad social strata. At present the fate of mankind depends greatly upon the breadth and continuous growth of the struggle of the masses against the nuclear danger. The struggle for peace and against the threat of a nuclear war is one of the indispensable elements in the struggle for the happy future of mankind and for socialism. The monstrous growth of the means of destruction does not make a world nuclear war automatically impossible. For preventing it it is essential to have a constant and growing struggle of all the progressive forces of the world.

"The basic link in the united actions of the anti-imperialist forces," stresses the document of the 1969 International Conference of Communist and Workers' Parties, *"as before remains the struggle against the danger of world thermonuclear war which continues to threaten the peoples with mass extermination, in addition to the struggle for peace throughout the world.* By the united efforts of the socialist nations, the international working class, the national liberation movement, and all peace-loving states, social organizations, and mass movements, a world war can be prevented." [11] The active struggle against the nuclear danger is one of the most important fronts on the basis of which the efforts of all progressive mankind are united and the leading role of the world communist movement is even more vividly apparent as the basic leading force of the struggle for social progress throughout the world.

Communists view the future optimistically. They have faith in the reason and energy of mankind. But this faith also presupposes continuous constant work in the name of achieving the set goal. The military service of men of the Armed Forces in our nation is a necessary link in solving this enormous task of world historical signifiance. They must keep the aggressor in check by the threat of inevitable retaliation until the growing movement for peace, liberty, and socialism will clear the moribund and harmful weeds of imperialism from the field of world history.

[10] L. I. Brezhnev, *Za Ukrepleniye Splochennosti Kommunistov, za Novyy Pod"yem Antiimperialisticheskoy Bor'by*, 62.

[11] *Zadazhi Bor'by Protiv Imperializma na Sovremennom Etape i Yedinstvo Deystviy Kommunisticheskikh i Rabochikh Partiy, Vsekh Antiimperialisticheskikh Sil*, p. 34.

Conclusion

Soviet military development is inseparably linked with the general process of socialist production in our nation.

The Communist Party, as was pointed out in the Accountability Report of the CPSU Central Committee to the 24th Congress, proceeds from the fact that in solving the basic questions of economic development, both from the standpoint of the immediate tasks as well as the long-range future, an acceleration of scientific-technical progress is of prime concern.

Scientific-technical progress is the material basis of those revolutionary changes which have occurred in the Soviet Armed Forces in recent decades. The relationship of military development to scientific-technical progress is becoming ever broader and deeper.

The revolution in military affairs has caused new patterns of modern warfare, with the combat capabilities of the armed forces being changed fundamentally as a result of this revolution. Because of this, the content, forms, and methods of warfare are now characterized by completely new previously unknown features.

In the first place, in a modern war, as a consequence of the possible unrestricted use of strategic nuclear weapons by the armed forces of the warring sides, the line between the front and rear is obliterated. The range of strategic missiles and their destructive might make it possible to hit any economic or administrative-political center of the enemy. This means that in contrast to the past, the entire economy, the state administrative system, and the vital centers of the warring sides, regardless of their remoteness, in a nuclear world war become targets for destruction just as the immediate military objectives.

For the Soviet state, completely new tasks have arisen for defending the nation against aggression, and these tasks derive from the threat of enemy nuclear attack and from the consequences of such an attack on civilian objectives, that is, cities, industrial centers, communications, and so forth. In this regard, national air defenses have assumed strategic state importance. Modern air defenses must simultaneously carry out their missions over the entire territory of the nation. At the same time the role of civil defense has grown immeasurably, and its functions are organically

intertwined in the process of military operations which can cover the entire territory of the nation.

Secondly, the use of strategic nuclear weapons for the purpose of the simultaneous destruction of frontline and rear objectives creates real prerequisites for achieving the goals of a war in a short period of time. A most important new qualitative feature of modern war is the possibility of directly achieving strategic results by using strategic nuclear forces, bypassing the consecutive stages of developing tactical successes into operational-level ones, and the latter into strategic ones, as was the case in previous wars.

Thirdly, the armed forces under the conditions of a nuclear war should be able to carry out missions which differ sharply from the missions which they carried out in the past. This, in turn, has necessitated an improvement in the organization structure of the armed forces, and the bringing of it into accord with the military-technical revolution. Naturally, this process will continue in the future on the basis of modernizing weapons and military equipment and by checking the existing organizational forms in the course of combat training.

Fourthly, the revolution in military affairs to a significant degree has raised the importance of the surprise factor. Hence the significance of combat readiness which L. I. Brezhnev mentioned in a speech at a reception in the Kremlin in honor of the military academy graduates on 5 July 1967. High combat readiness of the Soviet Armed Forces is caused by the most important of all the tasks confronting them, that is, to thwart the intentions and provide a decisive and complete defeat to any aggressor. The present capabilities of the Soviet Armed Forces make it possible to solve this problem.[1]

These, briefly, are the basic conclusions from the most important changes in military affairs which have occurred under the effect of modern scientific-technical progress.

Due to the leadership of the CPSU and to the efforts of all the Soviet people in the struggle to strengthen the defense capabilities of our motherland, the Soviet Armed Forces in terms of their technical equipping and organization, are on a level which fully corresponds to the character and patterns of modern war. The modern weapons and military equipment have been mastered by our officers, ensigns, warrant officers, petty officers, sergeants, soldiers, and sailors, all indoctrinated by the party and always ready to carry out the orders of the motherland and to dependably defend it against encroachments by any aggressor.

In the course of military-technical progress, new qualities have been formed in the personnel of the Armed Forces. The equipping of the Armed Forces with nuclear weapons and modern military equipment has futher raised the role of man in achieving victory over the enemy.

The training of officer personnel is of particularly important significance,

[1] See L. I. Brezhnev, *Leninskim Kursom*, Vol. 2, p 49.

as they are the creators and carriers of military art. The qualities of officers in the Soviet Armed Forces are basically determined by the level of their special military training, that is, by theoretical knowledge and practical experience, and by their ideological conviction which is formed on the basis of Marxism-Leninism. Marxist-Leninist teachings create a scientific basis for correctly understanding social phenomena, and for analyzing the patterns of war, the methods of waging it, and the trends in the development of military affairs. They serve as the basis of the ideological conviction of the rightness of our great cause, communist construction, of the unprecedented morale of the Soviet soldiers, and of high military discipline.

The revolution in military affairs is not only an abrupt change which ended at a certain stage with quantitative and qualitative changes in the development of nuclear missile weapons. The revolution in military affairs is a process of fundamental changes in all areas of military affairs and military-technical progress, based on a real scientific and technical foundation and having a theoretical substantiation. As a result of carrying out the revolution in military affairs, up to now a new content has been elaborated for the theory and practice of military art. This content is characterized by the fact that along with maintaining the historically justified and still viable forms and methods for the combat use of armed forces, new forms and methods have appeared and are being introduced actively, conforming to the nature of the missions and capabilities of modern weapons and military equipment.

All of this confronts military science with exceptionally important tasks. It must not only theoretically generalize the modern practices of military affairs, but also work out new problems the solution to which is of enormous significance for the future. As was commented by the Minister of Defense, Mar SU A. A. Grechko, the main task of Soviet military science at the present stage is to elaborate the problems of maintaining constant combat readiness of the Armed Forces to thwart an attack and defeat the aggressor under any conditions. Here it is essential to bear in mind that "the criteria of combat readiness have substantially changed. At the present stage, the Armed Forces should be able under any situation to thwart a surprise attack by the aggressor both involving the use of nuclear as well as conventional weapons, and by rapid crushing strikes to defeat the enemy's basic nuclear missile weapons and troop movings, having provided favorable conditions for the further conduct and victorious conclusion of the war." [2]

In light of solving this main problem as well as in line with the necessity of further elaborating the methods for conducting combat and an operation, considering the development prospects of weapons under the effect of an acceleration in scientific-technical progress on military development, a number of important questions merit particular attention by military

[2] A. A. Grechko, *Na Strazhe Mira i Stroitel'stva Kommunizma*, p 64.

science and the subsequent introduction of its conclusions into practice.

The constant rivalry between the means of attack and the means of defense at present is characterized by the superiority of the former, due to the present development level of nuclear missile weapons. The possibility of massing and concentrating nuclear strikes and of choosing objectives for them provides great advantages to the person making these strikes. Air defenses are thus confronted with difficult missions of protecting the important military, economic, and administrative-political centers over the entire territory of the nation. Air offensive weapons are being constantly improved, and for this reason, although the National Air Defense Troops are now armed with the most modern military and technical means for carrying out these missions, scientific research in the area of air and civil defense is continuing.

The questions of countering submarines are very important, as subs hold an important place among the strategic weapons of modern war. Powerful weapons, great range and high maneuverability comprise the inseparable qualities of this means of modern combat on the sea and ocean theaters of military operations. To parry these qualities in the enemy submarines means to solve a problem of strategic significance, and the possibilities to solve it depend directly upon the acceleration of scientific-technical progress.

The development of the means and methods for using the Air Force is also an urgent problem. The air sphere of military operations during the age of nuclear weapons has not only not lost its importance, but has greatly broadened. At present, the Soviet Air Force is able to carry out the most diverse missions, both independently as well as cooperating with other services of the armed forces and branches of arms. The Air Force can conduct air reconnaissance to a great depth over the land and sea theaters, make powerful strikes against enemy groupings of forces, including mobile targets, as well as move troops, military equipment and materiel by air. The nature of the missions carried out by the Air Force is becoming even broader and more diverse due to further technical improvements of the aircraft and the growth of their combat capabilities. As was pointed out by the Minister of Defense, our Air Force is developing in a direction of increasing aircraft capabilities to destroy targets, using the entire range of altitudes, increasing flight speed and range, and raising the ability to overcome air defenses.[3] The speeds of 2,500–3,000 kilometers per hour and an altitude of 30 kilometers reached by jet aircraft are not the limit, and can serve as lines for further scientific and technical progress in the development of the Air Force.

Under conditions of the use of nuclear weapons by the enemy, providing maneuverability and high mobility of the Land Forces assumes important significance. Not only the battlefield but also the operational depth of the theater of military operations, as a result of nuclear strikes, will

[3] See *ibid.*, p 47.

represent an area the crossing of which will pose serious difficulties for the troops. Aside from zones of radioactive contamination with high radiation levels, the routes of the troops' advance will cross large areas of fires, destruction, and flooding. In order to maintain a high rate of advance, and this is one of the most important conditions for success in battle and an operation, the troops should master the ability to rapidly cross such areas.

Along with other means, the engineer troops play an essential role in carrying out this mission. At present these troops are equipped with diverse equipment making it possible to carry out the difficult jobs of supporting troop combat, including in areas of heavy destruction caused by explosions of nuclear ammunition.

We must also point to the necessity of further improving the system of controlling the troops and the means for conducting combat. The speed of the modern processes of military operations and the abundance of information about them require the most efficient possible evaluation of occurring events and an equally effective response to them. With the complicating of the methods for conducting combat, the leadership bodies, that is, the commanders and the staffs, are confronted with the problem of constantly improving and widely introducing into the control system scientific methods of leadership, as well as making wide use of the achievements of general and military cybernetics.

All these and many other questions of military development are settled on the basis of general scientific-technical progress, and our nation holds leading positions in the most important directions of this progress.

The important consequences of the revolution in military affairs are changes in the relationship between man and technology, the growth of demands made upon man, and, simultaneously, the increase of his role in military development.

In carrying out the practical missions relating to the questions of technical outfitting, to troop training, to the development of military art and generally to the entire complex of measures related to strengthening and improving the combat might of the Soviet Armed Forces, the guiding principle is the thesis of the Communist Party that Soviet people have been and remain the main force in carrying out these tasks in peacetime as well as in achieving victory in a war.

Combat might is an indicator of the possibility for achieving victory. In order to turn it into a reality, there must be high creativity by the commanders, staffs, and all personnel. One of the basic conditions for this creativity is the attitude of the personnel in the Armed Forces toward the defense of the socialist fatherland. This is reflected in the political morale factor and in the level of the political, morale, and psychological state of Soviet military personnel.

The political, morale, and psychological potential caused by the attitude of the people to a war determines the ability of the troops to endure the

harshness of war and achieve victory. "In any war," said V. I. Lenin, "victory ultimately is determined by the morale of those masses who shed their blood on the battlefield." [4]

The significance of the political, morale, and psychological factor is also determined by the specifics of war and by that situation under which combat is waged. With good reason F. Engels pointed to the necessity, in evaluating an army, among the other elements characterizing its combat capability, to know what the morale of the army was, that is, what could be demanded from it without risking its demoralization.

The great role of the political morale factor was stressed by V. I. Lenin in his article "Advice of an Outsider," where he, in speaking about the particular laws of war, wrote that for achieving victory over the enemy, a superiority of morale had to be sustained no matter what the cost.

It is also essential to point to the organic tie between troop discipline which is the guarantee for combat readiness of the troops, and the political morale state of personnel. The higher the morale is, the stronger the military discipline. In turn, high military discipline strengthens the morale of the army.

In speaking about morale as an indicator of combat might, it is also essential to bear in mind the effect of a combat situation on the mental state of personnel, the influence on them of sharp changes in the course of combat, and in particular, with surprise attacks by the enemy, particularly when these attacks are directed against personnel not having combat experience and not having undergone the severe trials of war in the past.

In this regard, the significance of a high political, morale, and psychological state of troops under the conditions of nuclear war increases immeasurably. The nature of a combat situation in a war with the use of nuclear missile weapons can be represented only tentatively or more theoretically, however, such a possibility makes it possible to draw indisputable conclusions on the depth and unusualness of the effect of nuclear strikes on the state of the personnel.

For this reason, in solving the fundamental questions of military development, along with professional military and technical training for personnel of the Soviet Armed Forces, constant and enormous attention should be paid to the ideological, indoctrinational, and party political work with the men.

"The political morale qualities of the Soviet people," stated the Accountability Report of the CPSU Central Committee to the 24th Party Congress, "are formed by the entire socialist way of life, by the entire course of affairs in society, but above all by the purposeful and constant

[4] V. I. Lenin, *Poln. Sobr. Soch.*, Vol 41, p 121.

ideological and indoctrinational work done by the party and all its organizations." [5]

The main thing in the area of ideological work in the Soviet Armed Forces is the development of communist awareness in the men, and the formation of a Marxist-Leninist ideology, ideological conviction, loyalty to the socialist motherland and a readiness to carry out their military duty.

Under the conditions of the present improvement of the Armed Forces, the combination of military-technical progress, the development of military science, and the growing role of political, morale, and psychological qualities of personnel is a most important requirement for further strengthening the combat might of the Soviet Armed Forces.

The high indicators of combat might and combat readiness with which the Soviet Armed Forces greeted the 24th CPSU Congress were given high and proper praise in the Accountability Report of the Party Central Committee.

The Soviet Armed Forces are sparing no effort to carry out the missions posed by the 24th Congress, under the leadership of the Communist Party, and to further raise the level of their ability and readiness to defend the peaceful creative labor of the Soviet people in building communism.

[5] *Materialy XXIV S"yezda KPSS*, p 83.

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