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MEMORANDUM FOR: The Director of Central Intelligence

FROM : John N. McMahon
Deputy Director for Operations

SUBJECT : MILITARY THOUGHT (USSR): Some Problems in the Use of Electronic 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 discusses in detail the advantages and shortcomings encountered by the Military Academy of Armored Troops in its use of MINSK-1 and STRELA-6 electronic computers to solve the problems arising in a war game on the subject, "The Conduct of a Rapid Offensive by a Tank Army in Cooperation with Airborne Landing Forces in an Operation Conducted to a Great Depth in the Initial Period of a War". Also included in the article are the authors' suggestions for improving the training of the students with respect to the use of computers. This article appeared in Issue No. 6 (67) for 1962.

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

for John N. McMahon

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[redacted]

[redacted]

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SUBJECT

MILITARY THOUGHT (USSR): Some Problems in the Use of Electronic Computers

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Summary:

The following report is a translation from Russian of an article which appeared in Issue No. 6 (67) for 1962 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The authors of this article are Colonel L. Chernov, Colonel V. Moiseyev and Engineer-Colonel A. Kiselev. This article discusses in detail the advantages and shortcomings encountered by the Military Academy of Armored Troops in its use of MINSK-1 and STRELA-6 electronic computers to solve the problems arising in a war game on the subject, "The Conduct of a Rapid Offensive by a Tank Army in Cooperation with Airborne Landing Forces in an Operation Conducted to a Great Depth in the Initial Period of a War". Also included in the article are the authors' suggestions for improving the training of the students with respect to the use of computers.

End of Summary

[redacted] Comment:

After 1962 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.

[redacted]

Some Problems in the Use of Electronic Computers

Based on the experience of the Military
Academy of Armored Troops
by
Colonel L. CHERNOV
Colonel V. MOISEYEV
Engineer Colonel A. KISELEV

This year the Military Academy of Armored Troops conducted an army-scale research war game with command personnel, professors, and instructors on the subject, "The Conduct of a Rapid Offensive by a Tank Army in Cooperation with Airborne Landing Forces in an Operation Conducted to a Great Depth in the Initial Period of a War".

A number of operational-tactical problems were worked out on the MINSK-1 and STRELA-6 computers in order to test how the algorithms and programs of the main operational-tactical problems corresponded to the requirements of troop control, to have the generals and officers of the Academy acquire experience in working with electronic computers, and to develop suggestions for the use of electronic computers in war games and command-staff exercises.

In keeping with the subject and plan of the exercises, six problems were solved during the war game. Several of them were done more than once on behalf of the staff of the directing body in the working out of immediate hypothetical situations and for the staffs of the formations and large units participating in the game, in order to prepare the data given to the commanders for the latter's use in making decisions.

Let us examine to what degree the data obtained with the electronic computers facilitated the work of preparing and doing the most important operational-tactical calculations.

Determining the required number of nuclear warheads, their yields, and the means of delivery needed to destroy the enemy targets. The commander of the tank army required the necessary

data on these matters before making a decision on a meeting engagement. He had to come up with a version of allocating the available nuclear warheads and the means of delivering them to the target that would result in the most effective use of these weapons.

Fed into the machine as initial information was information about important enemy targets and data on the available missile means, aircraft, and nuclear weapons, as well as on the line reached by our forward troops.

The solution of the problem required 20 minutes of machine time, which permitted the most rational and effective employment of the available nuclear warheads for the destruction of the enemy targets. It should be noted that a manual solution of the same problem, besides resulting in a considerable loss of time, usually provides approximate results, which leads to the inefficient and, at times, unjustified expenditure of nuclear warheads.

The algorithm and program for this problem (developed by Central Scientific Research Institute 27) fully satisfy the present-day requirements of troop control. However, they must be improved in the future not only for the sake of simplification, but also to reduce the machine time involved in solving the problem. Moreover, the algorithm and program must be such that data can be obtained not only on the required "organic" warheads, but also on the calculated values of the nuclear charges. This will enable the army commander, in making a decision, to solve optimally the problem of allocating his available warheads against targets at any given moment.

Estimating the effectiveness of nuclear strikes against enemy targets. The war game showed that it takes 20 minutes to prepare the variable initial data used in estimating the effectiveness of a nuclear strike with 15 warheads (against 15 enemy targets). The total time involved in solving the problem, including processing the results and reporting them to the commander, amounts to 40 minutes, whereas it took qualified officers three hours, i.e, 4.5 times as long, to do these calculations manually. Moreover, an analysis of the results of the machine and manual calculations shows that the computer

provides the most precise calculations for each element of destruction.

Determining the expected radiation doses to which personnel might be exposed and calculating the expected losses from enemy nuclear strikes. According to the initial situation, the tank army troops moving to the front from the interior of the country were subjected to nuclear strikes by 28 warheads with a total yield of 5,700 kilotons. Created as a result was a broad zone of terrain contaminated by radioactivity (200 kilometers across the front and 400 kilometers into the depth), which completely covered the forward movement zone of the army troops. Moreover, the main grouping of the tank army was located inside the contaminated zone.

The algorithm and program for solving the problem on an electronic computer made it possible, on the basis of data about the enemy's nuclear strikes and the location and status of the army troops, to determine the probable losses in combat equipment, motor transport, and personnel; and, on the basis of additionally tabulated data about the meteorological situation in the forward movement zone of the army troops and along the routes, to determine the possible radiation doses to which personnel might be exposed in the negotiation by large units of the zone of radioactive contamination.

We must point out that the machine solution of these initial situation problems, although faster than the manual solution, still took a great deal of time. The problems were solved in eight hours. Three hours were required to prepare the data, two hours to record the variable initial data on perforated tape, and 15 minutes to make up the data cards with the results. The machine time amounted to two hours and 45 minutes. It took 12 hours for the manual solution. In spite of the time advantage (by a factor of 1,5), these amounts of time used in solving the problem are unacceptable for actual troop actions.

In calculating the army troop losses from the enemy's nuclear strikes and the possible radiation doses to which personnel might be exposed in negotiating the zone of radioactive contamination, the results of the machine solution prove to be more accurate when compared with those of the manual calculation done by the officers of the staff's operations department and

department of chemical troops.

The following example may serve as confirmation of the above. The manual calculation method indicated that the personnel of the army missile brigade received radiation doses of 112 roentgens, whereas the machine calculation on the MINSK-1 and STRELA-6 computers showed the amount to be 26 roentgens.

Calculating the expected consequences of enemy nuclear strikes. The problem was solved several times in the course of the war game. The MINSK-1 computer produced in seven to ten minutes data on the losses from one enemy nuclear burst, with the following figures reflected in the solution: the loss of personnel outside of shelters, in shelters, and in tanks; losses of tanks, with an indication of the number of damaged tanks requiring running, medium, or major repair; and the number of irrecoverable losses. Similar calculations were produced on the losses of all types of the most important equipment in the inventory of the tank troops and motorized rifle troops. The results from the solution of the problem were given as percentages of the existing number of personnel, weapons, and combat equipment, or in absolute numbers.

The manual solution of a similar problem would take 21 to 23 minutes.

Calculating an army's tank equipment that would be potentially in service in an operation. The need for such calculations is explained by the following circumstances.

A correct determination of the balance of forces and means of the sides in an operation is one of the most important conditions allowing the army commander to draw the necessary conclusions from an assessment of his own and the enemy's troops for the purpose of reaching a sound decision. For this reason, the operations department of an army staff, in addition to its determination of the balance of forces of the two sides with respect to nuclear weapons, missile launchers, and artillery, also prepares data on the balance of forces with respect to tanks for a report to the commander of the army. In order to prepare these data, they must know, as a rough guide, what number of tanks in the army might be in service at the beginning of the execution of the immediate task and the subsequent task and

during the days of the army operation. The answers to these questions can be obtained from the solution of the problem under examination. It is important also for the control of the army's tank-technical support.

The essence of planning an army's tank-technical support lies in determining the requirement for and the capabilities of the technical support means and in substantiating the most expedient methods and forms of organizing the support in accordance with the place, time, and tasks of the army in the operation.

The means needed to repair damaged tank equipment are presently determined on the basis of approximate calculations of the possible breakdowns of tanks in an operation. And it is on the basis of the need to restore the damaged tanks that the problem is solved regarding the reinforcement of the army with front tank repair means. Furthermore, on the basis of an estimate of the probable breakdown of tanks, measures are planned for the tank-technical support of new equipment being received to keep the army troops fully equipped during the operation.

The solution of this problem is just as important for planning the work of the army rear services. Changes in the amount of tank equipment are taken into account in organizing the fuel, lubricant, and ammunition supply for the troops, as well as in determining the requirements for transport means to evacuate the damaged tanks requiring major repair to front shops and to the interior of the country.

Calculations of the tanks potentially in service are made both in planning the operation and in organizing the carrying out of the individual tasks in the course of the operation. In the latter case, the problem is solved by the same method used in planning the operation, but with some changes and reductions in the volume of the calculations, depending on the specific conditions involved in carrying out the individual tasks of the army.

A great deal of time was spent in doing the above-indicated calculations manually. Thus, for example, in the DON exercise, an average of two whole days out of the two and a half days available for the preparation of the operation was spent by each

officer in the tank armament department of the 2nd Army of the Don Front on calculations, working out the tank-technical support plan, and issuing instructions. Approximately the same amount of time was also spent in the war game in doing the calculations manually.

The present method of determining the probable losses of armored equipment in an operation does not satisfy the requirements for the control of tank-technical support under the new conditions, since at times there are results that clearly contradict the nature of the combat actions of the troops. An estimate of the probable amount of armored equipment requiring repair in an army operation shows that the potential losses of armored equipment from conventional weapons of destruction are two to three times as great as the potential breakdown of this equipment as a result of enemy nuclear weapons. The unreality of such calculations for modern operations is clearly evident.

The potential breakdown of armored equipment in an operation is determined separately on an electronic computer according to the types of damage done to the equipment: damage resulting from nuclear weapons and damage resulting from conventional means of destruction.

A comparative evaluation of the results shows that the machine solution includes a broader range of the factors influencing the possibilities of damage to armored equipment and ensures a greater accuracy of calculations, not to speak of a great saving of time. Thus, for example, with no more than ten factors taken into account, it takes six hours for the tank armament department of an army to compute manually the potential breakdowns and the amount of tanks requiring repair in an operation. About 25 minutes were required to solve the same problem on the MINSK-1 computer, with the preparation of 32 variable initial data that made it possible to take into account the most important operational-tactical factors influencing the dynamics of the formation of the stock of tanks requiring repair.

Nevertheless, the war game revealed a number of shortcomings in both the preparation of the initial data and in the method of solving the problem. Among the most vital shortcomings of the algorithm is the fact that the calculation of the potential tank losses from nuclear weapons is premised on nuclear warheads with

a yield of not over 20 kilotons and the coinciding of the nuclear burst ground zero with the center of the battle formation of the tank battalion, which in reality will not be such a frequent occurrence.

Estimating the combat capabilities of a grouping of single-type surface-to-air guided missile systems for the air defense of troops. The problem was solved twice in the course of the war game: the first time, in two versions; the second time, in five versions.

The experience gained shows that for a sound decision to be made with respect to the establishment of a surface-to-air missile grouping for the air defense of the troops of a tank army, this problem should be solved on an electronic computer each time in not less than in four to five versions. In this case, the air defense chief of the army is able to select the most expedient version after a comparative analysis of the results of the solution contained in each version.

It should be emphasized here that the time spent on the preparation and solution of this problem on the electronic computer is considerably longer than that spent on the solution of the preceding problems. Preparing the variable initial data and filling out the request forms (one for each version) requires one and a half to two hours. The machine time involved in solving the problem in one version amounts to 26 minutes; and two hours and ten minutes, in five versions. It takes eight to ten minutes to process the results of the solution of the problem in four or five versions. Consequently, the total time for solving a given problem in four to five versions is four to four and a half hours. This time is so long because of the very complicated algorithm and no less complicated request form. For this reason, it will be necessary in the future to continue work on improving the algorithm and simplifying the request form.

Nevertheless, the use of the electronic computer to solve these problems still provides a considerable advantage in time, makes it possible to obtain more accurate data, and also makes it easier for the air defense chief to reach a decision with respect to the formation of the most advantageous grouping of surface-to-air guided missiles.

The war game showed that the solution of problems on general-purpose electronic computers, as a rule, provides a considerable advantage in time and accuracy even for the most complex and time-consuming operational-tactical calculations. All of this facilitates the work of the generals, officers and staffs and allows them to analyze the situation in greater depth, reach a more substantiated and informed decision, and determine more accurately their own and the enemy's losses in forces and means.

Along with the several positive results from the use of the electronic computer, some essential shortcomings were also revealed in the war game.

The algorithm and programs for some problems, particularly for determining the expected radiation doses, still do not permit a solution within a time frame corresponding to the actual actions of the troops. Much time is spent on the preparation of the initial information, which is excessively voluminous. The time involved in solving the problem on the computer itself is sometimes only one-tenth that required for preparing the initial data and processing the results so that they can be reported to the appropriate commanders. This is explained by the large amount of initial data requiring manual preparation and by the officers' lack of the proper work experience in preparing such data.

In the war game, the preparation of the data and the processing of the results of the solution were done mainly by a small group of officer specialists of the academy's scientific research laboratory.

A more efficient use of electronic computers in the future will require that this preparation and processing be done by all officers, particularly the professors and instructors of the operations and tactics departments. In this connection, we believe that within the system of commander training, special courses must be planned and given on the fundamentals of electronic computer equipment, programming, the preparation of initial data, and the processing of the results.

Moreover, immediately before war games are held, special training exercises must be organized in which all the processes

involved in the use of electronic computers will be worked out in practice.

An analysis of the first experience of the academy in the use of general-purpose electronic computers justifies raising the question of the bolder use of computers in solving operational-tactical problems with the students of higher courses. It is known that the student training program provides a special course on the fundamentals of the automation and mechanization of troop control, the study of which should result in final-year students acquiring a firm knowledge of the problems of using electronic computers in the various areas of activity of commanders and staffs.

In carrying out group training sessions, games, and exercises with students, it is necessary to establish maximum conditions for them to solve problems using all available means of automation and mechanization -- electronic computers, as well as sound recording, television, facsimile, and keyboard calculating equipment. This is particularly important in solving such complex and laborious problems as forecasting the radiation situation, determining the aftereffects of nuclear strikes, allocating nuclear weapons for destroying various enemy targets, and other problems whose solution requires that calculations be made with maximum accuracy and with a minimum expenditure of time and forces. All of this will contribute to our officer cadres being trained well in advance in the use of computers for automating various processes in the activity of commanders and staffs.