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WASHINGTON, D.C. 20505

24 March 1976

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (USSR): Speeding up the Automation of Control Processes in Ground Forces Formations

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 describes the OPYT system of automated ground forces troop control which the author was involved in developing based on the URAL-4 stationary computer and existing communications means, as opposed to a new and more expensive integrated system. Based on experience in the Leningrad Military District, the author believes the OPYT system is adequate for peacetime problem solving, and applicable to operational situations with the addition of special communications channels. When further refined by the MINSK-22 mobile computer, the system also may be employed for troop control under combat conditions. This article appeared in Issue No. 1 (83) for 1968.

[redacted]

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 [redacted]

William E. Nelson
Deputy Director for Operations

[redacted]

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MILITARY THOUGHT (USSR): Speeding up the Automation of Control Processes in Ground Forces Formations

SOURCE Documentary

Summary:

The following report is a translation from Russian of an article which appeared in Issue No. 1 (83) for 1968 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The author of this article is General-Leytenant P. Kurochkin. This article describes the OPYT system of automated ground forces troop control which the author was involved in developing based on the URAL-4 stationary computer and existing communications means, as opposed to a new and more expensive integrated system. Based on experience in the Leningrad Military District, the author believes the OPYT system is adequate for peacetime problem solving, and applicable to operational situations with the addition of special communications channels. When further refined by the MINSK-22 mobile computer, the system also may be employed for troop control under combat conditions.

End of Summary

[redacted] 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. [redacted]

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Speeding Up the Automation of Control Processes in Ground Forces Formations

by

General-Leytenant P. Kurochkin

Work in connection with automating the control processes has been proceeding in the ground forces for more than ten years. During this time the scientific organizations of the Ministry of Defense have completed a series of research, scientific-theoretical and experimental design activities. The troop staffs and command-type military academies already have gained some experience in using electronic computers to automate control when preparing and conducting operations.

As a result there have emerged two basic directions for possible solution of this problem.

One of them consists of developing an integrated automated system embracing all the tactical and operational command levels of the ground forces, which must ensure receipt, collection, transmission and processing of operational-tactical information, as well as solution of almost all information and calculation problems related to planning and conducting any type of combat actions. In other words, such an integrated system is expected to effect maximum automation of the processes of troop control, and thereby increase its efficiency and effectiveness.

It has been proposed that military mobile field computers become the materiel and technical basis of such an integrated control system: general-purpose computers for all combined-arms staffs (front, army, division), and specialized ones for branch arms and special services; automatic integrated and autonomous information transmitters for rifle (tank) battalions, missile (artillery) battalions, radiation (chemical) patrols, reconnaissance organs and units of special troops; and, an automated multichannel communications system possessing high reliability and transmission capacity.

The virtue of this direction in solving the problem of automating the ground forces has been demonstrated by a number of scientific research works. However, along the way two obstacles have been encountered which are difficult to overcome: first, the considerable economic expense and,

secondly, the fact that a great deal of time is required to develop, manufacture, introduce and master the highly complex technical means comprising the integrated automated system.

The second direction for automating control differs from the first primarily in its materiel and technical basis. For this purpose it is proposed to use the general-purpose computers available in the civilian economy and a number of military scientific organizations, and for the exchange of information use the existing military and State communications channels.

Thus the second direction for solving the problem of automating control does not require developing and mastering new technical means, which promises a considerable saving of means and time. Nevertheless, the gain, although in such important indices, still does not provide all the grounds for considering this direction the most acceptable. Therefore its advantages and deficiencies have to be compared in greater detail with the first direction for automating ground forces control, but the main thing is to determine how thereby to solve the principal problem of increasing the dependability, efficiency and effectiveness of control as a whole.

This also should be done because quite often one may encounter the opinion that using computers from the civilian economy for controlling the ground forces is not supposed to be promising but rather, desirable only as a temporary measure for training purposes in the staffs of the military districts, and when doing military scientific work.

It should be noted that the idea of using general-purpose computers from the civilian economy to solve problems associated with troop control has not arisen suddenly. It has a history of its own.

Such an attempt was made for the first time in 1959, when in one exercise three problems involving troop control were solved by means of the computer center computer. In 1960 in an inter-academy war game five problems were solved; in 1961 in a troop exercise in the Moscow Military District, 21 problems; in 1962 in command-staff exercises in the Kiev and Leningrad Military Districts, 43 problems; and, in 1963 in command-staff exercises in command-type military academies, 106 problems.

As a rule the computers of the computer centers and other scientific organizations were allocated to this work. The problems were developed and solved by the workers of the scientific organizations. The combined-arms staffs used the results of the computer solution only very cautiously, as a

rule duplicating this work by the conventional manual method. The coincidence of the manual and computer solutions of the problems convinced the combined-arms commanders of the desirability and ease of using computers for troop control.

At this stage some experience had been accumulated, which indicated the potential and desirability of using computers for troop control, and the problems of describing, algorithmizing and programming various types of calculation problems of an operational-tactical and rear services nature, had been solved successfully. But unfortunately there still was no precisely formulated idea then of the possibility of systematically using for troop control the computers being used in the civilian economy. Furthermore, the proposals expressed on that score as a rule were not shared with others and were turned down.

The year 1963, when the decision was made to use the URAL-4 stationary computer to support some control processes in the Leningrad Military District, should be considered the beginning of the second stage of utilization of computers from the civilian economy.

The author of this article had the occasion to exercise scientific supervision in developing this system, which was organized in conformity with the control structure and deployment of the district troops, and was designated OPYT. It consisted of a computer center containing a URAL-4 computer, a communications center, the existing district communications system, and data collection and transmission points and centers. In addition to the URAL-4 computer, numerous technical means had been used for troop control in the Leningrad Military District earlier, and it was only a matter of adapting them to work in integration with the computer.

The OPYT system is designed for automatic solution of a wide range of problems concerning materiel and technical support, mobilization and table-of-organization problems, topographical support, distribution of radio frequencies for district communications, and other problems arising in the process of controlling troops.

The solving of many problems relating to the conduct of front and army operations is provided for in order to ensure the operational training of troops and combined-arms staffs in the OPYT system; these include the planning and employment of the means of mass destruction and conventional weapons; problems of operational regrouping of troops; forecasting the radiation and chemical situation; determining the radiation doses received by personnel when moving over contaminated terrain; engineer support;

assault crossing of water obstacles, communications support and others.

The operation of this system for almost three years and theoretical research allow us to make some judgments about its technical and economic efficiency. For example, the time spent on solving problems is reduced by a factor of 3.1 and labor expenditure by a factor of 6.4. The saving in work time through daily solution of 17 to 20 problems on the computer can total more than 10,000 man-hours per year.

The economists participating in the development of the OPYT system maintain that as a result of solving everyday problems on the computer, the district also can obtain a substantial indirect economic gain. For example, due to high accuracy and efficiency in carrying out military shipments, 100 to 200 thousand rubles may be saved per year; by improving the system of accounting and distribution of materiel, the reserves of it at district depots and bases are reduced, and this provides a saving of two to 2.5 million rubles per year.

Sufficiently conclusive data are received also when examining the efficiency of using the OPYT system in command-staff exercises. The reduction of time when solving some operational-tactical problems may be judged by the following table.

Designation of Problem	Solution time, hours	
	manually	URAL-4 computer
Planning nuclear strikes for a front operation	5	1.3
Planning front ammunition support	50	3
Calculating troop airlift by air transport	6-7	0.75
Determining our troop losses from enemy nuclear strikes	3-4	0.9
Calculating a march for regrouping of troops, using their own transport	9-10	1.12-1.62
Determining personnel radiation doses when moving over radioactive-contaminated terrain	2	0.58
Planning engineer support during the assault crossing of a river	25-30	2.2-3
Determining potential aftereffects of enemy destruction of hydraulic engineering structures	2-3	0.22-0.32
Determining probability of change in the personnel strength and combat strength of an air army during a front operation	4	1.53

The table shows the gain in time obtained from solving the individual problems of the operational-tactical plan on the URAL-4 computer. On an average, even with repeated solution of some problems, time for an operation is reduced by a factor of 2.5 and labor expenditure by a factor of 4.7.

The OPYT system, as already stated, was based on the existing communications system of the Leningrad Military District, which for everyday operation was provided mainly by overhead wire communications channels leased from the Ministry of Communications and by the communications centers of the troop staffs, and, for the command-staff exercises, primarily by troop radio, radio-relay and wire means, and partially by Ministry of Communications channels. Courier-postal communications were used in both instances.

Since communications have a very important place in any automated system, it is appropriate to discuss communications in the OPYT system as well. It is useful to mention it also because many representatives of scientific organizations almost fully discount the possibility of developing automated systems on the basis of existing State and military communications means, arguing that they supposedly are not sufficiently dependable and have low transmission capacity and low reliability.

In order to establish whether such arguments are convincing, we will examine the practice of using communications means in the OPYT system.

In the exchange of information necessary to solve everyday peacetime problems on the computer, no particular difficulties have arisen in respect to communications. Such problems in the majority of cases are solved no more frequently than once weekly, and only some of them every 24 hours. Consequently successful exchange of information for the majority of everyday problems is provided by courier-postal communications, which are not limited by transmission capacity, reliability and dependability problems.

For daily problems and some problems of weekly occurrence information must be exchanged only via electrical communications channels. It has been demonstrated in practice that no difficulties arise even in this instance. The necessary information may easily be transmitted by existing channels when they are free from routine telegraphic traffic (or telephone conversations).

The experience of the Leningrad Military District showed that the coefficient of utilization of the telegraphic channels of the existing communications system for routine traffic averaged 14 to 18 percent per day on a district-army link and only five percent on a district-large unit link.

The dependability of the existing communications system also proved to be sufficient for information traffic: for the Leningrad Military District it is characterized by the coefficient of serviceable operation, equal to 0.8 to 0.85 for wire telegraphic communications channels, and 0.6 to 0.8 for radioteleprinter channels. As for the reliability of transmission via electrical communications channels, obtaining the necessary level likewise does not present great difficulties.

Thus, based on Leningrad Military District experience we can confirm that existing district communications can support the exchange of information for solving everyday peacetime problems on the computer. Of course, this requires some adaptation of the existing communications to requirements stemming from the use of the computer. But all this can be accomplished by using the technical means available to the troops. In the Leningrad Military District this required the addition of a few dozen telegraphic apparatuses (STA-2M), about two dozen sets of secure communications equipment, a few dozen coding machines and a slight additional leasing of transmission channels for communications with certain data sources.

In respect to providing communications for the exchange of information in command-staff exercises, the matter is somewhat more complicated. The solution of almost all problems on the computer in this instance is strictly regulated in terms of time, which is determined by the time limits for the planning of the operation and the dynamism of the development of the combat actions. Because of this information must be exchanged via electrical communications channels and within limited time periods. This factor requires allocating special channels designated only for the exchange of information to support the solution of problems on the computer. Complications in the command-staff exercises were made worse also by the fact that the dependability of communications organized under field conditions proved to be lower than that of the stationary links. For example, the experience of the exercises conducted in the Leningrad Military District show that the coefficient of serviceable operation of the wire telegraphic communications channels equals 0.7 to 0.8, of radioteleprinter 0.5 to 0.7, and radio-relay telegraph, 0.6 to 0.7. Therefore, in order not to slow down the transmission of information, the

number of communications channels has to be increased.

It is evident from practice that creating the conditions for normal exchange of information has required providing communications from the front staff to the computer center via three or four wire (radio-relay) telegraphic and two radioteleprinter communications channels, and, from the rear control post of the front to the computer center, via two wire (radio-relay) telegraphic and one radioteleprinter communications channels. It should be noted that these communications were required because the computer center of the Leningrad Military District was located a great distance away from the area of the exercises.

When the computer center is colocated with the front staff those communications will no longer be necessary; only the communications with the rear control post will be needed. The exchange of information between the computer center and the staffs of the armies and large units subordinate to the front requires one wire (radio-relay) telegraphic and one radioteleprinter communications channel with each staff. When these communications are available no significant delay occurs in the exchange of information.

We note, incidentally, that in one of the exercises in the Leningrad Military District with less (by approximately a third) provision for communications channels, about 40 problems concerning the planning and conduct of a front offensive operation were successfully solved. Considering that some problems were solved several times, a total of more than 350 solutions were obtained on the URAL-4 computer during the operation.

When the OPYT system was developed there was concern over the possibility of distortion of the information during its passage via communications channels. The problem is that satisfactory solution of problems on the computer is achieved only if there is no more than one distortion per 100 thousand characters transmitted via communications channels.

The number of distortions describes the quality of the communications channels in respect to the reliability of information transmission, or, as it is customarily called, communications reliability.

The existing channels usually do not provide the required level of reliability. For example, in transmission via wire communications channels an average of one distortion is received per thousand transmitted

characters, and via radio channels, one per hundred.

During research it was established that communications reliability may be increased significantly by undertaking entirely available and relatively uncomplicated organizational and technical measures.

To resolve this problem the Military Communications Academy, a representative of which participated in developing the OPYT system, proposed a number of methods, including manual readback, semiautomatic readback, triple transmission, and a combined method. When any of the proposed methods were used, communications reliability was increased to the required level.

The practice of using general-purpose computers for automatic solution of the problems of planning and conducting operations during operational training leads to thought about the desirability of using this type of computer not only in the military district staffs but also for automating control in the staffs of ground forces formations under combat conditions. Mobile computers are necessary in order to accomplish this task. But they can be useful, you know, only if they are located at the command posts and relocated with them. The new MINSK-22 general-purpose computer, which has replaced the URAL-4, makes it possible to accomplish this task. Its mobile version is transistorized, highly dependable, compact and easily installed.

Thus we already have all the necessary materiel and technical prerequisites for establishing field automated systems on the basis of general-purpose computers and existing communications means. Of course, they will not be equivalent to the planned integrated automated control systems, but the troops can use them now to increase the efficiency of control.

The basic outlines of this automated system in its first approximation may be as follows.

Computer centers -- composed of mobile-version MINSK-22-type computers as well as punchcard and keyboard calculators, also adapted for vehicle transport -- are being developed for front and army command posts. To ensure dependability and continuity of operation, each computer center must be designed for two positions (operating and reserve), that is, contain two computers and two sets each of punchcard and keyboard calculators. To ensure the exchange of information (receipt of initial data and transmission of solution results), two telegraphic communications channels (one wire or radio-relay and one radioteleprinter) from the overall front

communications system must be allocated to each army command post and front missile brigade command post, and to the front rear control post, and one telegraphic communications channel (either wire, radio-relay or teleprinter) from the army communications system must be allocated to the division command posts, the army missile brigade command post, and the army rear control post. All of the allocated communications channels are expected to provide security of information transmission.

Establishing this system will not require developing new computer and communications means, only some technical adaptation of the existing means and their organizational integration into the system for the appropriate command level (front, army). Thus, given proper attention, the systems can be established in a short time.

As to economic expenditures, we can say that, as a rough estimate, they will be several dozen times less in comparison with the expenditures on an integrated automated system.

In conclusion, we will note that establishing automated systems based on existing general-purpose computers and communications means for the staffs of the ground forces operational formations is the realistic and economical way to automate troop control the most rapidly. Despite the inherent defects of these systems, they permit successfully solving the urgent operational problems involved in making the most rational decision on an operation, and sharply reducing the operation planning time and increasing the accuracy of calculations.