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CENTRAL INTELLIGENCE AGENCY  
WASHINGTON, D.C. 20505

24 February 1976

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (USSR): Methods for Determining  
the Combat Capabilities of the Troops of an Army  
in an Offensive Operation Through the Use of  
Computers

1. The enclosed Intelligence Information Special Report is part of a series now in preparation based on the ~~SECRET~~ USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". This article explores the use of computer problem-solving methods, as opposed to manual calculation, to determine the combat capabilities of troops in offensive operations and thus provide an objective base for operational decisions. The author describes the development of a computer program, defining the various stages of an operation to be researched against specific situations to determine the optimum variant. This article appeared in Issue No. 1 (80) for 1967.

2. Because the source of this report is extremely sensitive, this document should be handled on a strict need-to-know basis within recipient agencies. For ease of reference, reports from this publication have been assigned

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William E. Nelson  
Deputy Director for Operations

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Intelligence Information Special Report

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COUNTRY USSR

DATE OF INFO. Early 1967

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SUBJECT

MILITARY THOUGHT (USSR): Methods for Determining the Combat Capabilities of the Troops of an Army in an Offensive Operation Through the Use of Computers

SOURCE Documentary Summary:

The following report is a translation from Russian of an article which appeared in Issue No. 1 (80) for 1967 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal 'Military Thought'. The author of this article is Colonel I. Yeregin. This article explores the use of computer problem-solving methods to determine the combat capabilities of troops in offensive operations, the advantages over manual calculation being speed and the capacity for incorporating the capabilities and actions of both opposing sides. The author describes the development of a computer program, defining the component engagements of an operation as stages consisting of several factors such as fire power, strength and disposition, sequence of strikes and intentions, and quantifying the results as total combat losses. Each stage is researched for several specific operational-tactical situations to determine the optimum variant. The resulting data provide an objective base for operational decisions.

End of Summary

Comment:

The SECRET version of Military Thought was published three times annually and was distributed down to the level of division commander. It reportedly ceased publication at the end of 1970.

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Methods for Determining the Combat Capabilities of  
the Troops of an Army in an Offensive Operation  
Through the Use of Computers

by  
Colonel I. Yeremin

The fulfilment of the tasks assigned to an army in an offensive operation is achieved by destroying the main groupings of the opposing enemy with nuclear weapons and heavy fire of other means, by the rapid advance of tank and motorized rifle troops to a great depth and by destroying the enemy in detail. The degree to which these tasks are fulfilled is determined mainly by the capabilities of the troops to inflict that amount of damage on the enemy which had been established for the specific conditions of the situation. As is known, these capabilities are based on the destructive capabilities of nuclear and chemical weapons, tanks, antitank means, artillery, air defense means and the aviation supporting the army.

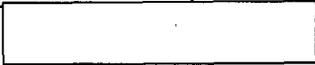
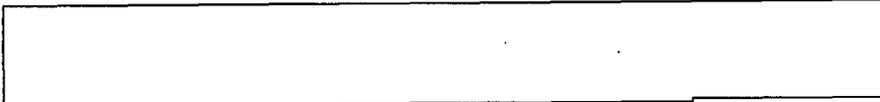
The above-listed capabilities are determined by the composition of the army troops, the level to which they are manned and equipped with personnel, weapons and combat equipment, and by the number of nuclear, chemical and conventional weapons. They also will largely depend on the capabilities of the army to detect the enemy grouping, on the mobility of the troops, on the level of training of personnel, their combat experience and their political, morale and physical state, and also on the effectiveness of various forms of support for troop combat actions.

The currently existing methods of determining combat capabilities consist of making certain manual calculations using standards, tables and graphs for reference. For this reason these calculations produce approximate results, and then only for each of the branch arms and means of combat individually.

The main shortcoming of existing methods is that they do not make allowance for enemy counteraction while the troops are fulfilling combat tasks, and only to a certain extent make it possible to judge the potential capabilities of the combat means of the army to inflict destruction on the enemy.

The combat capabilities of the troops of an army in an offensive operation may be most reliably calculated only by carefully taking into

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account the composition and quality of the troops of the opposing sides, the form of their combat actions, the methods and sequence of their use of combat means and the optimum use of forces, means and resources, and also by necessarily making allowances for enemy counteraction.

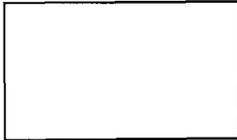
This task may best be accomplished by using a two-sided mathematical model. For this purpose a diagram is made which represents in basic outline the processes of an offensive operation of a tank army; a task is then assigned.

The diagram and the assignment of a task. There are two opposing sides: the troops of a combined-arms (tank) army on the offensive and the troops of the opposing enemy grouping, each pursuing mutually exclusive goals. Each of the sides strives to fulfil its own combat task and to prevent the other side from fulfilling its task. The combat actions of both sides are characterized by the combat of all forces and means at their command: rocket troops, tanks, antitank means, artillery, aviation, air defense means, etc.

An offensive operation of an army includes a number of engagements (battles) of its troops, interrelated by a common goal. For the specific conditions of an operational-tactical situation, each of these engagements is characterized by a certain composition and number of the troops from both sides participating in it, by the operational disposition of the troops, by the method and sequence of using various combat means, and by other factors. During the course of the engagement (battle) the sides deliver strikes by various means in a definite sequence typical of a given situation and in accordance with the decisions made. Each of the sides, when delivering any strike, tries to allocate its combat resources against reconnoitered enemy targets in the optimum manner, i.e., in such a way as to inflict the most damage on the enemy while using a minimum of means.

During the engagement both sides will suffer losses in forces and means. At the same time, during combat actions they are replenished by receiving or recovering weapons, combat equipment and personnel.

A command usually has sufficiently complete information about all that pertains to its troops. An army staff also has corresponding information on enemy targets based on reconnaissance data. As a whole, in every engagement (battle) of an offensive operation the quantitative and qualitative characteristics of the troops of the army and the enemy are considered to be known, i.e., their table of organization, location, dimensions of occupied areas, level of manning and equipment, amount of





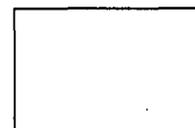
protection, form of combat actions, length of time spent in one location, availability of ammunition in the subunits, and technical specifications of armament and combat equipment. Also known are the degree to which the troops of both sides have been reconnoitered and the substance of their intentions regarding actions in the engagement (battle): the sequence for destroying the enemy, the axis on which the main efforts are concentrated, the grouping of forces and means, the methods and sequence of using various combat means and the nature of their maneuver.

The result of the engagement (battle) and operation as a whole is quantitatively defined by the value of the losses of each side. Therefore, the problem is to determine:

- the value of the damage sustained in one engagement (battle) by enemy troops as a result of strikes by our army, making optimum use of the means of destruction, and taking enemy counteraction into account;
- the value of the damage sustained by the troops of our army as a result of enemy strikes in the same engagement (battle);
- the value of the damage sustained by the troops of each side in several variants of the same engagement differing from each other in the operational intentions of both sides, and on this basis to select the best variant of employing the forces and means of the army within the limits of the engagement (battle) being researched;
- the total value of the losses inflicted on the enemy as a result of all the engagements of the offensive operation, when the optimum variants for using the combat means of our army are selected for each engagement.

The method of solving the problem stated consists of the following. An offensive operation is subdivided into a number of engagements (battles), conventionally called stages, in the sequence in which they most probably may occur during the operation. Each of these engagements is researched on the model.

A certain interval of time (period) during which there occurs one engagement or part of it is taken as the stage to be researched. During this time the large units of an army carry out one combat task, and the form of the actions of both sides does not undergo substantial change.



These stages may be:

- the negotiation of an enemy covering zone by divisions of the army first echelon;
- the breakthrough of the forward defensive line to the entire depth of the divisions of the enemy first echelon;
- the destruction of enemy reserves and accomplishment of the task of the day by the divisions of the army first echelon;
- the destruction of the divisions of the first echelon of the enemy grouping in meeting engagements;
- the breakthrough of the enemy defensive line in the operational depth, etc.

Each stage is spatially defined by the dimensions (in frontage and depth) of that area in which the combat actions of the troops of our army and the opposing enemy grouping are developing. The number of stages is assumed to equal the number of engagements, or even separate battles, making up the offensive operation. For each of the stages there is a corresponding specific operational-tactical situation: a specific number and composition of the troops of both sides, a form of their actions, availability of different ammunition (resources), an amount of protection for personnel, etc.

The installations to be researched during combat actions are assumed to be those organic troop elements which operate in the different forms of battle without, as a rule, splitting up, and which are positioned relatively compactly on the terrain: missile batteries, tank and motorized rifle battalions, artillery battalions, aircraft squadrons, antiaircraft batteries, command posts, ammunition depots, etc.

A definite classification of the installations has been established for the whole research process. In one class are placed those combat installations which are similar in their nature, function and the tasks they perform, even though they differ in operational-tactical characteristics. An example of a variant for classifying combat installations may be the following: class I installations - operational-tactical and tactical missile batteries, nuclear artillery batteries, cruise missile squadrons, subunits of delivery aircraft for nuclear warheads; class II installations - the control posts of armies, corps and divisions, aviation guidance (control) centers, and the control posts of missile units; class III installations - tank battalions; class IV installations - artillery battalions, etc. The number of classes and their

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composition are determined each time by the commander and staff of the army or by the staff of the directing body of the war game. Within each class, the installations are ranked in descending order of importance. An assessment of their operational-tactical importance is made on the basis of various characteristics. The following are assumed to be the most essential characteristics of combat installations: their capability for affecting enemy troops by one method or another (i.e., that which characterizes their potential capabilities), readiness to carry out aggressive combat actions, position within the operational disposition of the troops, and the form of their combat actions.

Installations which are capable of inflicting damage on the enemy are simultaneously defined as means of delivering a strike and as installations representing targets for the enemy in the event of his counteraction. Those which themselves cannot directly destroy the enemy, but which have a considerable effect on the course of the battle, are defined only as targets. These include: control and guidance posts; radar sites; repair, medical and supply subunits; depots of various types, etc.

For each stage being researched, the combat installations of the troops of our army and the enemy which may participate in the combat actions are determined. For this purpose, the operational-tactical situation is analyzed, and those installations which may be put into operation in the stage being researched are determined. For the troops of our army these include all installations in the operational disposition of the army and the battle formations of the large units, and for the enemy - installations located in territory bounded by the forward edge, the boundary lines defining the army offensive zone, and by the prearranged line determining the depth of the stage being researched, and also other installations which, while not located immediately within the area of the stage being researched, may participate in the combat.

For each stage there are several variants of the sequence in which the troops of both sides enter an engagement (battle). This is based on the intentions of both sides for the conduct of the combat actions, and on their decisions regarding the methods and sequence of employing combat means. The variants for our troops are prescribed, and those for the enemy - prescribed or probable.

The value of the damage, which includes losses of those elements of a combat installation which are necessary for it to function, is taken as a criterion for evaluating the combat effectiveness of the installation.

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For example, the combat effectiveness of a tank (motorized infantry, motorized rifle) battalion is determined by the presence within it of companies, a command post and a rear.

When all of its tank (motorized rifle) companies are put out of action, the battalion completely loses its combat effectiveness, and when some of the companies are lost, it partially loses effectiveness. When the command post or rear is put out of action, combat effectiveness is lost temporarily.

The quantitative aspect of the outcome of an engagement (battle) is defined as the total value of the losses of each of the participating sides. In this category are included combat installations which have completely lost their combat effectiveness (they are not taken into account in subsequent combat in the given stage being researched) or have partially lost effectiveness (they continue to carry on the battle, but with less effectiveness).

To determine the value of the losses inflicted on enemy troops during the stage being researched, a number of specific problems are solved on a computer regarding the optimum employment of the nuclear (chemical, conventional) weapons allocated to the army troops in the given stage, and regarding determination of the level of damage inflicted on the enemy as a result of these strikes.

These problems also are used to determine the level of probable losses which would be sustained by army troops as a result of action against them by enemy means. In so doing, the information regarding targets and means is changed: the means of delivering strikes are the enemy installations, and the targets - the installations of the army troops. Accordingly, set information defining the technical specifications of enemy combat means also is used.

The order of priority for solving the above-named specific problems is determined by the previously mentioned diagram of the sequence in which the different combat means of both sides enter combat.

As each problem is solved, an answer is given regarding the number of completely destroyed and partially damaged combat installations -- indicating the degree of damage to each, both for troops of our army and for enemy troops. For the convenience of analysis the results are differentiated by classes of combat installations.

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Any specific problem, and the problem as a whole, concerning the stage of combat actions being researched is solved when one of these conditions is achieved:

- enemy losses reach that level (established by the commander as a result of evaluating the situation) at which his troops become combat-ineffective;
- the losses of the troops of our army reach the level at which further conduct of offensive combat actions is impossible or undesirable;
- the army troops seize the designated area (line);
- all ammunition (missiles, resources) allocated for the stage are expended.

After the whole set of specific problems for a given stage has been solved, the losses are totalled separately for each side and are differentiated by classes of combat installations.

The total values of the losses sustained by both sides characterize only a specific variant of troop actions in the given engagement which is being researched. Other values of total losses will correspond to other variants. There may be several such variants, since within each stage being researched there may be several combat situations which are most typical of the stage and which differ from each other in the operational disposition of the troops, the axis on which the main efforts are concentrated, the sequence in which strikes are delivered by the different combat means, and the nature of the troop maneuver.

This problem is solved again for each variant, i.e., this whole set of specific problems is solved in the same or different order depending on the diagram of the sequence in which the means of destruction of both sides enter the battle. The level of damage sustained by both sides is determined for each variant. After the problem is solved in several variants, the optimum variant of army troop actions in the engagement being researched is selected, i.e., that variant in which, while carrying out the assigned combat task, they would inflict maximum damage on the enemy and at the same time would have minimum losses themselves. The method of selecting the optimum variant is based on the minimax and maximin principles from mathematical game theory.\*

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\*See the article by Engineer Colonel A. Tatarchenko, Military Thought, 1966, No. 5.

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The stated procedure for researching the combat actions of army troops during one stage is also carried over to subsequent stages of combat actions throughout the entire depth of the offensive operation. The results of the calculations of each preceding stage (troop losses of each side) is automatically carried over to the next stage as initial information characterizing the troops who were operating. The problem as a whole is solved when the research on all the stages of the offensive operation is completed. Then the losses of each side are totalled separately (differentiated by classes of installations) for all stages of the research. The damage sustained by the enemy in the offensive operation will define the capabilities of the army troops to inflict damage, based on optimum use of its forces and means and aggressive counteraction.

An algorithm and program for solving the problem on a computer have been developed in accordance with these methods. The methods and algorithm make it possible to:

- obtain computational data on the level of damage inflicted on the enemy by the army troops in individual engagements, and also the total for the entire operation;
- determine the value of the possible losses which would be sustained by the army troops as a result of enemy counteraction in individual engagements and for the operation as a whole;
- on the basis of the computational data obtained, evaluate the effectiveness of the combat action of the different branch arms of the army and its means of destruction when they are used optimally and when allowance is made for enemy counteraction both in the offensive operation as a whole and in the individual engagements;
- comprehensively research combat capabilities in each engagement, solving the problem repeatedly for a number of the most probable situations in a given engagement, situations which differ from each other in the intentions of the sides regarding the conduct of combat actions; on this basis select, for the troops of our army, the optimum plan for conducting the engagement and make sound conclusions regarding the advantages and shortcomings of different methods of employing the means of destruction.

The volume and substance of the data obtained attest to the desirability of making these calculations on a computer. Data on the combat capabilities of troops, which would take enemy counteraction during combat actions into account, and would be based on the optimum employment of the means of destruction, are virtually impossible to obtain by means of

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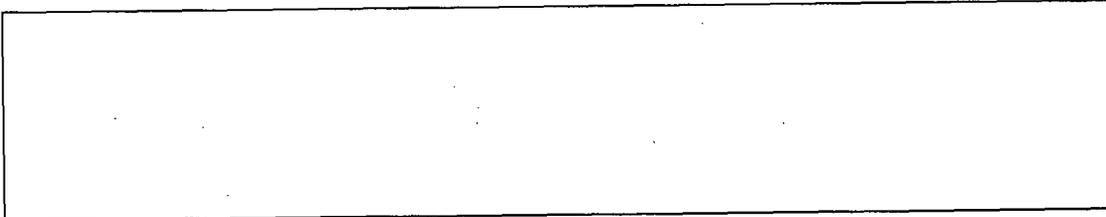
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manual calculations in view of the great expenditures of time required to perform the calculating operations. Therefore, the proposed methods should be used (when a computer is available) in the practical work of staffs in exercises and war games, and in scientific research work.

In conclusion we believe it necessary to emphasize that the proposed methods for using high-speed computers for calculations does not produce a ready decision for an offensive operation. Their use will only make it possible to provide the commander with the objective computational data needed to evaluate the capabilities of army troops to inflict damage on the enemy, to conserve the efforts and time of officers, and to free them to carefully analyze all aspects of the operational situation and prepare sound proposals for the decision.



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