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SOME QUESTIONS OF MEETING ENGAGEMENTS OF LARGE TANK GROUPINGS

CPYRGHT

by Maj Gen Tank Trps A. ZHILIN

There is no doubt that in operations conducted by ground troops in a nuclear war meeting engagements will arise frequently. This is especially true of tank troops, which have high mobility, striking power, and maneuverability, and stability against nuclear strikes. Of great interest are engagements of large tank groupings which are called upon to exploit fully the results of nuclear strikes for the final defeat of the enemy and the accomplishment of the operation's objectives in the shortest period of time.

Such meeting engagements may arise in the most varied situations, both at the beginning and during the course of offensive operations.

At the beginning of operations meeting engagements are most likely to occur if both sides simultaneously attempt to achieve their objectives by a decisive attack. In this case a tank grouping will conduct an engagement on the main axis in coordination with neighboring groupings of ground troops attacking on other axes.

Entirely different conditions may arise for tank groupings in a meeting engagement during an offensive operation of one of the sides or during action in the operational depth, especially when cut off from other forces. Here a tank grouping of the attacking side must conduct a meeting engagement with large operational reserves of the defending forces, which also have a considerable number of tanks and which are striving to achieve success with nuclear strikes followed by a powerful counterthrust. If a tank grouping of the attacking force becomes separated by a considerable distance, its troops will sooner or later have to conduct an engagement independently.

It must be assumed that such meeting engagements will begin with nuclear strikes of rocket troops and aviation and will have a purely tank character and large scope. They will usually evolve on a wide front and to a great depth under complex, rapidly changing situations, and will be distinguished by exceptional intensity, dynamism, and varied operations of tank troops.

Obviously, the employment of means of a higher command in such a meeting engagement is not excluded, since this engagement is not an isolated occurrence, but an integral part of the operations of both sides. Therefore, each side tries to achieve the most decisive objectives, not only to destroy the opposing grouping, but to complete the operation in the shortest possible time, primarily with its tank grouping.

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These objectives can be accomplished only through the coordinated efforts of rocket troops, tank soyedineniya, and support aviation. The most important principle for ensuring success in tank meeting engagements is the forestalling of the enemy in all operations. This principle, especially in meeting engagements of large tank groupings, in our opinion, is becoming more important. Tank troops, it would seem, have the greatest potential for accomplishing this. Success can be expected by the side which is able to forestall the other side in delivering nuclear strikes, in achieving and maintaining fire superiority and superiority in the air, and in advancing and deploying tank soyedineniya and chasti for tank strikes from the march.

Nuclear weapons and their effective use by rocket troops and aviation will be of decisive importance to both sides, since in modern meeting engagements, including those involving large tank groupings, they will be the main force for destroying the enemy. A powerful nuclear strike at the beginning of a meeting engagement can play a most important role. Forestalling the enemy with an effectively delivered nuclear strike will unquestionably have a real influence on the success of operations of large tank groupings. However, this strike alone will obviously be insufficient for the total destruction of the enemy. Both the attacking and defending forces will try to deliver successive nuclear strikes against nuclear means and tank soyedineniya as they appear when enemy objectives are still in the concentration area, during an advance, and at the beginning of a meeting engagement.

An important requirement is the use of a large part of the nuclear ammunition against the main forces of the enemy rather than an equal distribution or their use against secondary targets. When destroying an enemy tank grouping it should be remembered that its nuclear weapons are primary objectives.

In addition to nuclear means wide use will be made of conventional means: aviation strikes in support of a tank grouping (with nonnuclear ammunition) and the fire of artillery in the tank grouping.

We especially wish to emphasize the important role of aviation both in operations in support of a tank grouping and in providing cover for it by countering enemy aviation during a meeting engagement. In meeting engagements of tank groupings, the majority of targets of both sides will be mobile. Aviation will therefore be the most effective means of destroying the enemy. To a certain degree it will be given preference by both sides.

In certain areas, especially in the area of a battle of tank chasti and podrazdeleniya, action against the enemy may be limited to ground means of destruction.

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As concerns troop operations of a tank grouping in a meeting engagement, one of the basic conditions for their successful execution, as we have already noted, is the forestalling of the enemy in the deployment of tank soyedineniya and the launching of thrusts from the march, with the maximum exploitation of the results of nuclear and air strikes to complete the defeat of the enemy in short periods of time.

The Great Patriotic War showed that in large tank meeting engagements the main condition for achieving success was the forestalling of the enemy in deploying tank soyedineniya and launching thrusts from the march against the flank of the enemy's main tank grouping. The meeting engagement of the Third Guards Tank Army with units of the enemy's First and Fourth Tank Armies during the Kiev Offensive Operation of 1943 and that of the Fourth Tank Army of the First Ukrainian Front with the First and Eighth tank soyedineniya and other soyedineniya of the enemy tank grouping during the L'vov-Sandomir Offensive Operation in July 1944 were won in this way.

We are fully aware that the means of armed struggle and the conditions and ways of conducting operations, especially meeting engagements, have changed greatly. In contrast to the past, when tank troops were the main means of defeating the enemy in a tank meeting engagement, the main means today, as has already been stated, are nuclear weapons employed by rocket troops and aviation. Tank soyedineniya and chasti, possessing great striking power, are the main means of completing the defeat of an enemy tank grouping with the maximum exploitation of the results of the use of nuclear weapons against it.

This is why the main principle of tank troop operations in a meeting engagement in the past, the forestalling of the enemy in deployment and the launching of thrusts from the march, will, in our opinion, not only be fully preserved but further developed.

A large variation in the forms of operational maneuvers and the methods of combat operations will be characteristic of modern meeting engagements.

Tank groupings of both sides will be able to use the most varied forms of operational maneuvers. The main forms will include the following: a flanking maneuver and the delivery of a tank thrust by the main forces against the flank and rear of the enemy's main grouping; a double envelopment and the delivery of tank thrusts simultaneously or consecutively against both flanks of the enemy grouping; the delivery of a powerful frontal tank thrust by the main forces to split the main enemy grouping.

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In situations involving the advance of tank groupings of both sides in several directions and the development of a meeting on a wide front and to a great depth, with dispersed troop formations, a form which provides for the simultaneous or consecutive delivery of a number of thrusts by tank soyedineniya and chasti from several directions will, in our opinion, be characteristic.

Modern means of combat and the great striking power and mobility of tank groupings make it possible for both sides, by maneuvering extensively, to use any of these forms and to combine them into different variations or alternate them during a meeting engagement. However, these forms will not always be equally suitable. Depending on the actual situation, the use of this or that form may prove inexpedient or even impossible. We will try to explain this briefly.

The delivery of a flank thrust by the main forces of a tank grouping in a meeting engagement is, of course, the most suitable for swiftly completing the destruction of the enemy. If conditions are favorable, obviously neither side will hesitate to deliver such a strike. Moreover, each side will do everything it can to create these conditions by making appropriate use of nuclear weapons, conducting maneuvers with tank soyedineniya, and containing the maneuvers of enemy troops.

The delivery of a flank thrust by the main forces of a tank grouping, in our opinion, is especially practical when a meeting engagement occurs at the beginning of operations, when troops will assume the offensive after an advance from the depth, and also during operations, when the position of the tank grouping in respect to the enemy favors such a thrust.

A situation may arise, however, in which this would require the execution of a long and difficult maneuver by large forces of tanks and the negotiation or detour of wide zones of destruction and radioactively contaminated terrain with a high level of radiation. If this takes too much time, making it impossible to forestall the enemy in deploying and delivering a thrust, such a maneuver may be inexpedient.

It must also be remembered that modern means of reconnaissance enable both sides to detect a maneuver of large enemy forces, which in turn presents them with an opportunity to destroy them with nuclear weapons. Also, while one side is executing a flanking maneuver the other side will not be inactive. It is therefore necessary to take all measures to ensure that one's own flank will not be exposed to a thrust during the delivery of a flank thrust.

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Thus, when selecting a form of operational maneuver in a meeting engagement of large tank groupings it is necessary to consider the time factor. It played an important role in the past. Under modern conditions, considering that the use of nuclear weapons in a meeting engagement can quickly change the situation and that the meeting engagement itself is characterized by sudden changes and swift maneuvers, the importance of the time factor for making a maneuver for the delivery of a sudden and powerful tank thrust during the intense struggle to gain and maintain the initiative has increased immeasurably.

A frontal salient thrust by the main forces can be advantageous when the enemy's main tank grouping has been considerably weakened by nuclear strikes or if it has not had time to deploy. Moreover, a frontal thrust will be expedient if the situation and time do not permit making a maneuver for a flank thrust in a short period of time. The use of this form of operational maneuver reduces the time needed to prepare for a meeting engagement, facilitates the swift delivery of a powerful initial tank thrust, and eliminates the necessity of complex reformations and relocations of troops (the advance and deployment is made along the shortest axis). In addition, during a frontal salient thrust there may be more favorable conditions for the maximum exploitation of nuclear strikes, for swift penetration into the depth of the enemy's operational formation, for gaining time, and for seizing and holding the initiative in a meeting engagement.

On the other hand, delivery of a frontal salient thrust by the main forces can, for example, be disadvantageous for a tank grouping which has sustained heavy losses and become weaker than the grouping of the other side or which has an insufficient amount of nuclear ammunition.

Delivery of a flank or frontal thrust during troop operations on a wide front and along different axes does not mean that all troops of a tank grouping will necessarily operate in the same way. In our opinion it is expedient to launch a flank thrust with part of the forces simultaneously with, or even during a frontal thrust by the main forces, using the favorable position of one's own tank chasti, the operations of troops along separate axes, the gaps between combat formations, breaches created by nuclear strikes, and exposed flanks. Each side will try to use these gaps and breaches for swift penetration into the depth of the enemy position following nuclear strikes.

During the delivery of a frontal thrust, a flank thrust can be delivered by the tank grouping's second echelon or reserves which in these cases are intended for increasing the force of the thrust by the first echelon, for completing the annihilation of the enemy grouping, and for developing the attack in depth.

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[illegible] the main forces of one's own tank grouping, contain enemy operations, and repel thrusts with separate chasti on the axis where the enemy grouping will launch a thrust with its main forces.

The selection of a form of operational maneuver in a meeting engagement depends to a large extent on the operational formation which exists or which can be created at the beginning of the engagement. At the beginning of the engagement this formation may be single-echelong or double-echelon. A single-echelon formation is unavoidable if the second echelon has already been engaged in a preceding attack and there has not been time to restore it. A double-echelon formation is naturally more desirable. A second echelon, or at least a strong reserve, can exert a timely influence on the course of a meeting engagement, especially in developing the attack and exploiting the results of nuclear strikes against the enemy in those areas where the troops of the first echelon are unable to do so (because of heavy losses or strong enemy resistance).

In determining the forms of operational maneuvers and the methods of combat operations of a tank grouping, it is also necessary to take into account the technical capabilities of the tank soyedineniya to execute a maneuver. The separation of attached or supporting rocket troops and their ability to quickly prepare for rocket launchings to forestall the enemy also play an important role.

Speaking of technical capabilities, we have in mind primarily the rated cruising range of the tanks. The results of incorrect evaluation of technical cappabilities in the last war are well known. In particular, delayed refueling in a number of cases placed tank armies in a critical situation. For example, during the L'vov-Sandomir Operation soyedineniya of the Third Guards Tank Army and the Fourth Tank Army had to wait nearly 24 hours for fuel on the approaches to L'vov and as a result were temporarily unable to continue the execution of their assigned mission. This slowed the rate of advance and allowed the enemy to become organized to a certain degree, which had an adverse effect on the course of the entire operation.

Under modern conditions failure to consider technical capabilities can lead to still more unfortunate consequences. Therefore, in planning maneuvers of a large tank grouping over a great distance, including those for delivering a flank thrust in a meeting engagement, the supplying of tanks with the necessary amount of fuel, their timely refueling, and the activities of the repair and reconstruction service must be considered. This is especially important in those cases in which an operation does not end with a meeting engagement (and this will often happen), and the tank grouping is required to continue the attack to a great depth.

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The methods of operations of a tank grouping in a meeting engagement, in comparison to those of the past, will, of course, have a number of special features connected with the nature and conditions of initiating and conducting a meeting engagement. First of all, considering that tank soyedineniya and chasti can advance and deploy for a meeting engagement in wide zones and along separate important axes, it must be assumed that their operations will develop differently. One chast', located in a more favorable position, can go over to the offensive from the march and swiftly develop the attack to a great depth, exploiting the results of nuclear strikes. Another, encountering strong resistance, will have to overcome the enemy. A third will be subjected to a nuclear strike and will have to repel the enemy. The simultaneous entry into battle of all chasti of a tank grouping from a single line, as in the last war, will obviously be difficult today. Waiting for chasti which are late in advancing and deploying for their simultaneous entry into battle can only result in a loss of time and, consequently, a loss of the initiative. Therefore, the consecutive entry into battle of tank chasti from different directions as they approach and deploy will be most common under modern conditions. This will apply particularly to those chasti operating in areas where nuclear strikes are delivered against the enemy.

This does not mean, however, that the efforts of the tank grouping will be dispersed. On the contrary, in all cases there must be a concentration of the efforts of rocket weapons and tank chasti on the most advantageous axes. A decisive attack by the main forces of the tank grouping with the maximum exploitation of effectively delivered nuclear strikes can bring about the destruction of a larger grouping which has not had time to deploy.

Under favorable conditions, especially in areas of nuclear strikes where the enemy has been safely neutralized, tank chasti in a number of cases can from the very beginning of an engagement successfully advance in approach march formations and even in march formations under the cover of strong advance detachments, deploying into combat formations only upon contact with enemy troops. This, in our opinion, is a new characteristic of a modern meeting engagement connected with the effort to exploit the results of nuclear strikes as swiftly as possible.

After the defeat of the enemy in a meeting engagement, a tank grouping will usually continue to develop the attack to accomplish the final objectives of the operation. This mission may be assigned to the tank grouping during a meeting engagement if motorized rifle troops arrive in time to complete the annihilation of the enemy.

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It is also necessary to emphasize the complexity of controlling tank groupings in a meeting engagement. The wide zone of combat operations, the speed of operations, and the sharp changes in the situation during the battle naturally require the use of those forms of control which will make it possible to direct troops in disconnected and sometimes even isolated areas, at various depths, and quickly influence the course of the engagement. Depending on the situation, both centralized and decentralized control can, in our opinion, be used in a meeting engagement.

During the organization of a meeting engagement and at its beginning it must be assumed that each side will attempt to centralize control in order to make the most effective use of all troops through the close coordination of their efforts for delivering the most powerful initial nuclear, aviation, and tank strikes. For this, troops will naturally be directed from the main command post.

During a meeting engagement auxilliary command posts may be organized for the control of tank soyedineniya operating in secondary or isolated areas or at a considerable distance from the main forces.

In this article we have examined only certain questions concerning the conducting of meeting engagements of large tank groupings in modern offensive operations. Unquestionably, this important subject requires further study and development.

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THE THEORY OF OPERATIONS RESEARCH

Comment by Engr-Maj Yu. PEVNITSKIY

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Voyennaya Mysl', No 7, 1963, published an interesting article by Maj Gen Engr-Tech Serv I. ANUREYEV, Engr-Lt Col V. BORISOV, and Lt Col I. SHCHERBAKOV, "The Tasks and Content of the Theory of Research Operations." As is evident from its title, the authors attempted to define to a certain extent the comparatively young, let us call it an applied, scientific discipline -- the theory of operations research.

It should be noted that among specialists working in the field of practical application of the theory of operations research there is still no uniform opinion on a considerable number of problems of the methodology of this new scientific discipline. In particular, there are differing concepts. What place does this discipline have among the others? Can the theory of operations research be identified with the totality of mathematical methods for conducting research? In what direction should this theory be developed? How should specialists in operations research be trained?

First of all we ought to consider the definition of the theory of research operations as a scientific discipline. The authors of the article gave the following definition: "The theory of operations research defines and analytically describes law-governed factors in various processes for the purpose of deriving quantitative bases, or recommendations made on the basis of them, for decision-making" (page 17). We can begin an analysis of this definition if only from the specific question: why only describe analytically? After all, the authors themselves subsequently discussed analytical and conjectural modeling. This is one of the instances when the authors' positions characterizing the content of the theory of operations research differ from the definition of this new discipline accepted by them. But as we already noted this was essentially a specific question. It is important to establish how the given definition differentiates the theory of operations research from other scientific disciplines. Take structural mechanics, for example. This science also defines and analytically describes the principles of distributing stresses in beams and girders for the purpose of deriving quantitative bases for decision-making in building bridges and other structures. But is structural mechanics operations research? Obviously, no, although the tasks we are discussing, which structural mechanics is confronted with, completely fit the definition used by the authors of the article. We conclude from this that the definition referred to does not reflect the basic content of the theory of operations research and does not permit determination of the place of this scientific discipline among other disciplines, and, therefore, requires definite clarification.

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First, it is necessary to define more accurately the concept of operations as involved in the name of this scientific discipline. By operation should be understood any purposeful action; that is, any organized action, or more precisely any action being organized. Thus, the theory of operations research by its very title is concerned with research of various processes, the basis of which is formed by the actions being organized. Since the problem of researching actions being organized is worthwhile, then one of the main questions which the theory of operations research must answer is: how expediently organized are the actions? The second and main question arises as a logical sequence to the first: what must be done to organize the actions most expediently? From here it is evident that the ultimate goal must be to obtain practical recommendations which will permit the manager to reach a decision more soundly -- that is, to control rationally. (The term "optimum control" is not used here intentionally. The concept of optimum presupposes reaching the maximum or minimum of any one criterion or criterional function. The manager who makes the decision by no means always has the possibility of using as the basis of his decision any one criterion but has to compare the results of estimates of various criteria.)

Thus we have examined what the theory of operations research studies and for what reason this is done. A final question remains: how is the research done?

Before answering this question it is necessary to dwell briefly on the similarity of elements of the actions being organized. Processes which are seemingly completely different outwardly are similar in many respects if one digresses from the concrete form of the process and examines its abstract nature. For example, if we carefully analyze a number of processes, beginning with the simplest, most ordinary and ending with more complex processes, then such processes as the flow of clients through a barbershop, documents within an institution, and aircraft through an air defense system; they prove to be similar in their abstract form. They are all characterized by having essentially one logical structure -- the clients which enter a service system, having in each case several channels; either they are serviced in a definite period of time or, if there are no free channels, turns are organized, or they leave the system.

The theory of operations research should expose the abstract nature of operations and create models of various operations which will permit making a quantitative analysis.

As a summation of these discussions we can propose the following definition of the theory of operations research. The theory of operations research is a scientific discipline which is concerned with analysis of similar elements of various operations (actions being organized),

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of similar structures, and with quantitative analysis of them for the purpose of reaching a scientific basis for rational decisions acceptible by executing organs in control processes.

As can be seen, this definition of the theory of operations research permits characterizing the nature of this scientific discipline on the one hand, and on the other hand defines its place among the other scientific disciplines as an integral part of the general science of control -- cybernetics.

Now we come to another incorrect position, in our opinion, of the article of ANUREYEV, SHCHERBAKOV, and BORISOV. In discussing the correlation of cybernetics and the theory of operations research, the authors made some misjudgements in defining these scientific disciplines and as a result came to the conclusion that "it is incorrect to consider the theory of operations research as an integral part of cybernetics" (page 26).

First let's look at their definition of cybernetics. "Cybernetics," the authors wrote, "is the science of control. It establishes the general principles of control processes independent of their physical nature and provides general methods of describing and studying the processes of control by means of the theory of algorithms and the information theory" (ibid.). In the authors' opinion, from this definition it follows that the algorithm and information theories must be a part of cybernetics and, obviously, the theory of operations research does not belong in cybernetics. We will return to this definition of cybernetics later.

The authors' second premise is the definition of operations research as "the theory of decision-making (note that this definition does not agree with the definition used in the beginning of the article). The authors further claimed that this theory "establishes the principles of the processes of decision-making in numerous fields of practice and provides general methods of studying and finding the optimum resolution of a large circle of practical problems" (ibid.) , emphasizing by this, apparently, the practical direction of the theory of operations research in contrast to cybernetcs.

The authors' third premise is, apparently, included in the following phrase: "It cannot be forgotten that the problems resolved by operations research methods arise outside the sphere of control and these problems are the overwhelming majority" (ibid.). By asserting this the authors obviously want to suggest to the reader that the majority of problems whose resolution is the concern of the theory of operations research lie outside the sphere of control; that is, outside the competence of cybernetics. This is clearly mishmash. Here the authors in fact identify the theory of operations research and the methods used by the

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theory of operations research. The methods of the theory of operations research are the methods of mathematics, and in practice almost all scientific disciplines use certain mathematical methods.

Thus, from that fact that operations research methods -- that is, generally speaking, certain mathematical methods used for resolving problems lying outside the sphere of control -- it does not at all follow that the theory of operations research lies (even if partially) outside the sphere of control. Moreover, it can be proven that the theory of operations research is concerned exclusively with the processes characterized by purposeful activity and these processes to a certain extent are definitely associated with control, since control, according to Academician A. I. BERG's definition, is the process of changing a complex dynamic system from one condition into another by affecting its variables. (Kibernetiku na sluzhbu kommunizmu, Cybernetics at the Service of Communism; A collection of articles edited by Academician A. I. BERG; Vol I, The State Publishing House for Power Engineering Literature, 1961).

Every kind of purposeful activity is always associated with decision-making; that is, with affecting certain parameters of a system for the purpose of changing it into a condition needed by the person making the decision. The theory of operations research is concerned with preparation for these decisions; that is, selection of parameters which it is expedient to affect for changing the system into the necessary conditions, and analysis of the ways of influencing these parameters. Thus, the theory of operations research is not outside the sphere of control.

We cannot agree with the definition of operations research as the "theory of decision-making." It is very tempting to give a brief definition of a scientific discipline, but in doing so essential traits of that which is being defined must not be overlooked. The meaning can be distorted, which strictly speaking, happened in this case. If the authors definitely wanted to give a brief definition, it would have been more accurate to say: "Operations research is precisely concerned with preparation for decisions and not with decision-making. This is a very important detail and it must be emphasized rather clearly.

Finally, we will discuss the definition of cybernetics. In principle the definition given by the authors was accurate with the exception of the final phrase (by means of the theory of algorithms and the information theory) which unjustifiably limits the scope of cybernetics. Apparently, to include an enumeration of the methods or theories used by a scientific discipline in its very definition is useless in general, for such a definition quickly becomes obsolete as new theories and methods are developed.

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Returning to the definition of cybernetics given in the article, it should be noted that since it is a general definition to a considerable extent it conceals certain details which are important from the point of view of the question under consideration here on the association of cybernetics and the theory of operations research.

We can introduce here, for example, a definition of cybernetics as a science "on the common characteristicsof control processes, on the optimization of control (on optimum control), and on the use of information for optimization of control." (Kibernetika, Cybernetics; Philosophical and Sociological Problems; by I. NOVIK, The State Publishing House for Political Literature, 1963, page 34).

Analyzing this definition from the point of view of the applicability of its positions to the theory of research operations it is not difficult to note that:

First, the theory of research operations also proposes an abstract approach to the control processes; that is, it is interested in their abstract nature more than their specific;

Second, the theory of operations research is concerned with problems of the optimization of actions; that is, optimization of control;

Third, the theory of operations research certainly proposes to a certain extent the use of information on the course of a process (or analogous processes) for control optimization.

At the same time, however, the theory of operations research and cybernetics are not synonomous. In contrast to cybernetics, which is concerned with analysis of any possible processes of control in nature and society, the theory of operations research is concerned with a comparatively narrow circle of control processes -- only those control process in the realm of man'n activities. From here it directly follows that the theory of operations research is an integral part of cybernetics.

It is necessary to discuss still another of the articles positions. The authors offered 2 varieties of the method of mathematical prediction -- mathematical modeling and estimate of effectiveness. In our viewpoint this division is not competent from a methodological standpoint.

Actually, the meaning given by the authors to both concepts is essentially an estimate of effectiveness. On the one hand, that which the authors call mathematical modeling is never an end in itself, but is always conducted to estimate the effectiveness of the processes being modeled. On the other hand, that which the authors call estimate of effectiveness is also mathematical modeling, since mathematical dependence

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of the criterion of the effectiveness of the actions on the basic paramenters characterizing these actions is nothing more than a mathematical model of these actions. A characteristic feature of such a mathematical model is that only a definite element of these actions is actually modeled (described by mathematical dependence). All the remaining elements of the actions are the parameters, which are essentially the results of an earlier modeling of these elements of the actions.

Thus, the authors' position on the method of mathematical prediction of actions could, apparently, be formulated in the following manner: Mathematical prediction of actions is an estimate of their effectiveness by means of mathematical modeling of these actions. If it is necessary to interprete the mathematical model itself, then this can be done, using the concepts of direct and indirect modeling fitting the concepts of mathematical modeling and estimate of effectiveness used by the authors.

In conclusion let us examine the problem of training cadres of military specialists in operations research. By proposing inclusion of a course on operations research in the programs of secondary and higher command educational institutions, the authors raised an extremely important question concerning the profundity and depth of commanders' knowledge of operations research methods; that is, the readiness of commanders of various grades to use in their practical work various methods of analysis fromthe arsenal of the theory of operations research.

Such a measure would undoubtedly be an extremely important step toward the broad introduction of scientific methods in the practice of troop control. But this is only one aspect, though a very important one, of this problem. The second aspect is associated with broadening the front of work in the field of operations research and with the creation of new developments in applying the methods of this scientific discipline to resolving practical tasks. Thus, the question is about highly qualified cadres of military specialists who are able to use the apparatus of the theory of operations research in practice to perfection, and, moreover, who are able to make their contribution to the theory of operations research.

These specialists will apparently need: comparatively high mathematical training; the ability to digress from the concrete forms of certain actions and to expose their abstract structure; a knowledge of the specific nature of military actions; and the ability to expose factors which cannot be ignored without distortion of the real nature of military actions in building mathematical models.

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Officers having operational-tactical training experience difficulties to a greater extent when they begin the study of operations research than do officers having engineering or mathematical training. These difficulties, being a consequence of insufficient mathematical training, are understandable in the all previous training and work experience of operational officers is associated with examination of concrete forms of phenomena with all the abundance of details inherent in each concrete form.

Officers having engineering or mathematical training experience difficulties to a lesser degree, perhaps, when they begin working in the field of operations research. This is explained by their lack of operational training; that is, by a comparatively poor understanding of the problems of control of combat actions and general experience in the forms and tactics of the combat employment of various arms of the Armed Forces. This experience is naturally acquired in joint work with operational officers. However, in our viewpoint, it would be expedient to teach these officers the fundamentals of operational art in a system of special courses attached to command academies.

Comment by Engr-Lt Col N. BAZANOV and Engr-Capt V. MALINOVSKIY

In modern combat, which is characterized by fast-moving actions and the employment of powerful weapons of destruction, particularly serious consequences might becaused by inaccurate operational calculations. They can be excluded by conducting comprehensive and thorough analysis of planned operations on the basis of modern mathematical methods.

The more complex combat weapons and tactics of armed conflict become, the broader and more diverse is the use of mathematical methods of research in the Armed Forces and the more important is profound understanding of them by military specialist of all grades.

In light of these pproblems, we believe Voyennaya Mysl' is showing useful initiative by publishing articles on the role of mathematics and cybernetics in military affairs and, particularly, in troop control.

Especially significant are those articles disclosing the problems and content of the theory of operations research, which is concerned with the development of methods for analyzing operations and determining the best (optimum) alternatives for using resources. Whereas the 1958-1962 articles discussed the general traits of this theory and identified it as a part of cybernetics, the article of Maj Gen Engr-Tech Serv. I ANUREYEV, Engr-Lt Col V. BORISOV, and Lt Col I. SHCHERBAKOV, published in 1963 disclosed the problems and content of the theory of operations research on a good military-scientific level and in more detail.

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In general, the authors of the article in question succeeded in correctly presenting the problems and content of operations research. We fully share the authors' viewpoint on the expediency of preserving the term "operations research" in view of the fact that today it has already practically demonstrated its viability. As for conformity with the operational meaning of this concept, the working practice of groups occupied with operations research shows that it is always easy to define the concept in question.

We cannot help but agree also that one of the reasons for wide spread use of quantitative analysis methods in military affairs was the introduction in the troops of new, powerful weapons of destruction, namely nuclear weapons, for which very little error in estimating the results of their use is tolerable, since even insignificant mistakes in this could lead to fatal surprises.

However, there were positions in the article with which we cannot agree. Contradictions made by the authors are evident even in their definition of the theory of operations research. In the beginning of the article it was correctly asserted that the theory of operations research defines and analytically describes the laws of a course of events or phenomena for the purpose of placing at man's disposition quantitative bases for decision-making in controlling these events and phenomena, but at the end of the article the authors clained it to be a "theory of decision-making" and said that this theory "establishes the laws of the processes of decision-making." With statements like these we positively cannot agree.

The fact is that the process of operations research does not examine how decision are made, but only provides quantitative recommendations which help to reach the most correct decision in a complex situation. Of course, operations research can influence the decision-making process. But the principles of applying this theory's methods in researching the processes of decision-making are the same in researching any other process.

The process of decision-making might involve the theory of research operations, for example, if it is necessary to determine the best organization of work in an apparatus, staff, or institution for reaching a decision in the fastest time with the least expenditure of resources, etc. As a result of research like this, quantitative recommendations will be obtained which the chief will need to reach a sound decision on reorganizing the work of his apparatus, staff, or institution.

In defining the place and role of operations research methods in the processes of decision-making, the authors made a number of stipulations which contradicted their main, and in our viewpoint accurate, view on this aspect. The authors stated that operations research methods sometimes permit reaching a decision [illegible] that it

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provides a quantitative basis. As an example, they cite the task of assigning targets to weapons by operations research methods to inflict maximum losses on the enemy. In their opinion such a target assignment is the sought-after solution to distribution of nuclear strikes on targets, and the commander has only to be guided by it.

The authors forget that in analyzing the results of the distribution the commander for many reasons might not agree with them. In particular, in a certain situation the criterion for assigning weapons to inflict maximum losses on the enemy might not suit him and he will deem it necessary to consider an alternative in which the maximum destroyed targets will be taken as the criterion of distribution. He might indicate the relative importance of targets and require target assignment to be carried out in these conditions. When analyzing, the results of assignment might be made more precise by allocating additional weapons or by partial redistribution of them within the proposed alternative.

All this shows that the one who makes the final dicision is free to disagree (wholly or in part) with the quantitative recommendations. At the same time, he might completely agree with the results of the calculation, but in this case they will remain only the basis for the final decision made by the commander with regard to a whole number of factors and considerations which could not be expressed quantitatively. Therefore, the authors are incorrect when they claim that in the event man disagrees with the obtained quantitative recommendations, his actions will never be the best and will not be free from gross errors.

The authors correctly noted that operations research "must supersede rough comparisons of a qualitative character and replace them with quantitative mathematical bases" (page 19). But we cannot agree that operations research will replace all subjective considerations, such as intuition, for example.

Dialectical materialism considers that intuition is the result of previously acquired experience, skill, and knowledge and that it plays a definite role in cognition.

A man who uses operations research methods in cognition of predicted control processes improves his experience and knowledge; that is, he continuously increases his intuition in this field and in turn influences the development of these methods. It is certain, for example, that all the most important factors of phenomena in the processes of prediction will be selected on the basis of common sense, which, in turn is based on experience, skill, and knowledge -- that is, on intuition.

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On page 24, the authors wrote that the hypothesis on the law of distribution of each element of an operation in researching it by means of a conjectural model is formulated on the basis of common sense. We believe that analytical methods, which are the basis of operations research, must not be looked upon as the antithesis of common sense or as a substitute for intuition, but as a method making it possible to join the experience or the intuition of specialists of a given field for achieving results which go beyond the limits of the experience or the intution of any individual person. Morever, in combat conditions, situations are possible in which it will be possible to reach decisions by intuition alone. Therefore, it is important that our commanders develop intuition and acquire knowledge and experience which can be gained in peacetime by means of operations research methods, particularly for predicting actions (for example, modeling various actions on a computer).

In examining the mathematical apparatus and methods of operations research, the authors, in our viewpoint, artificially divided the method of mathematical prediction into two varieties: mathematical modeling and estimate of effectiveness. The fact is that a mathematical model is almost always a means of estimating the effectiveness of a modeled operation or phenomenon. On the other hand, when determining the indicators of effectiveness, the creation of a mathematical model of the process whose effectiveness is being estimated, is obligatory. Almost always the researcher of an operation has to express the system under study in the form of a model. In all cases, however, they must correspond to real situations and be suitable for use and prediction.

It is not clear what the authors mean by research of a mathematical model. Optimum meanings of the paramenters of an operation are also established according to certain indicators of effectivenss. This again shows the artificiality of dividing the methods of mathematical predicition into two varieties.

In our viewpoint, the authors were wrong in stating that to obtain optimum resolutions in the field of troop control the approximation of the method of estimate of effectiveness "is more than compensated for by the rapidity of obtaining optimum resolution" (page 23). In the first place, if one agrees with this way of compensating for methods of approximation of resolutions, then it will turn out that one might not deal with more precise methods of calculation, since they, as a rule, are more unwidly. In the second place, methods of approximation yield only approximate, but not optimum, resolutions.

In reading the article one gets the impression that problems of prediction appeared only in the postwar period. We cannot agree with this either since scientific methods have always been methods of prediction to a certain extent. Science has always had to predict the most expedient

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methods of action. Almost all problems of a military nature have always been decided on the basis of methods of prediction. Of course, the old methods of scientific prediction are for the most part unsuitable for resolving modern problems. From here comes one of the tasks of the theory under study -- to develope and improve methods of research, primarily methods of prediction.

In conclusion we will dwell on how the authors discussed the connection of cybernetics and the theory of operations research. Without denying the close cooperation of these scientific directions, they sharply differentiated them according to subject, purposes,and methods. They wrote: "it is incorrect to consider the theory of operations research as an integral part of cybernetics;" and further: "there is a close cooperation of the two new scientific directions which differ according to subject, purposes, and methods" (page 26). But a little earlier, when pointing out the connection of cybernetics and the theory of operations research, the authors argued that their methods coincided exactly.

Comrades ANUREYEV, BORISOV, and SHCHERBAKOV refused to consider the theory of operations research as a part of cybernetics on the basis that the problems resolved by operations research arise outside the sphere of control processes, the general principle of which are the study of cybernetics. The authors did not cite any examples in support of their conclusions.

In our viewpoint, an impending decision cannot be outside the sphere of control processes since its acceptance is unavoidable associated with the presence of the controlling object and the object of control. Since this is so, operations research cannot be separated from cybernetics. This theory is an independent scientific direction but remains a basic part of cybernetics. In our opinion, there is no necessity of limiting the field of operations research. It can be assumed that in practice almost any application of the mathematical methods of quantitative analysis for the purpose of obtaining best organization of an operation, the best use of weapons, the best organization of combat actions, etc. are fields of operations research.

Now that our Armed Forces possess the most powerful types of weapons and are being equipped with perfect combat equipment, employing them most effectively is an extremely serious task. That is precisely why it is so important to introduce operations research methods in the work practice of management organs of the Armed Forces.

In light of this, the necessity of close coordination of operational officers with mathematicians and of appropriate instruction of the former and the latter with the aim of training specialists who will be able to utilize operations research methods effectively is

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Preparation of Operational and Tactical Problems for Electronic Computers

by Engr-Col S. PEREPELITSKIY and Lt Col I. RYBOLOVSKIY

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The article by Col P. MYASOYEDOV and Lt Col K. SAMIGULIN, "Methods of Preparing an Operational and Tactical Description of Problems To Be Solved by Electronic Computers" (Voyennaya Mysl', No 8, 1963), concerns one of the most important questions in the sphere of automation of control. Experiments in the solution of problems by universal computers in the process of military games and training exercises have confirmed, repeatedly and convincingly that the quality of solutions and the possibilities of practical application of results depend to a large extent on the quality of preparation of problems from an operational and tactical point of view, i.e., on the extent to which the operational and tactical essence of a problem and its content and methods of solution have been investigated and programed.

We share the authors' point of view on a number of points discussed in the aritcle and would like to make a few comments and express our opinion concerning the role of military specialists in the preparation of problems for electronic computers.

As the authors of the article point out correctly, the central part of the preparation of such problems is the development of a method of solution. However, in making this statement, they merely refer to the preparation of initial data, i.e. the requirements concerning the form of presenting the results of a solution, as well as a number of other secondary questions. The author say very little about the most important part, i.e., the development of a method for the solution of problems, claiming that this requires "ingenuity," "creative initiative," and "careful analysis" on the part of the researcher. Furthermore, they claim that "most of the operational and tactical problems are solved by common methods. Therefore, it is possible to find a way for the solution of any problems, regardless of their special features" (page 32). This is not quite correct, since every problem actually requires its own method of solution, and only the method of preparation is common to all. However, these methods of preparation have not been sufficiently elaborated and have not become available to military researchers. To a certain extent this situation may be explained by the level of mathematical training of officers, i.e. tacticians and operators. Therefore, in practice, there is now a fairly distinct division of labor in the preparation of problems between officers of an operational and tactical specialty and specialists in mathematics.

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The whole process of preparing problems for electronic computers includes the following stages: 1. selection of problems which may suitably be solved by electronic computers; 2. elaboration of an operational and tactical algorism; 3. operational and tactical description of the problem; 4. mathematical description of the problem; 5. elaboration of a mathematical algorism; and finally, 6. programing of the problem.

The questions examined and decided in the first three stages are mainly operational and tactical, while those in the last three stages are mathematical.

As it appears from the designation of the first three stages, we distinguish between the operational and tactical elaboration of a problem. i.e., the creation of an operational and tactical algorism, and the description of the problem. We believe that the preparation of a problem involves the development of a method of solution, which would subsequently permit the use of a mathematical apparatus and, consequently, the use of an electronic computer.

While the elaboration of a problem is a creative, investigative process based on a search for an acceptable method of solution, the description of the problem is a statement of results of such research. It is intended for mathematical specialists and permits them to make a careful study and understand the essence of the prepared problem, as well as the sequence and methods of its solution by commanders.

Whenever military specialists are sufficiently trained in mathematical research methods, there is no need to prepare detailed and cumbersome descriptions, since the military researchers will be directly involved in preparing mathematical algorisms for the problems. Such a possibility has been confirmed by experiments made in several military academies.

In our opinion, the general principle in the preparation of problems from an operational and tactical point of view consists in finding the most efficient sequence in the actions of commanders at all levels of a definite control system for the solution of such problems by them. In this connection the following should be determined: which factors and circumstances are being taken into consideration, and which factors are not considered; whether the solution of a problem by other methods (if such exist), without the use of computers, is sufficiently accurate; and whether the sequence used in a solution without computers would be the most appropriate for a computer solution. On this basis one should prepare a new sequence of actions, most appropriate for a computer solution, and a list of factors to be considered.

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The authors of the article have given their principal attention to those problems which already have quantitative methods of solution (they call them, not quite accurately, "manual methods"). In our opinion, military researchers do not encounter any special difficulties in the preparation of such problems. It is much more difficult to deal with problems which have had no quantitative solutions up to the present time and which have been solved mainly by "an act of will," i.e., on the basis of experience, intuition, and approximate estimates. In preparing such problems, the following points should be elaborated: statement of the problem; selection of criteria; indication of factors determining the process and results of solution, as well as their evaluation; determination of component parts (stages) of the problem and of the sequence of their solution; and preparation of a book diagram of the solution.

The statement of a problem includes a brief explanation, without unnecessary details but sufficiently accurate, to indicate the starting point for the solution of a problem and to explain what should be obtained as a result of its solution. It is also customary to state the conditions of the solution.

For example, the statement of a problem concerning the distribution of forces and equipment of an air army in carrying out an attack may include the following basic date: bases and troop composition of the air army; combat readiness of chasti and soyedineniya; resources apportioned to the air army (nuclear and conventional weapons, fuel, etc.); and data on enemy air defense (insofar as known to intelligence). It is necessary to establish what weapons should be used, and at what time, against certain targets. The conditions for carrying out a combat assignment are as follows: the attack is to be made in the daytime (or at night); information is included on anticipated weather conditions, and the order and methods of coordination.

For the purpose of distributing the forces of an air army, it is necessary to know the requirements for such a distribution. In this case it is not enough to indicate that the distribution must be "the best possible" or "most efficient," as it is sometimes done by operators. One must establish the specific requirements which should be met in order to make the distribution most efficient. These requirements are determined by appropriate criteria.

The selection of criteria is an important and complex matter. It is not possible to swell on it in more detail within the confines of this article. However, it should be noted that as far as the formulation and selection of criteria are concerned, all problems to be solved by computers should be divided into two groups. The first group includes problems connected with the determination of

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various characteristics of combat equipment (for example, range and flight duration of aircraft under different conditions, detection lines, geodetic and initial data for guidance systems in rocket launching, bombing, etc.). The formulation of problems of this group usually causes no difficulties and is always the same. Neither does the selection of criteria present any difficulties.

The second group includes problems connected with the evaluation of effectiveness of combat actions and the search for the most favorable solutions (or the most favorable alternates of combat actions).

In the solution of such problems, their formulation and the selection of criteria depend to a great extent on the conditions of combat actions and on the results which a commander wishes to obtain on the basis of the solutions.

Thus, in solving a problem concerning the distribution of forces of an air army, the following criterion may be established: destruction of a maximum number of enemy targets with the use of all one's forces and with a preaccepted level of losses. In this connection one may also establish a certain level of damage to be inflicted on enemy targets, and a certain guarantee that such damage will be inflicted. Or, for example, one may require that the expected amount of damage is inflicted according to a given guarantee, and with a minimum use of nuclear ammunition. In both cases, the degree of damage and the amount of guaranteed probability may vary. In the above cited examples, we have cases involving different criteria.

One should keep in mind that the formulation of a problem and the selected criteria affect the content and sequence of a solution, the mathematical apparatus to be used, as well as the time required for the computer solution of a problem. Therefore, it is very important to approach the formulation of a problem and the selection of criteria very carefully and to present them in such a way as to leave no room for doubts or ambiguities in the process of the subsequent mathematical treatment of the problem.

Unfortunately, the authors of the article completely disregarded this question, when speaking of the preparation of problems.

After formulating the problem and selecting the criteria, it is customary to develop the operational and tactical algorism of the problem. This term has recently come to be interpreted as the strict sequence of actions, logically leading to the receipt of an answer to a certain question.

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In working out such an algorism, an operational and tactical specialist makes use of his experience and practical skill acquired in the solution of similar problems without the use of a computer.

The preparation of an operational and tactical algorism usually begins with establishing the number and sequence of stages, which constitute the component parts of the whole problem. One should always try to find a sequence enabling one to use the results obtained in preceding stages as initial data for the solution of subsequent stages.

The development of an operational and tactical algorism is based on the widely used method of formalization of processes and phenomena. The essence of this method consists in breaking up the processes under investigation into the greatest possible number of stages and in discovering the mutual relation and dependence between them. This study makes it possible to establish the principles of the process as a whole. If the study reveals cause-and-effect relationships between individual stages of the process, and if these relationships can be expressed formally (in the form of logical rules, mathematical functions, charts, or tables), the strict sequence of actions obtained in such a manner will make it possible to solve problems of a definite type and may be put into practice with the help of a computer.

It should also be noted that the process of developing an operational and tactical algorism does not require an obligatory determination of mathematical functions (although that is desirable). On the other hand, in preparing such an algorism, one should be concerned not only with distinguishing stages of the problem and establishing relationships between them. One should also (whenever possible) indicate the principal methods for solving these stages. In order to be able to indicate such methods of solution, the researcher must compile a list of factors determining the course and result of the problem's solution, or of individual stage solutions, to determine which are the most important factors, i.e., which of them have a substantial effect on the result of the solution. As a rule, it is impossible to take all of the factors into consideration. Only an operational and tactical specialist, who has a good understanding of the substance of the problem to be solved, can indicate which factors should be considered, and how this should be done, and also which factors may be disregarded in certain cases. This is, essentially, what any commander does when he makes a decision after examining the combat assignment and evaluating the situation.

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The discovered factors may be divided into two groups. The first group includes factors which have already been evaluated and considered in a quantitative sense; for example, the effective strength of troops, the technical characteristics of weapons of attack and defense, temporary characteristics, etc. In the case of such factors, it is sufficient to determine the range of fluctuation of possible values within the limits of a certain problem and the required precision in regard to such values.

The second group of factors includes those which have not yet found a direct quantitative expression and are usually evaluated qualitatively. These include, for example, the political attitude and morale of the troops, the degree of training, the quality of leadership, and the organization of control. A machine solution of problems requires either the finding of possibilities for a quantitative determination of such factors, or a complete ommission of such factors. From the above cited enumeration it appears that these factors are very important and that they should not be omitted. One of the most important tasks of military researchers is to discover ways for a quantitative evaluation of the influence of factors included in the second group. In a number of cases this has already been done. For example, the indices used in evaluating the quality of training of bomber crews include the probable deviation of bomb dispersion for excellent, good, and satisfactory crews, or the time spent on a bombing run.

The principal method in the solution of a particular problem consists in discovering the physical essence of the influence of certain factors on the solution of the problem as a whole, or on the solution of its individual stages; after that one may seek ways to determine the quantitative characteristics describing this influence.

For example, in considering questions concerning the motor transport of ground echelons of units of the air force rear service area, the condition of roads is influenced mostly by the weather, as it may effect changes in the degree of road passability. The quantitative expression of this influence may be the average speed of movement of various transport vehicles on various types of roads and under various weather conditions. On the other hand, in solving problems concerning aerial photography the same factor, i.e., the weather, will have the greatest effect on the visibility of targets and, consequently, will influence the flight altitude and the required accuracy in approaching the targets. These factors can already be determined quantitatively.

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[illegible] in the solution of individual stages of a problem, an understanding of relationships between these stages, and the consideration of factors influencing the course of the solution, will make it possible to construct a block diagram for the solution of problems.

In our opinion, the authors of the article have not used a very suitable example of a block diagram for the solution of problems. The illustrated diagram does not correspond to any operational and tactical or mathematical algorisms. The operations of addition, subtraction, division, and others, are elements of a mathematical algorism (or rather of a program of solution), and the term "particular problem" applies only to those cases where so-called complex problems are solved. In our opinion, the block diagram should include the order and sequence of solution of all stages of a problem, with all of its possible ramifications determining one out of several possible ways of the further solution, depending on the results obtained in the preceding stage.

After developing an operational and tactical algorism of a problem, the military researcher prepares a description of the problem according to the following plan: general characteristic of the problem (purpose, content, acceptible assumptions and restrictions); formulation of the problem (aim of the solution, initial data, required result and conditions); suggested or existing methods of solution (operational and tactical algorism); temporary characteristics of the problem (requirements concerning frequency and allowable time for its solution by computer); and explanations (other possible formulations, reference literature, etc.).

In conclusion, it may be noted that it has not always been possible to obtain a mathematical solution which corresponds completely to the prepared description. In addition, the conditions assumed during the preparation of a problem may not always correspond to actual conditions of combat operations; this limits the possibilities of making use of the problem. An important practical conclusion may be drawn from this fact in regard to the use of computers in the work of staffs. A commander (staff officer), who uses the results of a computer solution of operational and tactical problems, must thoroughly understand the essence of these solutions and must know the type of conditions for which they were obtained. He must evaluate each time whether the obtained results are the ultimate ones for a specific situation, or whether they represent merely an approximate quantitative basis for making a decision.

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Obviously, for this type of analysis a commander must have a detailed knowledge of all factors and conditions which were definitely assumed in the preparation of a problem. A clear understanding of these questions will help a commander to find the best method of using the obtained results. During the course of combat operations, certain conditions may develop which would make it pointless to resort to a computer solution of any particular problem. This indicates that questions pertaining to the preparation of operational and tactical problems for computers are extremely important, since they determine not only the degree of automation of control processes, but also the methods in the use of computers by commanders and staff officers. Therefore, we would like to emphasize once more that the problem discussed in the article by MYASOYEDOV and SAMIGULIN is of great theoretical and practical interest and is greatly in need of a thorough discussion.

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THE DEVELOPMENT OF SOVIET MILITARY SCIENCE AFTER WORLD WAR II

by Maj Gen S. Kozlov

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The slightly less than two decades which have passed since World War II have been filled with events of tremendous historical significance. Extending to all fields of social life--political relations, economics, science and technology, ideology--they could not fail to find expression also in the military field, and particularly in military knowledge and science.

The transformation of socialism into a world system and the growth and strengthening of its vital forces were an expression of the main laws of our time. In peaceful competition with capitalism, socialism has steadily won one position after another. The relative share of the socialist system in world production has increased. The rates of development of socialist production forces are steadily outstripping those of the most developed capitalist countries and have reached an unprecedented high level. "The successes of socialist production of Soviet science and technology have enabled us to accomplish a real revolution in the military field," said N. S. KHRUSHCHEV in his historic report to the 22d Party Congress.

The policies of the CPSU, the increased defense power of the Soviet Union and other socialist countries, and the peace-loving forces throughout the world have created practical conditions for averting a world war, have changed the balance of forces in the international area in favor of peace and socialism, and have deprived imperialism of the power to decide the question of war and peace at its will. Consequently, there has been a radical change in the conditions for the outbreak of war, the threat of which continues to exist as a result of the aggressive policies of imperialist circles.

The revolution in the military field has taken place not only in the field of material means of waging war, but also in the realm of ideas. It has required a radical review of existing military-theoretical views, a working out of new principles of military science, and a thorough development of all its constituent parts and branches on a new basis.

As a consequence, these scant two decades represent an important stage in the development of military theory, and deserve careful study.

A generalization of the experience of the recent past, unquestionably, is of great interest from the point of view of solving practical problems of today. Marshal R. Ya. Malinovskiy has repeatedly pointed out the importance of work in this direction. In this connection it is appropriate also

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to recall the following statement of his: "Needless to say, the existence of the history of military science, that is, the history of military-theoretical thought, and also the history of military art, the generalization of combat experience of the past, is completely in conformity with law [zakonomerno]." (R. Ya. MALINOVSKIY. Vigilantly Stand on Guard of Peace. Voyenizdat, 1962,p 51)

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For the development of military theory, World War II, like any great war, was a great stage, one which saw great advances in the military field. It may be said that it completed the development of military art and science on a certain level, attained by the means of combat and the ways of using them up to that time. At the end of the war there appeared the first beginnings of essentially new possibilities of armed conflict, and prospects of a completely new character of such conflict were opened up. This was expressed in the use of nuclear energy for military purposes, the wide use of radio-electronics, of jet engines in aircraft, and of rockets.

Inasmuch as what was essentially new in the military field did not at once, with full recognition, break through in the realm of ideas, did not immediately gain recognition and win firm positions, so all the post-war years may be distinctly divided into two main periods, sharply differing in their content and direction, according to the views and tendencies prevailing in them.

In the first post-war period the development of Soviet military theory predominantly proceeded along the traditional path of generalization and analysis of the experience of the past war, of working out on this basis conclusions and recommendations for the conduct of armed conflict by ordinary means. This period may be considered as 1946-1953.

The second period, lasting till now, had and has as its main content the recognition of nuclear weapons as the chief means of combat. This period in turn may be divided into two clearly defined stages. During the first of these, as there began to be a distinct awareness of the new factors in armed conflict which has demonstrated new qualitative characteristics and unprecedented prospects for the future, there occurred an agonizing reappraisal of the previous experience and, mainly, an adaptation of the new weapons and means of conflict to the old views and concepts. This transitional stage encompassed the secon half of the 1950's. Finally, when the new hadtriumphed completely, there began the stage of wide dissemination of the new ideas and an intensive working out of them. Beginning at the end of the 1950's and the beginning of the 1960's with the appearance of such progressive means of delivering nuclear warheads on the target as strategic rockets, this stage continues to the present time.

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Naturally, within the limits of a journal article it is impossible to describe and analyze completely and deeply enough the exceptionally rich content of the numerous and various factors in the development of Soviet military science after World War II. We intend to limit ourselves to an elementary formulation of the problem, without pretending to any exhaustive treatment, or infallibility of our judgements.

* * *

During a great war all the pre-war principles, recommendations and conclusions of military doctrine and of the military science which supports this doctrine are put to serious, severe, practical tests. War is the great tester of the truth of any military theory. All of World War II had this significance for Soviet military science.

During the war there met in fierce conflict not only various kinds of armed forces, but also different military doctrines, and through them, the the theories on the basis of which these forces were prepared, armed and trained, and carried out combat actions. Unquestionably the result of the war depended to no small degree, along with other determining factors, on the state of the military theory of each of the sides, and on the capability of the military personnel to put into practice their military knowledge.

The victory of the Soviet armed forces in a difficult war against Fascist Germany was a triumph of Soviet military science, the basic principles of which withstood the test of fire on the battlefields of a world conflict unprecedented in scope and bitterness.

The eight years after the war were the first complete period in the development of our military theory. They were concerned with the generalization of the vast experience of the war and its formulation into ordered theory.

There is no doubt that all parts and branches of military science underwent development during the war. However, the accumulated facts and first conclusions required scientific analysis, establishment of the theoretical bases, and being put in final form. The experience and practice were extremely great and varied -- it all had to be examined, retaining what had the right to inclusion in theory, and casting aside what was incidental and not to be regarded as material for the future.

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The utilization of the objective value of this colossal experience was to a great degree undermined by the discredited methodology of scientific investigation in use at that time, which was born of the Stalin personality cult. Soviet military science even before the war was proclaimed as "Stalinist", and Stalin was considered its creator and founder. (See, for example, the article by K. Voroshilov, "Stalin and the Building of the Red Army" Izvestiya, 21 December 1939) Any further development of military theory depended on his pronouncement -- direct or implied. If there was no opinion from this authority on a certain problem of military theory, either working it out was not undertaken at all, or, at best, there was an attempt to fit the problem under one of his remarks, even if it were far removed from the subject or made with regard to a completely different matter.

Nevertheless the vital experience of the war, especially in the sphere of tactics and operational practice, was so important and obvious that it did not get stowed away in dead dogmas, but forced its way through subjective obstacles, and scientific theory got the necessary formulation.

It was worse with the higher fields of military theory -- the general bases of military science and strategy. In them the views of Stalin dominated completely.

Immediate sources for the development of military theory in the first post-war period were the printed issuances which came out during the war, including regulations, manuals, instructions, directives and orders, other operational documents, bulletins, periodicals, military-historical accounts compiled on a documentary basis, etc. The personal experience of generals and officers working in the field of military science, particularly in military training institutions, helped to understand the materials, to compile them in proper form and to systematize them, and in enriched them, made it possible to make useful theoretifal generalizations.

But the books and speeches of Stalin served as the source for the most extensive generalizations, particularly his book, "The Great Patriotic War of the Soviet Union." On a level with these sources, considered basic, stood such publications as the biography of I. V. Stalin, a number of articles published in the periodical press on Stalin's seventieth birthday, and K. Ye. VOROSHILOV' book, "Stalin and the Armed Forces of the USSR," which also appeared in connection with this birthday of Stalin.

All of these, and many other materials, published during this period, were of a plainly apologetic nature, promoted the spread of the cult of personality, and did much harm to the scientific study of the experience of the past war.

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the letter of Professor RAZIN, and the above-mentioned book of VOROSHILOV.

In his answer to Prof. RAZIN, Stalin, in an intolerable manner, tried to diminish the importance of Lenin as the real founder of Soviet military science and to ascribe that role to himself. In VOROSHILOV's book there was tendentiously set forth the role of Stalin in the Soviet military structure for the whole period of the existence of the Soviet state and its armed forces. To him was ascribed all initiative and all the successes achieved in this field. He was called the creator of all the victories won by the people and the army in the civil war and in World War II, and the founder of Soviet military science.

The anniversary report devoted to the 30th anniversary of the Soviet Army and Navy was also of a certain importance to Soviet military science in this period. In this report, expressing the ideas of Stalin on problems of military science, an attempt was made officially to define in general form the boundaries of Soviet military science, its subject matter and basic content.

Without introducing any thing essentially new in the understanding of the essence of the subject, and repeating in less precise form the well-known Lenin principle of the determining effect of economic and morale factors on success in modern war, the report gave ground for excessively widening the interpretation of the subject of military science, increasing in it the importance of economic and morale factors. It correspondingly diminished the importance of military art. It should be noted that still earlier, by the well-known thesis about the constantly operating factors, the role of military art was reduced to the organizing capabilities of command personnel. In the report it was identified only with military plans.

This was no accidental formulation, but a strictly though-out concept. A plan is the embodiment of the intention of the military leader. Carrying out the plan requires only the organizational capabilities of those who are to execute it. Thus was increased the importance of the personality of the"genius leader" and lowered the creative role of the masses, who were regarded only as "cogs on the wheel" -- executors of what has been outlined for them in advance from above.

Pushing into the foreground the problems of the knowledge and consideration of economic and morale potentials (in particular as they were fully expressed, including, as emphasized the report, the needs and capabilities of the population) limitlessly expanded the subject of military science, deprived it of its definitiveness, and made it a "science of sciences",

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Instead of correctly orientating military researchers to the necessary consideration of the economic and morale and political factors affecting the course and outcome of the war, defining their real place in military science, distinguishing as to what in this field military science would study independently and what it would receive in ready form from other sciences, using it for its own purposes, this formulation continued the lack of clarity and the confusion. Military-scientific thought was directed to the study of a multitude of problems only indirectly related to armed conflict, as a result of which there was a dissipation or duplication of effort, and the most important objects of study of military science either were lost sight of (like strategy, for example), or were regarded as of tertiary importance.

The one-sidedness to which this formulation led undoubtedly retarded the development of military theory. This was all the more so because of the fear of stepping out of the bounds set by the authority and of differing with his statements and evaluations. From this, dogmatism and the citing of authority arose and flourished, and for research there was substituted the explanation of, and finding grounds for, already stated theses.

Stalin's scornful statements about atomic weapons were the reason why our military thought was not directed in time to an objective and far-seeing evaluation of the new instruments of warfare, to the discovery and analysis of new phenomena of armed conflict and of the revolution in military affairs which had developed. Going contrary to obvious facts, study of the problems of the military art was turned to the embellished past and confined to the experience of the past war.

In spite of the expansive interpretation by Stalin of the field of military science and of the whole stifling atmosphere of the period of the cult of personality, in the first post-war years, by the efforts of officers and generals who had participated in the war, the theory of military art did undergo generalization and crystallization, especially the art of tactics and operation. Having demonstrated its superiority over the military art of a strong and skillful enemy, our military art, we may say, became classic for the typical conditions of continental practice of World War II.

Effective means were worked out of carrying on combat by combined-arms forces, involving all kinds of forces, closely cooperating with each other, in various terrain conditions, seasons, times of the day, and weather. The role and place in combat of each of the instruments of warfare was clearly defined. There developed the possibility of making more precise the forms of organization of military units, making them correspond fully to the nature of the battle being carried on by conventional means.

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Practical standards were worked out for the use of various means of combat, determined by the need to carry on successful battle against a strong enemy both on offense and on defense. The theoretical bases were established for the most rational combat formations, sequence of committing to action troops and weapons, and precise direction of them. All this was in conformity with the main idea -- ceaselessly to increase the force of attacks all the way to complete defeat of the enemy.

The combination of the power of massed attacks with maneuver was recognized as the heart of tactics. Tactics were basically orientated to the following: on the offensive -- on the creation of an impregnable, solid, deep, prepared defense. Thus tactical operations in theory were aimed at the most difficult conditions of battle, and this was correct. But as a matter of fact, at the same time there were canonized in tactics uniform methods of operations, corresponding to the former nature of combat. There is every basis to think that in tactical theory, the experience of the war underwent predominantly quantitative changes.

As a result of the extensive and varied experience of the war, Soviet operational art achieved the greatest development. In this, too, was evidenced the priority of Soviet military science in elaborating this branch of theory.

Theories of army and front offensive and defensive operations, their preparation and execution, were precisely formulated. There were defined the types of operational ob"yedineniya, their composition and, size, and the nature of coordination in operations of various scales. The theoretical basis was established for the various kinds of reserves of the Supreme High Command as a means of effecting the conduct of operations by branches of the armed forces.

There were worked out the general fundamentals of operational art applicable to operational ob"yedineniya of ground troops, and also of other branches of the armed forces (Air Forces, Navy, and PVO Strany Troops), and the theoretical fundamentals of the operational rear. It may be said that the theory of the conduct of operations of various scales within the land and land-sea theaters of operations, on the basis of the armament, technical equipment, and organization of forces which had developed in conditions typical of World War II and the immediate post-war years, was worked out with great completeness and was notable for its flexibility. And, although it contained some stereotyped patterns in the sequence of operations and the methods of use of forces and material, it was undoubtedly a great achievement of Soviet military-scientific thought.

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here the personality cult and the subjective and idealistic aspects of methodology attending it were particularly felt. It was considered that since higher military leadership remains the prerogative of the "genius leader" it was not subject to elaboration on a lower level.

"An absolute contradiction arose. The principles of the Marxist-Leninist method of acquiring knowledge were being violated. These required that one examine all the inter-relations and dependencies of phenomena of the same order on an objective, concrete-historical basis. Stalin himself often brought forth the well known thesis which gives the decisive role to strategy in relation to the other parts of military art. This indisputable methodological principle required that the art of tactics and operations be developed in conformity with the aims and principles of strategy. At the same time, even for the more or less wide circle of leaders, strategy remained a secret and taboo subject, the prerogative and the product of the creative genius of one man. Thus for the subordination of theparts of the military art there was practically no guiding and determining source, except the most general directives, often bordering on abstractions.

Therefore strategic theory was mainly reduced to the study of strategic operations which, as a matter of fact, differed in content from operations on a front level in only a few, primarily quantitive, respects.

However, the general interest in military science, caused by an awareness of its importance from the experience of a long and bitter war, could not die out, even though it was restrained by the personality cult, and, in response to persistent practical demands, it led to the creative elaboration of problems of military theory. Even in the years of the personality cult, the Communist Party spirit did not fade, the efforts of the Party to strengthen the defense of the country did not cease, and fruitful scientific studies and elaboration of theoretical problems were carried out.

It is important to note that the experience of the war, along with the interest in military art, also occasioned great interest in the general bases of our military science. There arose no doubts about the superiority of our military science to the military theories of imperialism, and inquisitive scientific thought wanted to know the sources of this superiority, wanted to know the principles and leading tenets of our science, and to have a clear picture of its subject matter and content.

The great attention paid to working out the general bases of our military science must be considered a favorable thing in the development of military science in that period. There was begun again a study of the place in this science of the problems of economic and morale factors in armed conflict, to which great importance had been assigned in the period of the formation of Soviet military science (the 1920's).

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The practical [illegible] was reinforced with new force the tremendous in the final analysis decisive, importance for the outcome of the war of the economic structure of the country, its political organization, the attitude of the great masses of the people to the aims of the war, and their willingness to make unheard-of sacrifices for the sake of victory.

The decisive role of the leadership and the organizational and ideological work of the Communist Party is the mightiest factor in making it a reality.

In 1951 the problem of the place of the theory of military economics in military science underwent wide discussion. This problem was rightly presented, but to this day it is one of those least elaborated in theory.

The point of view presented in the discussion was that military science could not be limited to a consideration only of the general laws of development of socialist and capitalist economics. Military science must know the operation of these laws in their concrete expression under war conditions, for only then can it correctly consider the economic capabilities both of its own country and that of the enemy. Thus there arises the necessity of establishing within military science a branch of knowledge which would especially study the economic capabilities of the country as applied to carrying out war-time tasks. Such a branch might become "the theory of military economics," as a constituent part of military science, along with the theory of military art and the theory of the moral factor.

This statement was received not without a fundamental clash of opinions. No one really denied that military science had to concern itself with problems of military economics or "the theory of the economic support of the conduct of the war," as it was proposed to call it. Opinions differed on the matter of classification. Some asserted that it was incorrect to insist on an independent theory of military economics, since strategy was concerned with this question. Others said that this was the concern of military geography. There was also the opinion that the problem in its general formulation was studied in the bases of Soviet military science, and indirectly in the respective parts and branches of military theory.

The discussion, although it culminated in the publication in the journal Voyennaya Mysl' of an article summarizing its results, nevertheless produced no practical results. However, it certainly promoted a more correct picture of the subject matter of military science and the range of tasks to be taken up next.

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Parallel the discussion of military economics there developed a discussion of military geography. It was, on the one hand, a continuation of the preceding, and on the other, the expression of a desire to define accurately the bounds of military science, its subject and content.

The discussion of military geography was of positive value. It helped to outline correctly the boundaries of this discipline and to clarify its place in the system of military science. Attempts of some scholars to gain recognition for the right of military geography to be concerned with the theory of the economic support of the conduct of the war rejected in the course of the discussions. Military geography was correctly defined as that branch of military science which studies the current level of the political, economic, natural, and military capabilities and conditions of various countries, theaters of military operations, and individual regions from the point of view of view of their effect on the preparation for and carrying out of armed conflict.

In this same period there was first presented (in 1952) the problem of the role and place of the military-technical sciences in the system of military fields of knowledge. This drew the attention of the military-scientific community to a new, emerging factor which is imperiously thrusting itself into the subject of military science and lawfully expanding its content.

There was also discussion, in passing, of Soviet military pedagogy, which disclosed the necessity of providing a more solid scientific base for the practice of educational work and the training of the armed forces. Unfortunately this useful discussion was not carried to the end, because some military leaders incorrectly (in our opinion) denied the existence of such an independent theory as military pedagogy, and limited it just to the bounds of methodology.

In 1953 a discussion of the nature of the laws of military science arose in the military press.

It is easy to see that this question, presented for discussion, had a most direct relation to the subject of military science and its general theory, for the very existence of military science is justified only if, in the field of the phenomena studied by it, laws operate. The discussion produced little that was useful, for many of the speeches bore the stamp of scholasticism or dogmatism, proceeding not from experience or practice, but from quotations. For example, by analogy with the presentation of the problem of the laws of economic development, the existence of a general law of military science was considered self-evident, and it was only necessary

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to formulate it. This they were unable to do. However, a positive effect of the discussion was that there was a confirmation of the interest in the philosophical problems of military science, the need for a profound elaboration of its content, and a still more careful study of the nature of armed conflict and of the laws pertaining to it.

The discussion of the subject and content of Soviet military science, published in Voyennaya Mysl', aroused great interest. This discussion arose on the basis of an article by four authors published in this journal. With no pretense to priority or infallibility of their views, the authors undertook to summarize and give some results of the numerous discussions which in various forms had taken place on this subject during the post-war period. An attempt was made in the article to give a definition of the subject of military science. It was noted that war, as a multiform social-historical phenomenon, occupied the attention of many sciences: social-political, economic, historical, and others. Military science cannot and ought not try to encompass all aspects of such a complex phenomenon as war. It analyses the means by which war is waged, the conditions in which it takes place and which affect its course and results. Based on the Marxist-Leninist teaching about war, which reveals its social-historical nature and the relationship to it of classes and states, as on an ideological-theoretical basis, military science studies the specific expression of war, armed conflict, using within necessary limits the achievements of all other sciences. However, the task of military science is not limited just to the investigation of the methods and forms of conducting armed conflict. It analyzes the means by which the war is waged, and the conditions in which it takes place and which affect its progress and results. Military science studies the historical experience of armed conflict, predicts its possible nature in the future, and reveals the laws of armed conflict which arise in various historical conditions and depend on the effect of various factors. So we cannot reduce military science just to the theory of military art. Its content embraces a number of theories, in their totality and interrelationships reflecting all the aspects of military affairs of armed conflict. In its general form, military science is the theory of military affairs.

Military science must not be regarded as a conglomeration of military knowledge. It is an orderly system of fields of knowledge relating to armed conflict. In this system there are bases common for all its constituent disciplines -- a general theory, or, as M. V. Frunze said, a general part of military theory (M. V. Frunze. Selected Works, Voyenizdat, 1951, p. 159); there are the principal parts -- the theory of military art, as it has come to be called, consisting of strategy, the art of operations, and tactics; and there are the auxiliary derivative and supporting disciplines -- military history, the theory of training and education,

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history of military organization, and military geography. An important and continually developing part of military science is the group of military-technical and special military sciences which reflect the tremendous qualitative rise and the great variety of the instruments of war, equipment and armament.

Such a complete, detailed and inter-related representation of military science should have helped military cadres correctly define the role of military theory in the preparation, instruction and training of troops, the securing of combat capability and a high degree of combat readiness of troops, for the sake of successful carrying out of military operations on all levels.

During the discussions many useful and interesting opinions were expressed which promoted a more correct and accurate definition of the submect and content of military science, and at the same time give evidence of the still inadequate working out of a number of problems of military theory.

After the death of Stalin, changes in military-scientific methodology and military-theoretical thought did not take place at once. The correct approach to overcoming the consequences of the personality cult was not found immediately, and military scientific work did not at one sweep free itself from methodological errors. The spirit of quotation, of dogmatism, continued by inertia to dominate the first year in scientific work. It required the life-giving influence of the 22nd Party Congress to find the necessary ways and methods by which to cleanse military science of everything left deposited by the years of the personality cult.

However, already in 1954 steps were taken for a complete restoration of Lenist norms and methodology of scientific acquisition of knowledge. Articles appeared which correctly evaluated the role of Lenin and of the Lenin theoretical heritage as the basic stroehouse of ideas forming the basis of Soviet military science.

There began the second post-war period of development of Soviet military science (1954 - 1960). The first, but constantly more decisive steps were taken toward trying to understand the new phenomena of arm[illegible] conflict, connected with the appearance and furious development of nu[illegible] weapons.

At first there was a purely quantitative evaluation of the new means of conflict. They basically tried to regard them as some new quantitative expression of the chief factor in armed conflict -- fire power. Although the new directions in the main correctly orientated military practice to

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the necessary evaluation of the importance of the new weapons, their was an attempt to adapt them to the established methods and forms of carrying out military operations, which Soviet theory only recently before that had so well worked out, based on the experience of the recently ended war. Then gradually theory began to work out more precisely and in a more well-grounded manner the principles for carrying out armed conflict using weapons of mass destruction. As we became more acquainted with the properties of the new weapon, with the quantities of it available, and with the improvements in methods of delivering it to the target, the methods of combat operations became more decisive and original. The purely quantitative considerations, which accompanied the first introduction of the new weapons, began to acquire a more and more clearly expressed qualitative nature.

The practical situation confronted the researchers with a multitude of new, important and basic problems, for it was not possible to draw from previous experience any conclusions with regard to the use of the completely new means of warfare.

Theory defined the radical change in the nature of war which resulted from the revolution in military affairs, which revolution in turn resulted from intensive scientific and technical progress and from the rapid development of the forces of production.

The bold and thorough exposure by the party of the personality cult, naturally provided an immediate basis for questioning the infallibility of the many theoretical principles which had been put forth during that time, the inadequate scientific ground for which had been felt from the very beginning.

One of the serious problems which for a long time occupied the attention of military researchers, and especially those writing for popular consumption was the thesis of the permanently operating factors which decide the outcome of a war. Formulated during World War II, in the main it conformed to the concrete historical conditions, and, not containing anything essentially new in comparison with the basic ideas of Lenin, it was disseminated as some kind of a Stalin discovery, having a universal character and not limited to any one period of history. To this thesis were devoted many studies, articles and monographs, which basically did not go beyond interpreting it and trying to elevate it to a basic law determining the course and outcome of any war. Such exaggerated evaluation of this theoretical position led to one-sided conclusions, to expanding the subject of military science and lowering the place and importance in it of military art.

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However, following this, the study of this problem outside the Procrustean bed of a single formula made it possible to seek anew to understand all the multiform conditions and factors affecting armed conflict. Soviet military science flexibly and creatively solved this problem on the basis of painstaking study of the totality of the real situation, considering and anticipating with the necessary completeness everything that contributes to the attainment of victory in a war against a strong enemy.

The chief importance of the 22nd Party Congress was not just that its favorable influence made possible the restoration of Marxist-Leninist methodology of military knowledge, although this was very necessary and important. The main thing was that the influence of the congress aroused the creative activity of the masses and fostered the bold posing and working out of a multitude of new problems connected with using the Lenin military heritage, and concerning the general bases of Soviet military science, particular those new problems brought into being by the rapidly advanced revolution in military affairs.

It may be asserted that the main task of Soviet military science in this period is seeking to understand and to provide the theoretical basis for one of the greatest revolutions in military affairs, a revolution of which we are contemporaries. Discovering the sources, the reasons, and the determining conditions of this revolution, our military science, supproting firm Marxist principles, has been proceeding from an analysis of the level attained in the development of the forces of production, of scientific and technical process, of the main characteristics of the historical epoch of the direction of politics and of the balance of forces in the international arena. It has established that the basis of the revolution in the military filed has been the unprecedented rise in the level of the forces of production. The furious pace of scientific and technical progress, accompanying the transformation of society, has made possible the creation in sufficient quantities of various, essentially new, instruments of warfare, of a new weapon, distinguished by unheard-of effectiveness and special qualitative characteristics unlike anything which ever existed before in this field. All the newest achievements of science and technology are being rapidly and extensively incorporated in the arming of armies and navies, and are being used by imperialism in the development of an arms race unprecedented in the scope and quality of instruments of war. The gap between scientific and technical discoveries and their application in military affairs is becoming ever less and less.

These objective material conditions were necessary preliminaries for the revolutionary transformation of Soviet military affairs in the face of the threat of imperialist aggression. Forced to enter into competition with imperialism in the quality and quantity of armament, the socialist state, relying on its historical advantage, has been able to attain superiority in this regard. The Central Committee of the Communist Party

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and appropriate government agencies, having assessed on their merits the new trends of development in this field, have undertaken bold and decisive measures for a radical improvement of Soviet military organization. Soviet science and industry have provided our armed forces with the most powerful instruments of war -- nuclear weapons of various TNT-equivalents.

At first the only means of applying the nuclear weapon to the target was the aerial bomb, and the means of delivering it, the bombing plane. At this stage of development of the new instruments of war, their unusual, special qualities were not yet fully recognized. They were to a certain degree regarded as some kind of quantitative modification of means of conflict from the air.

The new quality of nuclear weapons of mass destruction became fully evident when, in addition to the nuclear bomb, there was created in sufficient quantity and high quality the new powerful means of its delivery to the target -- rockets, especially long-range ballistic rockets.

Rockets of various types, ranges and purposes -- operational-teactical and strategic (inter-continental and global) -- in combination with nuclear warheads have become precisely the means which have radically transformed conventional means and methods of armed conflict. The whole character of war is changing -- the role and importance in it of branches of armed forces, the sequence of operations, the possibility of achieving strategic results deciding the outcome of the war. It has been necessary to reevaluate factors in the progress of the war. The importance of the morale factor has grown to a tremendous degree.

Regarding, from the position of Marxiam dialectics, moder war as a single process, Soviet military science has repudiated the unfounded attempts to make the subjects "naval warfare" and "air warfare" independent, and consequently to developme along with military science a "naval military science" and "air military science".

Discarded also was the attempt to regard strategy as something separate with regard to branches of armed forces involved. There was firmly established the concept of strategy as a single theory, by which are guided all the armed forces within the limits of armed conflict jointly conducted and subordinated to common goals.

In the realm of military art, a new relationship has been designated between the traditional methods of carrying on armed conflict: the offensive and the defensive. There have arisen new, previously unknown phenomena of armed conflict -- strategic nuclear strikes, rightfully assuming their place in the framework of armed conflict as a new category.

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Soviet military science has revealed all these new phenomena of armed conflict, has defined the essence of the deep revolutionary processes which are taking place in military affairs, and has studied and evaluated the conditions in which they arise in response to laws. As a result it has been able to give an orderly, scientifically-grounded presentation of the character of modern war, depending, unlike the past, not so much just on the experience of past wars, as on scientific prediction of a possible future war.

In the second post-war period of development, Soviet military theory was enriched by new works in all its branches. A great role in this was played by the military press and scientific and technical journals which published original and useful studies by many authors, the number of which is steadily growing. Great monographs were produced on important problems of military theory, including those on strategy. This part of military science, like military history, which had been especially harmed by the personality cult has been completely freed from its consequences. There have been published many works which have completely restored the historical truth with regard to the civil war and Great Patriotic War. Readers have received volumes completing the description of the history of the civil war, and a number of monographs correcting mistakes allowed in the elucidation of military events of 1917-1920. There were restored to their importance the works of a number of Soviet military leaders who had been victims of unfounded repression in the period of the personality cult. The basic six-volume work, "The History of the Great Patriotic War of the Soviet Union, 1941-1945," was published in which with great completeness, scientific objectivity, and party spirit the causes, course, and results of this great achievement of the Soviet people are studied. There have been published a number of other substantial works on the history of this war.

The October Plenum of the C ntral Committee of the CPSU was of great importance in this period for strengenthing the power of our armed forces. The Plenum restored the Leninist party principles of leadership of the Army and Navy, violated by the former Minister of Defense, ZHUKOV, who followed a line of curtailing the work of party organizations, political organs, and Military Councils and elminating the leadership and control over the Armed Forces by the party, its Central Committee, and the government. Separating the Armed Forces from party leadership and influence, ZHUKOV also did irreparable harm to the development of military theory. The latter was orientated to narrow professionalism, apoliticalness and subjectivism. The Plenum resolutely condemned and rejected the cult of his own personality implanted by ZHUKOV.

The extensive and many-sided theoretical development of problems of military science in the period after the 20th Congress and up to 1960, inclusively, was, as a whole, an expression of the revolution which was taking place in the military field. An analysis of the new phenomena of

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armed [illegible] theory with the use of new methods of research on the basis of mathematics and cybernetics, made it possible to predict scientifically the nature of a future war. A scientific and technical basis was established for modern Soviet military doctrine, which was called upon to change the doctrine which was in effect before that, which had depended on the experience of two world wars waged by the ordinary instruments of warfare of the first half of the 20th century. Developed on the basis of the guiding directives of the Communist Party and the Soviet government, and of the data of military science, the doctrine includes a comprehensive evaluation of the character of modern war, i.e., of its social-political and military-technical essence, sets forth the principles of military structuring, and recommends the basic means of conducting warfare with consideration of its new phenomena.

Just what are these new phenomena of warfare, the rise of which is reflected objectively by the revolution in military affairs, in the practices of war -- phenomena which are the primary subject of the study of military science?

It is generally recognized that the essence of these new phenomena consists in the fact that the use of the nuclear weapon, especially with the aid of strategic rockets, gives war an unprecedented destructive character and inter-continental scope, and favors the conduct of a swift-moving war, which, depending on the conditions of its origin, however, may also be protracted.

The destructive nature of the war is determined by the power of the basic instrument of warfare, the nuclear weapon, especially in combination with other potential means of mass destruction -- chemical and bacteriological weapons, which the imperialist aggressors propose to use extensively.

In combination with the practically unlimited range of the chief means of delivering these charges to their targets -- intercontinental rockets -- the massed use of nuclear weapons is capable in an extraordinarily short time of putting out the war any enemy by the destruction not only of his main forces on land, air and sea, but also of targets even in his deepest rear. All this is essentially changing the whole character of war, which, as N. S. KHRUSHCHEV has pointed out, has become something quite different, and is waged quite differently, from what it used to be.

Strikes by strategic rocket troops, in combination with strikes by long range aircraft and rocket-launching submarines will be basic for the course and outcome of a nuclear-rocket war, a war in which the principal means of destruction will be nuclear weapons, and the main means of delivering them to targets, rockets of various types and purposes -- this under conditions of daily combat activity of PVO troops, faithfully protecting the main instruments of warfare, groups of troops, and important targets

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the rear of the country from attacks from the air. The role of other types of armed forces will consist mainly of carrying out military operations of various scales, aimed at taking advantage of an completing the results achieved by the strategic attacks, and also at breaking up, warding off and weakening such attacks by the enemy.

By virtue of this, the sequence, relative subordination and interdependence of military operations of various scales is changing, as in the inter-relationship of types of operations.

Different from all past wars, there has appeared the possibility of achieving a strategic result, the goal of the war, not by a sequence of gradually accumulated tactical and operational successes, but mainly by direct strategic attacks. In conditions of such a war, it is difficult to imagine the possibility of conducting a defense on a strategic scale in the principal theaters of military operations. In war, it appears, meeting offensive operations of sides will predominate.

In such a war the economic capabilities of the country will be demonstrated mainly in the period preceding the war, in preparation for it, and to a less degree in the course of the armed conflict, since the latter will most probably be of short duration and so destructive that industry will prove to be limited in its capabilities of affecting the course of military operations, at least in the beginning period of the war. In case of a protracted war, the economic factor will take on an importance still greater than formerly, since the terrific destruction caused by nuclear attacks will require great efforts for the restoration of the military-economic potential, and only an economically very powerful country will prepared for waging modern war will be able to cope with such a task.

The morale potential in such a war should possess special strength and elasticity, for the psychology, will, and state of mind of the people will subjected to unheard-of trials throughout the whole war, and particularly in its beginning period.

In general, the nature of such a war will be such that the beginning period, and the result of the military operations carried out then, will be of the greatest importance for its outcome.

Having revealed and substantiated the typical characteristics and the laws of nuclear-rocket war, military science has established the necessary theoretical base for modern Soviet military doctrine, on the basis of which there is taking place further improvement of the Soviet military structure.

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Acceptance for guidance of the modern military doctrine, the basic principles of which were set forth by N. S. KHRUSHCHEV at the Fourth Session of the Supreme Soviet of the USSR in 1960, meant moving on to the next stage of the second period of the post-war development of Soviet military science, which is continuing at the present time.

The 22nd Congress of the CPSU, which adopted the new program of the Party, was of inestimable importance in the development of Soviet military science.

By the 22nd Congress the radical reorganization of the Soviet Armed Forces had been largely completed, as a result of which their power and combat readiness had immeasurably increased.

The Leninist Central Committee of the CPSU, headed by Nikita Sergeyevich KHRUSHCHEV, played a leading and organizing role in the reorganization of the Armed Forces. The correct military-technical policies of the Central Committee, the successes of industry, the outstanding achievements of Soviet science and technology have made it possible, in a relativel short time, to establish a powerful, qualitatively new, material base for arming the Army and Navy with modern military equipment, especially rockets.

The 22nd Congress summed up the results of the military build-up during the preceding years. The program of the CPSU deeply revealed the traits and characteristics of the epoch we are living in, the social-political essence of modern wars, their typical features. The principles of the program, as Marsu MALINOVSKIY Minister of Defense, noted in his speech to the Congress, are of essential importance for the correct determination of the paths of our military structuring and the solution of problems connected with preparing the people and the army for the defense of the Socialist Fatherland.

In the resolutions of the 22nd Congress the role of science was emphasized; it is now becoming a decisive factor in the growth of industrial power.

The principle also points to the growth in the role of military science, the necessity of still closer contacts of it with other sciences, especially the technical ones, and the use by it of the most modern methods of research on the basis of mathematics and electronic computer technology.

In his work devoted to the problems and tasks of modern military structureing in the USSR, "Vigilantly Stand on Guard of Peace," Mar SU R. Ya. MALINOVSKIY, Minister of Defense USSR on the basis of the directives of the party set forth in N. S. KHRUSHCHEV's report to the Fourth Session of the Supreme Soviet, described modern Soviet military doctrine, showed the role of military science in its formation, and emphasized the close

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connection between military matters and scientific and technical progress. "In setting forth the characteristics of the Soviet Armed Forces in the present stage," he wrote, "it should be noted that their power depends upon achieving an advanced military science."

The basic object of study of military science is armed conflict, since it represents the specific character of war. At the same time, certainly, it cannot ignore political, economic, geographic, national, and other factors which have a great effect on armed conflict. It considers and evaluates them in the interests of victory over the enemy. "Therefore one should refrain from an expansive interpretation of the subject of military science. This comes from under-evaluating its specific field of interest. At the same time military science must not be permitted to ignore the data of other sciences, which help to understand more deeply the political essence of war and the conditions in which armed conflict is conducted."

Along with this one important feature of military science was emphasized which occupies a border-line position between the social and the technical sciences. To it belong some features of both fields of human knowledge.

Military science is of tremendous importance for the combat-readiness of the armed forces. Now it is unthinkable to direct troops, to instruct and train them, without scientific knowledge, or contrary to science. And the further military affairs are developed, the greater will be the role of scientific theory, which makes generalizations from experience and illumines the way for practice.

Having performed its assigned role in the preparation of doctrine, military science, under conditions of putting this doctrine into practice, continues to develop in two directions. On the one hand it is called upon to provide scientific grounds for, and more deeply develop the formulated demands of doctrine, and assure its effectiveness. On the other hand, it must not limit its research and development just within the framework of existing doctrine, but look ahead into the future far enough so that no new phenomenon in military affairs, no trend in its development, will escape from its field of vision. As such new qualitative changes accumulate as require changes in doctrinal views, science presents its recommendations.

While recognizing as a basis for the conclusions of military science that the most probable future war will be a world nuclear-rocket war, our doctrine, in complete conformity with the conclusions of military science, does not ignor other methods of waging war which may arise both within the framework of a nuclear war as well as in a war in which nuclear weapons are not used.

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Soviet military science is a constantly developing system of scientific knowledge about military matters, about armed conflict. The need for it will not decrease until that day when mankind is freed from the threat of war. So long as this danger actually exists from the side of imperialism, the Soviet state is compelled to improve its Armed Forces, keeping them in full readiness for a crushing repulse of any aggressor if he dares to encroach on the peaceful, creative work of the peoples who are building socialism and the communist society.

In this connection, our military science continues to face great, varied and responsible tasks, put forth by the policies of the CPSU and the Soviet government, by the whole course of historical development, and by the difficult problems presented by the continuing revolution in military affairs.

These tasks in general form are defined by the program of the CPSU, which oblige the Armed Forces of the USSR "to display unabating vigilance with regard to the aggressive schemes of the enemies of peace, to be always on guard of peaceful labor, in constant readiness for armed defense of their Fatherland." The CPSU considers it necessary to maintain the defensive power of the Soviet state, its Armed Forces, on a level which will assure a decisive and complete defeat of any enemy which dares to encroach upon the Soviet Fatherland. The keystone of the military structure is the leadership of the Armed Forces by the Communist Party, the strengthening of the role of the party organizations in the Army and Navy. The Party does everything so that the Soviet Armed Forces may be a precise and smooth-running organism, may possess the most modern means of protecting the Fatherland, may have a high quality of organization and discipline, and may perform its tasks in an exemplary manner.

The Party is tirelessly concerned with the development of whole-hearted devotion to the cause of communism on the part of the command, political and technical cadres of the Army and Navy. "It considers it necessary," announces the program, "that the command personnel have a firm mastery of Marxist-Leninist theory, have a high level of military-technical training, and meet all the requirements of modern military theory and practice."

Military theory never loses sight of the problem of the role of the commander, the military leader, in conditions of modern war. Our science, having successfully overcome the consequences of the personality cult, is singularly correctly solving this problem on the basis of Marxist-Leninist theory. Guided by the views of the Communist Party, our military science attaches great importance to the leaders, whose role, especially in military matters, must not be under-estimated. Precise directives on this matter are given by the materials of the 22nd Party Congress. "The

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authority of the party officials, of its leading figures, is a great possession of the party. While rejecting the personality cult, we by no means put aside the problem of developing leading figures of the party and strengthening their authority. What is all amounts to is that the party leaders have moved up from the party masses by virtue of their talents, their political and administrative qualities, and have been closely connected with the communists and with the people. This was the way the formation of party leaders operated during the life of Lenin. And so it should be now." This principle applies fully also to the military leaders of the Armed Forces of the socialist state, who are nominated by the party and worthy of the trust of the people and the government -- true and devoted sons of the socialist Fatherland.

Based on the Marxist-Leninist doctrine of war, which is developing and being enriched as an ideological-theoretical foundation on the great wealth of Leninist fundamental ideas in it, on the achievements of advanced science and technology, and on the vast historical experience and practice of military organization, progressive Soviet military science, personified by a great army of military scholars and practical workers in military affairs, is responsibly fulfilling its duty to the Soviet Armed Forces.

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The Unified Automated Control System of the US Armed Forces by Engr-Col V. LEBEDEV

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Radical changes in the nature of modern warfare brought about by the appearance of nuclear-rocket weapons required the creation of a suitable armed forces control system based on the broad use of automated systems. In the first stages of development, these systems were primarily adopted into a control system for the separate branches of the armed forces -- the air defense forces, the air forces, the navy, and the ground forces. This, however, proved to be inadequate for the present time. Time magazine pointed out that "the armed forces control system was designed in such a way that during a general war it might prove to be in the position of a chicken with its head cut off. In the event its mind and nervous system are destroyed, its muscles with start to twitch convulsively and uncontrollably." (Time, 28 December 1962)

The following shortcomings of the present armed forces control system were noted in the US press. First, it is not automated enough, which does not allow the government to react quickly to changes in the international situation. Second, it does not have reserve command posts and does not define a precise order for transferring functions when one control organ or another is destroyed. Third, the control organs are inadequately protected against weapons of mass destruction and cannot provide contrinuous control in conditions of great destruction, radioactive contamination, or under the actions of chemical and biological weapons. Fourt, the control system involves separate lines of communication belonging to private companies, various institutions, and branches of the armed forces. The communications lines and installations are vulnerable and are not protected against nuclear strikes. Radio links are inadequately protected from interference and do not meet security requirements. The system does not provide for proper control over nuclear weapons, which would exclude the possibility of accidental or ill-intentioned use of them without the sanction of the supreme command.

As a whole the present control system does not ensure unified control of all branches of the armed forces, either in peacetime or wartime. That is why it became necessary to create a centralized automatic control system which would guarantee continuous control of the entire military machine, even in the event its separate elements are put out of action.

This was especially emphasized by professor O. Morgenstern of Princeton University, who is a US Department of Defense consultant. In the January 1963 issue of Fortune magazine, he wrote that for the US at the present time there is no more important problem than that of creating an accurate structure of command and control of the armed forces and the government. "It is absolutely necessary," he declared, "for us to be sure that in any condition all military orderse reach those who will carry them out and that feedback is ensured for the intelligence coming from below.

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If we do not provide a satisfactory control system, we will be deprived of the possibility of undertaking the optimum political action in time of crisis, which could affect the very existence of the nation." US military leaders express similar thoughts.

Considering the importance of this problem, the Secretary of Defense submitted a special report to the government on the necessity of developing a unified automated system of control of all the armed forces on a national scale. Together with this, he recommended a radical reorganization of the existing control system.

On the basis of this, in 1962 the decision was made to develop the system which became known as the National Military Command System (NMCS). (See diagram.)

The development of technical means of control, particularly means of communication and computers; accumulated experience in developing large automated systems for controlling troops, weapons, and combat equipment; and especially systems for controlling strategic forces, weapons of attack, the combat actions of ship soyedineniya, and active air defense systems with the successful application of computers for resolving special problems in the Department of Defense and other government agencies were the main prerequisites which made it possible to create this system.

The armed forces control system of the country, as the Secretary of defense pointed out in the report, will be used in the interests of the President, the Secretary of Defense, the Joint Chiefs of Staff, and their deputies and aids.

The most important elements of the NMCS system will be the command posts, the centers for processing data, the apparatus for collecting intelligence information, and the lines for transmitting the data connecting this system with joint and special commands.

The main command post is planned for location in the Pentagon. It is already completely staffed withpersonnel and will carry out command functions in peacetime and in periods of limited and general war until a higher authority considers it necessary to transfer control to the reserve posts of this system, or to any other center. For this purpose, the creation of three reserve posts is foreseen, one of which is located on a renovated turbojet aircraft -- the KC-135 tanker, and is already in operation. The second reserve post is being built on board the heavy cruiser North Hampton, and the third in Fort Ritchie.

Lines for transmitting data to the joint and special commands and to services and administrations of the Department of Defense are being built on the principle of communication from above to below. They must provide unified communication and control from the strategic means of delivering nuclear warheads to target. (Electronics, April 1963)

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The NMCS has also been entrusted with the task of providing an emergency government line of communication in the event the civilian system for control of the country goes out of operation.

"Contracts have already been concluded for developing the apparatus of the NMCS system. Appropriations for its realization were foressen in the budget for the 1964-1965 fiscal year. The program is planned for realization in 3-5 years. Approximately 300-305 million dollars will be required for this.

In view of the complexity of this program, realization of it will be accomplished gradually. At first, this system will provide for collection and display of data on the dispositions, degrees of readiness, and combat capabilities of the armed forces of the US, its allies, the neutral countries, and the enemy. This same system will report data on the conditions of the US armament, including the number, type, and disposition of it, and also information on the world military-political situation.

In developing the NMCS system, it is supposed that a high degree of standardization of various blocks and assemblies will be achieved. For unification of various sub-systems, special standard transitional equipment is being developed. It will make it possible to use any of the present systems of data display from any computer. Use of the transitional equipment will make it possible to include already existing sub-systems in the projected system without revising the whole complex.

In planning the system they are trying to avoid those shortcomings which appeared in the creation of the well-known Sage air defense system. After this complex and expensive system was put into operation, it turned out that the operators could not receive all the information they needed from it.

The NMCS system is supposed to be built with such calculation that it will be able to adapt automatically to unforeseen requirements as they appear. It can be revised while in operation.

The system of transmitting wartime data will be based mainly on the recently created unified global communications system of the US armed forces. It includes the Stracom strategic communications system, supported by communications centers in Fort Dietrich, Maryland, which is expected to accomplish automatic communication of 275,000 telegrams a within the US. Two other communications centers in Fort Leavenworth, Kansas, and Camp David, California, will provide a volume of 200,000 reports a day.

The system also includes the USAF global communications network being developed by Project 480L, connecting 80 command posts (60 in the US and 20 overseas). It will include the communications network of the US air

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defense forces -- NORAD, counting nearly 60 million channel miles and connecting NORAD bases in the US and Canada, and the BMEWS system with its networks stretching from Alaska to England, and a number of other networks.

To increase the reliability of international communications, the global system in the nearest future is supposed to be augmented with multichanneled lines of communication using artificial earth satellites. The first experimental launchings of communications satellites Echo, Courier, Syncom, Relay, and telstar, despite a number of difficulties, proved the feasibility of their use for military communications.

The global communications system will cooperate closely with a special network of government establishment serving 8,000 establishments in 1,750 US cities and with the largest private lines of communication, thus providing an outlet to civilian communications networks, leasing a number of lines, and developing communications in strategic directions in the interests of the US armed forces.

Control and construction of the military communications system has been entrusted to the Defense Communications Agency. The center of control of this system is located close to Washington. It permits viewing signal panel and makes it possible to control them by means of the M-2000 computer. This network will service all branches and arms of the armed forces and services of the Department of Defense. It is supported by four basic communications centers in Europe, Alaska, the Hawaiian Islands, and the US. Four IBM-1410 computers are being installed in these centers for controlling the switching of channels. The main centers will united nearly 6,5000 separate lines of communication in 70 countries, being joined by 79 main transducer centers.

Responsibility for development of this system of control of the armed forces has been placed on the Joint Chiefs of Staff, the Defense Communications Agency, and the directorate of defense research and development.

A special group has been created in the Joint Chiefs of Staff which has been entrusted with the elaboration of operational data on the system with consideration for the needs of the President and the Secretary of Defense. These data would form the basis for the technical planning of the system.

Together with the creation of the NMCS system, the US command for several years has taken all measures to protect various government organs from nuclear rocket strikes and to ensure the survival of the whole armed forces control system in wartime.

In October of 1961, the News and World Report published an article pointing out that there was being created a reserve government in the US which will operate in deep caves in an emergency capital capable of surviving a nuclear attack.

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It was noted in the magazine that a special communications system using cables and radio has been planned to ensure the activity of this government. To enable it to withstand a nuclear strike, special structures are being built for it.

In addition to this, a special line of succession has been established which envisages the order of succession of presidential power to one of 20 high ranking officials.

The reserve government, composed of surviving high ranking officials, is to be located in an underground capital 480 kilometers west of Washington. Government agencies will be located in a so-called government arc stretching several hundred kilometers. According to the author of the article, there ar 94 secret centers in this arc which have been prepared for the disposition of government agencies. A number of the centers, concealed in the ground, are able to withstand explosion, radiation, and are able to protect the officials from radioactive and chemical agents. Some of the centers are located in natural shelters. At the present time, 30 general government departments have personnel who constantly work in 52 emergency centers.

Outside this federal arc there are another 400 government establishments dispersed throughout the country from which the departments and other government organs must exercise control of the state and the military machine in the event the permanent center are destroyed.

Each secretary or prominent government official has clearly defined duties in the event of war. For example, the Secretary of Commerce is responsible for providing repair and movement on the highways and railroads, for regulating the use of commercial aircraft and ships, determining the meteorological situation, and for forecasting the movements of radioactive clouds. The Secretary of Agriculture, together with other tasks, is responsible for the organization of a rationing system for the distribution of foodstuffs.

A sequential transferrence of command functions in time of war has also been developed according to the chain of command. In the event the Pentagon is destroyed, the function of the general headquarters will transfer to one of several small Pentagons located close to Washington. One of these reserve centers of control is located in Fort Ritchie, 50 kilometers north of Washington. It is a 3-story building with the solid blast-proof doors. It is situated in a natural mountain cave.

Each of these little Pentagons will have constant radio and telephone contact with the President and with the eight district headquarters. In addition, they will be connected with the headquarters of the Strategic Air Command, which is responsible for delivering nuclear strikes on the enemy, and with the headquarters of the air defense -- NORAD. Both of these commands will also have sheltered command control centers.

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One of them, the sheltered command post of the combined commands of antiair and antirocket defense of the North American continent is being built in Cheyenne Mountain. According to the US News and World Report, a million tons of granite have been extracted from the mountain and underground corridors and rooms nearly five kilometers long have been built there. (US News and World Report, 23 September 1963)

The NORAD command center will consist of 11 armored rooms. It will be located at a depth of more than 700 meters. Eight larger buildings will have three stories 18 meters high. The total area of the underground buildings will exceed 16,000 square meters. They will provide working places for 250 men to work simultaneously, and in the event of war, bedrooms, dining halls, and hospitals for 750 men will be organized in them.

Entrance to the shelter will be protected by massive explosion-proof armored doors weighing up to 14 tons each. Special filters will keep out radioactive dust, chemical agents, and bacteria.

Steel armor around each building is intended not only to protect from the effects of strikes, it also provides shielding for radioelectric apparatus from the powerful electromagnetic waves arising from nuclear explosions.

The complex of buildings will have its own systems of water supply and electric power, heating facilities, and air conditioning systems.

In the communications network center will be six independent outlets to lines of communication. Radio and radio-relay communication is installed with the command centers of the continet and there will be direct lines of communication with the headquarters of the Strategic Air Command, the Pentagon, and the White House.

Security and survivability of the lines of communication of the NMCS system are achieved due to the use of various modern means of communication: shortwave and ultra-shortwave system, wide-band cables, frequency-division multiplexing apparatus, lines of ionosphere and troposphere dispersion, superlong waves, and the use of satellites and communications rockets. The complex of communications facilities will also include national government and private communications networks. Providing stability for transatlantic lines of communication calls for special concern.

Americans recognize that the present technology of security is inadequate. Moreover, providing security is considered a difficult task. One of the ways of resolving it is to develop special wide-band equipment which will permit transmitting digital data and telephone conversations on secure lines of communication (bearing in mind underground and underwater cables).

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effort to create an armed forces control system which would satisfy the requirements of modern war, and they are spending enormous efforts and means for this purpose.

Undoubtedly, the development of complex radioelectronic complexes, extensive work in the creation of underground command centers, and procurements of numerous and diverse equipment is of considerable advantage to US monopolies. Therefore, plans for the creation of such organs of control as the national NMCS system are finding great support from them and are widely discussed in the press.

FORCES AND MEANS OF COMBATTING SUBMARINES
by Capt 1st Rank Yu. KOLESNIKOV

Among those works systematizing information from the foreign press on the contemporary level of forces and means of combatting submarines, the book by A. A. KVITNITSKIY is one of the most successful. (A. A. KVITNITSKIY. Bor'ba s podvodnymi lodkami, Combatting Submarines, bases on foreign materials. Moscow, Voyenizdat, 1963 128 pages.) Although not large in content the work as a whole gives an idea of the level and paths of development of antisubmarine forces and means abroad, above all in the US Navy.

The ruling circles of the US pay particular attention to the development of forces and means of combatting submarines and to antisubmarine equipment of sea and ocean theaters. Expenditures for these objectives are characterized by the following data (Electronic News, July 1963):

Articles of Expenditure	1961-62	1962-63	1963-64 Estimated
Total for antisubmarine defense measures (millions of dollars)	approximately 1500	approximately 1800	More than 2000
That part of the above for research and elaboration of means for detecting and destroying submarines (millions of dollars)	233	300	373

A great scientific and technical apparatus is being enlisted to elaborate new and perfect existing types of antisubmarine equipment in the US and significant productive power is being employed. More than 200 firms are working in the field of electronic equipment for antisubmarine systems and antisubmarine ships and boats construction alone.

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The book also describes how this part of the military budget is being spent in the US.

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The author acquaints the reader with the general organization of antisubmarine defense in the Atlantic and Pacific theaters (Chapter 1). He cites information on the depth of the coastal antisubmarine defense of the North American continent (600 miles), indicates measures for augmenting antisubmarine forces in ocean theaters for the past three to four years, and also on the development and training of antisubmarine forces and means, and states the views of the US command on the organization of antisubmarine defense by soyedineniya of combat ships and convoys in the ocean (sea) when nuclear weapons are employed.

Existing US means and systems for detecting submarines are examined in the book and the basic characteristics of various types of this equipment and immediate prospects of development are given (Chapter 2). Aviation means for detecting submarines are radar equipment on the aircraft R2V Neptune and Lockheed P3V-1 Orion, towed sonar devices employed by helicopters and dirigibles, and aviation sonobuoys and magnetic detection devices.

Concerning shipboard means of detecting submarines interesting information was given on sonar gear installed on US Navy surface ships (AN/SQS-23, AN/SQS-26) and on submarines (AN/BQ-1, AN/BQS-2), towed sonar systems for surface anti-submarine ships, including the new killer system with variable depth sonar.

The readers attention may be drawn to information on the equipping of the Atlantic and Pacific coasts of the US with stationary sonar systems under the conditional designation Project Caesar and to the work underway in the US to perfect stationary systems for the long-range detection of submarines (Projects Artemis, Atlantic). Not of limited interest is the information on the elaboration of the computer Cyberton for identifying submarine targets, a brief interpretation of means of search, and the creation in the US of means for detecting submarines based on non-acoustic principles (analyzers of diesel exhaust gases present in the atmosphere, infrared instruments nothing the heat traces in water where submarines are moving, and instruments for registering radioactive traces of atomic submarines).

The examination of hydroacoustic and other systems emphasizes the statements of foreign specialists that despite significant successes of the US in this field the creation of an actually effective means of submarine detection has not yet been effected.

The author devotes the third chapter to the characteristics of basic systems and models of modern antisubmarine armament on ships and aircraft of the US Navy in addition to antisubmarine ships of England, France, Italy, Sweden, and Norway. The reader may acquaint himself with several of these designs (Caesar, types of depth bombs, and

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basic [illegible] antisubmarine system Terne, a means of detecting submarine targets, destroying them, and directing fire, is examined in more detail than other depth charge devices. Here the characteristics of various types of antisubmarine torpedoes are given and also information on the projected standardization in the US of four torpedo types -- Mk-37, Mk-44, Mk-45, and Mk-46 -- which arm antisubmarine surface ships, submarines, and aircraft. Discussed in more detail (as much as information published in the open foreign press permits) are the new complexes of the US antisubmarine armament -- the rocket torpedo Asroc for surface ships and the Subroc for submarines; designs for US ship armament according to weapon types are reported; consideration of foreign specialists on the ways to perfect rocket torpedoes and, particularly, on the physical bases of gravitation, are introduced effectively. Moreover, there is some brief information onbomb and torpedo armament of US antisubmarine aviation and on eht search for a technically acceptable version of an aviation antisubmarine rocket-torpedo.

Acquainting the reader with US carriers of antisubmarine weapons -- surface ships, submarines, aircraft and helicopters (Chapter 4), the suthor reports information on ships of post-war construction: the US Leahy and Coontz Class Guided Missile Frigates; on the improvement of antisubmarine and antiaircraft armaments on various types of US destroyers and on the apparent tendency to refit a number of ships for landing antisubmarine helicopters. There is a brief statement on US measures for construction and development of antisubmarine ships on hydrofoils and air cushions, including air cushioned ships with atomic-powered engines.

The author presents the views of the US command on the role and significance of atomic (special construction) and diesel submarines for executing antisubmarine missions. The characteristics of various types of American antisubmarine aircrafts are given: the P2V-7 Neptune, Grumman S2F Tracker, Lockheed P3V-1 Orion, P5M Marlin; the Canadian CL-28 Argus, in addition to US and Canadian helicopters.

In the last two chapters of the book aspects of combat training of Navy antisubmarine forces personnel are examined and certain sides of the tactics employed by them are elucidated. In the examples of exercises and maneuvers carried out by the US Navy in recent years, independently and jointly with other navies of the capitalist states, the author shows the scope of antisubmarine soyedineniya, and discloses the tendency of the foreign press to highlight successes allegedly achieved in the course of combat training of US antisubmarine forces.

Thus, A. A. KVITNITSKIY's rather short book acquaints the reader with the basic aspects of the activities of the US and of several other states in the field of developing forces and means of combatting submarines, and particularly with the methods for executing this mission.

The following would belong to the [illegible]

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The title of the book, Combatting Submarines, does not fit its content. Of the 126 pages of the book only the last chapter (116-126) speaks of the tactics of antisubmarine defense forces and means. It seems to us that it would be more applicable to call the book differently -- "Forces and Means of Combatting Submarines."

It would also be more expedient to expand the fourth chapter somewhat. After the characteristics of the carriers of US antisubmarine weapons it would follow to dwell briefly on the development of antisubmarine forces in other NATO countries. In support of this thought we introduce the statement of the US Vice-Adm G. Tech [sic]: "The navies of a majority of our allies have significant forces designed basically to combat enemy submarines. Thus the West Germany Navy can be employed to combat Soviet submarines in the Baltic Sea. The Turkish and Greek fleets should help us to stop the exit of Soviet submarines from the Black Sea through the Dardanelles. The Italian and French fleets have the mission of being in readiness in the Mediterranean Sea. The Norwegian and British Navies must help us to combat enemy submarines in the Norweigan Sea and in the Danish Straits." (U. S. Naval Institute Proceedings, January 1963) He speaks further on the hopes placed on the antisubmarine forces of Canada, Japan, and demonstrates to the reader this association of antisubmarine forces even if only about their technical level.

Of well-known interest, for example, is the decision of the Canadian Minister of Defense on the construction from 1963 to 1968 of eight frigates armed with antiaircraft guided missile complexes and helicopters with variable depth sonar (Canadian Shipping and Maritime Engineering News, 1962) and also the proposed placing of a heavy antisubmarine helicopter on two of the last (of the four being built in Canada) escort destroyers of the Mackenzie Class and carrying out plans for antisubmarine helicopter carriers of small displacement (for nine helicopters).

There are also insignificant inaccuracies in the book. Thus, on page 61 it states that "the warhead of the rocket-torpedo Asroc is...the acoustical antisubmarine electric torpedo MK-44 with a conventional change." It should have said: According to other information -- with a conventional or nuclear charge. This is important.

When the principles for employing the rocket-torpedo Asroc (page 62) are stated one is given to understand that they must be launched in all eight directions one after the other when in fact they can be employed singularly and serially.

In examining the question of the place of US Navy aircraft carriers in the antisubmarine defense system (page 79) the opinion of foreign specialists on the inexpediency of rearming obsolete aircraft carriers as antisubmarine defense helicopter carriers is pointed out and nothing is said of the plan being worked out in the US for designing antisubmarine

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aircraft carriers with atomic energy installations as swift-moving carriers of antisubmarine airplanes and helicopters equipped with constant and variable sonar devices. As a result there is established a not fully correct representation of existing and future helicopter-carrying ships in the US Navy.

When considering the views of the US command on the meployment of antisubmarine forces in war, the author combines concepts which are different in content: "Blockading submarine bases and the areas where they are deployed, "we read," can be effected by means of organizing powerful antisubmarine from moving through antisubmarine barriers, seaching for and destroying them in deployment areas are all various methods being considered by the US command for combatting submarines.

On page 27 there is an inaccurately formulated thought: "The chief distinction of modern positional systems consists in their being designed for long-range det. ction of submarines and defense (the emphasis is ours--editor) of a wide coastal area primarily againts rocket-carrying submarines." But systems for the long-range detection of submarines, while insuring the dissemination of responsible and factual observations, still do not in themselves execute the mission of defending the coast from anybody. If, as a further component of these systems, the US designs underwater platforms which are armed with self-guiding rockets or torpedoes (U. S. Naval Institue Proceedings,1963) then the term "coastal defense" to some degree (depending on the range and accuracy of detection and fire) will be justified.

On page 38 the river is presented with the foreign sensation of the alleged creation in the US of the hydro-acoustical system Amfar [sic.] for super long-range active detection of submarines and of a certain British hydro-acoustical system for super long-range detection, allegedly capable of detecting submarines when they leave their bases. It seems to us that it would follow to refrain from repeating this completely unreasonable boasting of the foreign press which is recognized by everyone as a means of propagandizing the Atlantic power of NATO.

It would be better to combine the last two chapters. If this were so it would be possible to coordinate several examples of tactical combat with submarines with the experience of exercises carried out in recent years by the antisubmarine forces of the US and NATO Navies.

And finally, a small detail, concering the publisher. The binding of the book is decorative. It does not go with the austerity, conciseness, and practicalness of the book's content.

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Cybernetics in Military Affairs

by Maj Gen Arty V. ROZHDESTVENSKIY

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Our military literature has been enriched by an interesting and necessary book. Its author, M. N. GONCHARENKO, is known to Soviet readers by the first edition of his popular work, Kibernetika v voyennom dele (Cybernetics in Military Affairs), published in 1960 (the second, revised edition was published in 1963 by the Dosaaf Publishing House, Moscow; 344 pages), and also by his popular scientific book, Rakety i problema antiraket (Missiles and the Problem of Antimissile Missiles), published in 1962.

Even though the period between the first and second edition was relatively short, i.e., 3 years, important events had taken place in the life of our country, the most important one being the 22d Party Congress which adopted a new CPSU Program. It is stated in this program that in the not too distant future "the introduction of highly perfected systems of automatic control will be accelerated. Cybernetics, electronic computers and control devices will be widely applied..."

The party and Soviet government are giving much attention to the development and introduction of cybernetic systems in our country and have supplied our Armed Forces, on the basis of cybernetics, with first-class military equipment. The book is devoted to this urgent, present-day topic.

The book under review contains a great deal of factual material, which is generalized with a wide knowledge of the subject. The second edition has an interesting introduction and includes several new chapters: "Cybernetics and Its Problems in Military Affairs," "Problems in the Use of Cybernetics for the Solution of Operational and Tactical Tasks," "Modern Means of Communication and Cybernetics," "Electronic Trainers and Teaching Machines," and "New Developments in Electronic Computers."

The book includes information on the latest achievements in the sphere of general and military cybernetics, the latter being one of its applied branches. The author presents to his readers the basic ideas and principles of general cybernetics, defines and describes the content of military cybernetics.

The book describes the control of troops and rear services of armies and of military equipment by means of instruments and machines of technical cybernetics.

The author believes that the law of dialectics concerning the transition from quantity to quality serves as the basis of military cybernetics, on which science will be able, in the next few years, to

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The introduction stresses the superiority of domestic achievements in the field of technical cybernetics, as compared with foreign achievements. The author aptly quotes the prophetic words of Lenin, which were spoken at the outset of socialist building, saying that "from now on all the miracles of technology and all the achievements of culture will become the property of all people."

Leading bourgeois scientists have misgivings about the further development of cybernetics. The creation and successful perfection of so-called cybernetic teaching machines, in the opinion of N. WIENER, founder of cybernetics, constitutes a threat in the event of their imprudent use in military equipment. A machine "thinks" more quickly than a human being and, at a moment of danger, men may not have enough time to think and to switch off a machine promptly, while the machine at this time, having received information and processed it "with the speed of lightning", will "push a button" to trigger the weapons of world destruction. It is known that a modern machine, playing a game of chess, is also to beat its programer. What assurance can there be that a machine, in the above described situation, would act "reasonably?"

The scientist quite rightly sees the greatest danger in the planning of a third world war and warns against the use of cybernetic machines in such a war.

Cybernetic technology is the technology of the developing Communist society. Therefore, it is based on a social problem, and N. WIENER, as a bourgeois scientist, does not understand this.

M. N. GONCHARENKO writes in an absorbing manner about the history of numbers, magnitudes, and computing; he shows how gradual progress has been made in comptuing, resulting in modern, electronic, high-speed computers which make 100 billion computations per workday. The author includes interesting examples for the practical use of electronic computers in military meteorology, in the launching of artifical earth satellites, as component elements of combat systems, etc.

The book explains the fundamentals of military cybernetics, which is the basis for the development of new devices for the control of equipment and troops.

The readers learn about interesting, adaptive, automatic control and regulation systems. The interest in this type of cybernetic adaptive systems is caused by the fact that they have long-range importance in military engineering. For example, there are now in existence antitank, antimine, naval, reconnaissance, and other types of "systems," used by the navies of foreign countries.

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The theory of information is the basic principle of cybernetics; it is the key to an understanding of its essence. Usually, this kind of material is hard to read, as it abounds in complicated mathematical formulas. However, the author has avoided the use of complicated formulas and has replaced them with popular explanations, thus making a very difficult section of cybernetics understandable to all readers.

We might mention here that it is greatly to the author's credit that his popular explanation of cybernetic principles does not detract from the scientific content of the book.

The chapters dealing with the use of cybernetic machines in modern branches and combat arms of the Armed Forces are filled with extensive factual material. Numerous examples relating to foreign armies illustrate the use of cybernetic machines and devices in aviation, antiaircraft defense, artillery, rocket troops, and in the navy. In particular, the book gives a description of the complex control system "Subik" [Subic?], the "Malafon" guided antisubmarine missiles, and the new "Typhon" air defense system on ships. The author also writes about the use of cybernetics in the navy for navigation purposes and for precise launching of rockets from submarines and of artificial earth satellites. Description are given of the cybernetic, tactical, communications system "Basic," the latest type of printing apparatus, a station for tropospheric propagation of ultrashort waves, and a system of artifical earth satellites as means of communication.

The book contains very detailed material on the use of cybernetics for the solution of tactical problems (pages 174-216). There is a line diagram for "Field Data" -- an automatic control system of US Ground Troops, and a description of an artillery center for fire control. An example is given for the solution of a tactical problem by an electronic machine, and several types of cybernetic machines used in the US Army for reconnaissance and for securing combat formations, are described.

The use of electronic trainers in the training of pilots, cosmonauts, and other specialists is discussed. Possibilities are offered for the use of teaching machines in the training process, thereby replacing teachers and instructors.

The book describes the achievements in air defense (pages 133-173). Cybernetic control systems for active air defense are discussed. The "Sage" system is described in detail and critically evaluated. In addition, the author discusses the fact that the design and control of artificial earth satellites is based on the use of the achievements of cybernetics.

The publication of this successful popular-scientific book is a great contribution by the Dosaaf Publishing House to the propaganda of new technical equipment, thus furthering the education of technically competent

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The author recommends his work to Soviet young people who have daring and a thirst for knowledge and who are studying military affairs. One may say without exaggerating that Cybernetics in Military Affairs is a valuable contribution to our Soviet popular scientific-technical, literature. The book is devoted to the leading, current topic of our time. A wide circle of military readers will find in it clearly understandable and interesting information on the most modern science, i.e., cybernetics and its application to military affairs. The book includes many good sketches and diagrams. Those who read Cybernetics in Military Affairs will enrich their knowledge and widen their horizon. It will be useful to have this book in one's personal library.

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