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CENTRAL INTELLIGENCE AGENCY

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3 NOV 1962

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (SECRET): "The
Automation of Troop Control Processes
Must be Comprehensive", by Colonel
B. Fedotov, Colonel N. Zubkov and
Colonel P. Myasoyedov

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Richard Helms

Richard Helms
Deputy Director (Plans)

Enclosure

APPROVED FOR RELEASE
DATE: DEC 2004

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The Automation of Troop Control Processes

Must Be Comprehensive

by

Col. B. Fedotov, Col. Zubkov, and Col. P. Myasoyedov

The complexity and the increased scope of modern operations, and also the extremely limited amount of time for their preparation, present increased requirements for troop control. The essence of these requirements is to bring the capabilities of means of control and methods of directing troops into complete accord with the weapons of destruction, which are very powerful in force and range, and with the significantly increased mobility of troops.

During the postwar years the means and methods of control were developed to a certain extent. In particular, the methods of parallel planning of troop combat operations, the reduction and replacement of written documents by graphic ones, etc., began to be employed in the practice of headquarters preparation more and more. Radio equipment that ensures searchless (bespoiskovaya) and non-adjusting (bespodstroyechnaya) communications has been created. Printers (bukvopechatayushchaya apparatura) have been introduced up through the headquarters of the combined-arms large units. A new type of electrical communications has appeared — multichannel radio-relay communications, which is distinguished by convenience of use and great mobility. Mobile centers have been organized to ensure fast establishment of communications of operational formations and combined-arms large units (units). Radar equipment and the first automated systems have begun to be employed in the control of combat weapons.

However, the development of the means and methods of control that has taken place so far, even though it has given

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some results in the improvement of troop direction, did not fully resolve the problems of control and did not bring it into conformity with modern requirements. The basic reason for this situation is that all measures which have been mentioned were carried out separately, with a varied degree of study, and were not designed as a single coordinated system. As a result, the most important thing did not materialize — the abrupt leap in accelerating the flow of information between the various control elements and within them.

The existing system of control is still insufficiently mobile, and it does not ensure the necessary efficiency and flexibility in the work of all the control organs. In this system, first of all one observes a considerable delay in information on developments of the combat and operational situation.

The experience of exercises conducted during the past few years shows that the difficulties in the flow of information with the existing system of control begin even at the lowest tactical units. Thus, a regiment needs a minimum of 25 to 30 minutes to collect data from the battalions. One must have not less than 10 to 15 more minutes for coding this information with the aid of documents of code communications (skrytoye upravleniye voyskami). The transmission of the prepared message to the division headquarters over communications channels takes 5 to 10 minutes, and more. When the division headquarters receives this information, 20 to 25 minutes is expended for decoding and working out the data received by the corresponding officials.

Thus, information on the situation, the nature of the operations, and the condition of the troops, even without taking into consideration interference created by the enemy, reaches the division in 1.5 to 2 hours. This data reaches the army and front with an even greater delay (up to 3 to 4 hours) because the flow of information process is further complicated. The troop commander of a front (army) or a chief of staff is unable to receive and process the increased flow of information personally.

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Therefore, in the given process it is necessary to have the participation of specially selected forwarding officers (ofitser-napravlenets), and also officers concerned with enciphering documents, and up to two-thirds of all the officials of the various headquarters, directorates, and departments.

Each officer summarizes and reports the received data to his direct superior. The appropriate superiors summarize the data at the directorate (department) level and report it to the senior commanding officer, etc. Thus, before reaching the troop commander, the information passes through a whole series of various stages. The lack of a device for automatically making this information secure complicates the multi-stage flow of information even more.

An analysis of the basic streams of information shows that the existing system of control is too overloaded by duplicated information. The same information is transmitted along the line of the various arms of troops and services. Parallelism in the flow of information greatly overloads the communications channels and introduces an element of disorder into the streams of information. Different sources possess varying degrees of subjectivity regarding the information being transmitted, and this adversely affects the reliability of the information.

The lack of special technical equipment to collect information on many situation indicators, the measurements of which could be completely automated, causes great difficulties in the flow of information. Thus, despite the fact that it has long been recognized that information on nuclear strikes is basic, the troops still do not have suitable equipment to measure and transmit the basic characteristics of nuclear bursts. So far, the type of burst is determined by external signs. The coordinates of the ground zero of a burst are determined by means of intersection from one or two points with the aid of optical devices or radar sets. The yield of a nuclear warhead that has burst is determined roughly according to the duration of the thermal radiation. Even when single, not to mention group nuclear strikes, are

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delivered, when strong overall thermal radiation and shock waves are created, it is impossible in practice to observe the development of the nuclear burst visually. Specialized equipment for intersecting nuclear bursts is essential.

The procedure for receiving meteorological data in order to evaluate the radiation situation does not meet modern requirements. Basically these data come from the missile units and large units or the air army. The number of meteorological stations is inadequate, they are not united into a system, and they do not ensure a single meteorological field.

Helicopter and aircraft dosimetric equipment has not been developed at all, even though it is completely apparent to everyone that the conduct of air radiation reconnaissance is the basic, and in several cases the only, way to determine the radiation situation quickly in areas where troops are not disposed with sufficient density.

The ground equipment for radiation and chemical reconnaissance is available among the troops in an amount that fully ensures the necessary density of measuring points in the contaminated areas. However, none of it is automatic. As a result of this, much time is expended to collect information on contaminated sectors of even a small area, because each measurement conducted manually must be recorded and also manually transmitted to the next element, after first having determined the coordinates of the measurement point, using the map. Each one of these reports must go through the hands of at least four signalmen to reach the division headquarters alone.

A study of the materials of several exercises shows that on the average 2.5 to 3.5 hours are required to collect information on the radiation and chemical situation in the zone of army troop operations with the means available at the present time. It is quite apparent that the indicated time limits do not meet modern requirements in any way.

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The existing system of control lacks technical means that ensure the automatic timely collection and constant updating of information on the exact position of the forward units of our troops which are waging combat. The automation of this process is very essential in order to make decisions in a short period of time, especially for the employment of nuclear weapons.

With a rate of advance of 10 kph, the troops can advance 2.5 to 3.5 km in 15 to 20 minutes. To avoid delivering strikes against our own troops, information on their position must reach the division headquarters in not more than five minutes (taking into account that safe removal when delivering nuclear/missile strikes by division (divizionnyy) weapons is 2 to 3 km). Information on the position of forward units must arrive at the headquarters of the army and front, which employ more powerful nuclear weapons against the enemy, in not more than 10 to 15 minutes.

It is apparent that within such time limits it is impossible to collect information on the position of troops with the necessary detail and in the required zone without means of automation. Despite this, there is an extremely insufficient development of ground navigation equipment, which permits automatic determination and transmission of information on the location of troops. The available topographical tie-in devices (topoprivyazchik) are cumbersome and imperfect. They are intended only to perform a very narrow task—to determine the coordinates in one plane. Moreover, the coordinates received are only given out to persons who are at the device.

The urgent development of more improved ground navigation equipment that permits the automatic and much more accurate receipt not only of coordinates X and Y, but also data on the location of the objective above sea level, is essential. Besides this, the equipment must ensure the automatic distribution of the indicated information to the higher echelons of control. Such equipment may be combined with other automatic devices, in particular with the automatic transmitters of information on the chemical, radiation, and meteorological situation.

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With the existing means of control, the processing of information causes difficulties that are too great. The majority of the information on the situation is processed manually at all levels. As a result, even a large number of staff officers are unable to analyze the varied and large amount of information in a short period of time. In connection with the employment of new weapons of armed combat, the volume of information increased in comparison with the period of the past war by three or four times and continues to grow. The amount of time for processing the information decreases more and more. As an example, it can be pointed out that in order to receive complete data on the radiation situation alone in the zone of operations of a combined-arms army, one must process about 2,400 messages in an hour about the radiation levels on the terrain. For this, with an expenditure of even two minutes to process each message, one would have to have more than 80 properly qualified analysts (vychislitel).

To a considerable degree, the availability of special automatic devices (transmitters of information on nuclear strikes on the radiation, chemical, and meteorological situation, and on the location of command vehicles) will simplify the collection of information and will free many staff officers of all levels from one of the most labor-consuming tasks which are not connected with creative activity in troop control.

However, automation of the collection of information alone does not fully resolve the problem of increasing the efficiency of the work of commanding officers and headquarters. As is known, an equally weak point in troop control is making operational-tactical calculations. An especially large amount of forces and time are expended for calculations on the employment of nuclear/missile and chemical weapons and other weapons of mass destruction. No less time is expended on calculations for the protection of our troops from these weapons. The high mobility of combat operations requires fairly complex and exact calculations on regrouping of troops and transporting freight by various types of transport. Calculations are made quite often

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on antitank and antiair defense, the organization of communications and radio countermeasures, on the engineer preparation of the terrain, the crossing of water barriers and large zones of radioactive contamination, the planning of materiel, technical and medical support, etc.

The complexity of the calculations is caused by the fact that one must take into consideration too many factors that characterize the combat situation and that are evidenced differently under various conditions. Thus, when determining the nature and the degree of destruction of an objective by only one nuclear warhead, one must take into account the type of burst, the safe removal of our troops, the conditions of the terrain, weather conditions, the degree of protection of the objective being destroyed, the possible zones of destruction by the shock wave, by thermal radiation, and by penetrating radiation, the direction of the spreading, the possible area and degree of radioactive contamination, etc. With massed use of nuclear weapons, the combination of destructive factors becomes more complex, and the calculations become cumbersome and even more complex. Together with this, as a rule the time for making calculations is limited, and in most cases it is counted in minutes. The following examples clearly testify to this.

The majority of the enemy's weapons of nuclear attack are located at the launch sites (firing positions) for not more than 15 to 30 minutes. To destroy these weapons, during the indicated time one must reconnoiter them, transmit all the reconnaissance information to the appropriate elements of control, make the decision, inform those who carry it out, prepare the initial data for conducting fire, and transmit the appropriate commands.

Under conditions of the increased combat readiness of our destructive weapons, they can start to perform the assigned task: the artillery in 2 to 3 minutes, the tactical missiles in 15 minutes, and the operational-tactical missiles in 25 to 40 minutes. The division command will have not more than 3 minutes at its disposal and the army and front command 10 to 30 minutes for the collection,

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transmission, and processing of information, for making a decision, and assigning combat missions to the executors to destroy the enemy nuclear weapons with at least a 70 percent reliability of destruction. To achieve greater reliability of destruction the time for preparing strikes must be greatly reduced.

With such time limits the methods of controlling missile and artillery large units and units must be extremely mobile. It is essential to ensure conditions under which the strike against the enemy, especially against his nuclear/missile weapons, would be delivered immediately, even before the missiles are launched against our troops. This task can be performed only on the basis of automating the control processes.

In connection with the movement of missile large units and units during an operation, and the constant expenditure of ammunition, the need arises to have information constantly on the location and degree of readiness of these large units (units) to carry out the combat mission. The expenditure of nuclear warheads is calculated down to the individual warhead, not only in tactical, but also in operational headquarters. The movement of munitions from the missile-technical large units (bases) to the launch sites, and their degree of readiness, require strict calculation. At the present time there are no devices and instruments to perform these tasks.

For the efficient employment of nuclear warheads one must select the optimal variant of target distribution. To perform such a task manually and sort out many combinations within condensed time limits is impossible in practice.

To satisfy the above requirements one not only must improve the existing system of controlling missile large units and units, but also find new, more efficient methods and equipment based on the latest achievements of science and technology, and first of all radio-electronics.

The employment of means of automation is especially essential in the system of antiair and antimissile defense.

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As is known, the enemy weapons of air attack are quite varied and are characterized by a large range of speeds (from several meters to several hundred meters per second) and by an almost unlimited flight range and a considerable ceiling (up to hundreds of kilometers). To carry out its tasks the system of antiair defense weapons must be extremely refined. At the present time a gap can be seen between the means for controlling weapons and the overall system for directing the antiair defense troops. Together with the use of completely modern automated systems for guiding antiaircraft missiles, the obsolete, so-called plane table-manual (planshetno-ruchnaya) system of control is used at the control points. The transmission of information on air targets and the assignment of combat tasks to units and large units for repelling the raid of the air enemy are carried out by voice or a telegraph key, and therefore require much time.

The fast and suddenly changing air situation and the short duration of the flight of targets in connection with the close basing of the enemy tactical aviation (about 100 km from the frontline) require that the process of controlling antiair defense troops from the moment that the air targets (aircraft) are discovered until the missile is launched takes 1 to 4 minutes, and when destroying enemy missiles—much less time.

Forces and weapons of antiair defense which are varied in their combat characteristics, organizational structure, and methods of operations participate in repelling the air enemy. In connection with this, within a short period of time one must select the most expedient forces and weapons to destroy a certain target in the actual situation that arises, prepare and issue the necessary orders for the employment of the selected forces and means, and make a calculation on the time and lines of interception, the fire capabilities, and the expenditure of ammunition (missiles). It is impossible to perform all these tasks without employing automation. It is essential to have an efficiently operating system of automatic and automated devices at PVO control points, connected by reliable communications channels with systems of antiaircraft weapons and fighter aircraft airfields.

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This system must be based on electronic equipment that would ensure the flow of information in fractions of seconds.

The problem of forecasting radioactive contamination is very complex with the existing means of control. It is known that the enemy's employment of nuclear weapons may result in the creation of contamination zones that encompass the areas of combat operations of whole operational formations. To retain the combat effectiveness of troops one needs exceptionally accurate and timely organization of their protection from the effect of radioactive substances and the swift elimination of the aftereffects in centers of destruction, without decreasing the overall speed of developing the operation.

Calculations for forecasting the contamination of terrain are so complex and laborious that they cannot be carried out manually within a realistically possible time, even by a large number of data-processing personnel. Nevertheless, these calculations must be done as quickly as possible in order to have time to lead troops out of the zones of possible radioactive contamination. Each minute saved by speeding up the calculations increases the time for maneuvering the troops. Despite their complexity and laboriousness the calculations must be exceptionally accurate. Even small errors in determining the possible boundaries of the contaminated areas and the radiation levels in them may lead to incorrect conclusions on the potential doses of radioactive radiation of personnel and may become the cause of mass troop destruction.

Consequently, the urgent need arises for the complete automation of all processes for forecasting radioactive contamination, starting with the measurement of the extent and the determination of the nature of the contamination of the terrain up to the calculation of the possible destruction of personnel.

Under modern conditions the significance of engineer support increases considerably and the direction of the

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engineer troops becomes more complex.

Engineer support of operations entails carrying out engineer work that is huge in volume. The fortification work alone, when fully preparing a defensive line of a combined-arms army, includes the excavation of 2.5 to 3 million cubic meters of earth and the preparation of 60,000 to 100,000 cubic meters of lumber. The engineer troops are equipped with complex, highly efficient equipment, the number of units of which is equal to the total amount of the motor vehicle park of a combined-arms army.

The commanding officers and staffs of the engineer troops and organic engineers constantly encounter the need to store up and process a large volume of information to plan the engineer support of an operation and battle. The planning itself requires laborious calculations that may be successfully fulfilled only with the existence of appropriate means of automation.

As is known, radioelectronic equipment is one of the basic means that ensure effective employment of various types of weapons and of combat equipment, and also troop control. It is possible to judge the scale of employment of radioelectronic equipment at least from the fact that in an offensive zone of one combined-arms army, with an enemy army corps defending against it, there may be up to 25,000 to 30,000 ground radio sets, about 200 radio-relay stations, and up to 300 radar sets, concentrated on both sides. Besides, aircraft with hundreds of their own radio sets and radar bomb sights may be operating in this zone.

Disruption of the work of radiotechnical equipment leads to a significant reduction of the troops' combat capabilities. Therefore, under modern conditions radio countermeasures and protection of our own means from enemy radio jamming acquire special significance.

To organize radio countermeasures one must have complete and timely information on the enemy's system and means of radioelectronic support, on their operating procedures, and also on the methods used to avoid radio jamming.

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The time for collecting and processing of such information must be calculated in seconds. This requirement stems from the fact that many of the enemy's control systems operate within very strict time conditions. Thus, for example, the radio remote control system of the "Lacrosse" guided missile is switched on for 30 seconds. During this time one must discover the system, obtain the appropriate data on its parameters, process the information, make up commands, transmit them to a subunit, and start radio jamming.

The radioelectronic devices of our troops and of the enemy may work on the same frequency bands. Therefore, during the indicated time it will also be necessary to determine to what extent the control of our own troops and combat equipment may be disrupted.

The execution of all radio-jamming measures requires fast and complex calculations. Not more than 20 to 30 percent of the time during which the device to be destroyed is transmitting must be spent on making such calculations. This can be achieved only by employing automatic means.

Troops armed with varied and complex combat and special equipment expend a large amount of materiel means in a battle or operation. To support the combat operations of troops in one front operation alone, about 700,000 to 800,000 tons of various materiel means may be required. The average expenditure of these means fluctuates between 70,000 to 100,000 tons per calendar day. When managing a modern rear service, one must deal with hundreds of thousands of materiel items (nomenklatura) and with hundreds of consumers and suppliers. The rear services control organs must perform laborious work on the planning and execution of supply, using all types of transport efficiently within a limited time and under complex conditions of the situation.

The versatile activities of the rear services for the uninterrupted support and servicing of troops require precise planning of all types of rear services support that is based on a large number of calculations. Much time is spent in making these calculations. Thus, from the experience of several exercises it

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has been established that the time spent only to calculate the weight of the POL supplied to the front comprises not less than 20 man-hours, and to calculate the supply of materiel takes not less than 60 man-hours.

The increased possibility that a large amount of personnel, equipment, and materiel means may be put out of action will require various types of recalculations to determine the true condition of troop supply and their requirements during an operation.

Delay is especially intolerable in the work of rear services organs in supplying troops with ammunition with nuclear charges and with fuel, because it will immediately influence the success of the operation negatively. Therefore, envisaging possible changes in the situation and constant readiness to utilize all the available forces and means of the rear service are very important when there is a threat that the planned materiel support will be disrupted.

The successful solution of all these problems depends directly on improving the methods and means of controlling the rear services on the basis of new equipment.

From all that has been stated above, it is apparent that no matter which arm of troops or service we take, and which area of control we examine, the means of control that exist at the present time do not fully ensure the completion in short periods of time of the large amount of operational-tactical calculations that are essential to make the optimum decision, to plan the combat operations of troops in a timely manner, and to use combat weapons efficiently, because the majority of the calculations are done manually.

Most often, commanding officers have to make decisions only on the basis of the knowledge of the nature of modern combat operations, the capabilities of their own troops and those of the enemy, and of some logical assumptions.

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To make operational-tactical calculations without employing means of automation requires much time and a large number of well-prepared executors. The results of such calculations may have great errors. Besides, most often the calculations are made as applied to one or to a limited number of variants and do not permit the commanding officer to select the optimum one. They do not ensure taking into account completely and comprehensively the many varied factors of the situation.

Equally, the great mobility of troops supplied with nuclear/missile weapons permits both warring sides to concentrate their efforts quickly and deliver sudden, powerful strikes. The slightest delay in carrying out the collection, processing, and transmission of information, and also in making the decision under these conditions, may lead to the fact that the enemy will prevent the strike or will have time to carry out measures that decrease the effectiveness of our troops' combat operations. Therefore, under modern conditions the time factor in controlling troops attains decisive significance. It is the most important reason creating the need to introduce means of automation.

The development and introduction of means of automation must be done not in an uncoordinated manner but in a single system. The automation of only separate sectors of the control process will not give substantial progress in resolving the main problem—reducing the time limits for passing and processing information, because with this its multistage transmission will be retained, with numerous interruptions of the automatic processes by inefficient manual labor. Comprehensive automation of the control processes is necessary.

A comprehensive automated system of controlling troops is understood to be a system that simultaneously ensures the requirements of all arms of troops and services at various levels of control and is based on a whole system of technical means of control that vary in organization and purpose. The system must envisage the employment of devices, equipment, apparatus, and machines that permit carrying out part of the control processes without direct human participation,

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but only under his control, and also controlling troops by combining the use of technical means and the creative activity of commanding officers and staff officers.

Comprehensive automation permits using the advantages of each technical means in the most effective manner. It can satisfy the requirements of all arms of troops and special troops, who are executing the common combat task in close cooperation, more fully and comprehensively.

The intercoupling of all the technical equipment in a definite system will produce an unquestionable saving of time when passing information and making operational-tactical calculations, because the opportunity will be created to receive information automatically and to make many calculations without direct human participation.

The comprehensive employment of means which vary in their capabilities and purpose also permits coupling them in various combinations and thus ensures the quick transfer from one type of control methods to another, retaining stability of troop direction when not only single elements but also whole levels of the system are put out of action

The basis of the system of new technical means of control in the automated system will be composed of electronic computers and means of communications and of forming (formirovaniye) initial information that corresponds to them, among which are the sensors (detcnik) of information on nuclear strikes, on the radiation, chemical, and meteorological situation, ground navigation devices, automated devices for relaying information (receiving-transmitting), automatic devices to make the information being transmitted secure, automatic distributors of information, and new and more effective means of communications.

The employment of the above means will permit the introduction of the basic mass of operational-technical information necessary for troop direction into the system automatically, without any human participation. The information that entered the control system with the aid of electronic computers may be automatically summarized (consolidated) to

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the necessary degree and transmitted from one echelon of control to another. In those echelons of control where electronic computers will be employed, the distribution of information to the commanding officer and to other vital personnel may also be carried out automatically—it will be projected on a screen in graphic form against the background of a topographic map, through a special reflecting apparatus.

With the aid of a comprehensive automated system of control, it will be possible to automate fully the entire process of exchanging information with the higher, adjacent, coordinating, and subordinate staffs, and also between the directorates and departments within the staffs. Thus, with a minimal expenditure of human labor, one of the most important problems of control—the problem of ensuring coordination—may be resolved to a significant degree.

In the end, the comprehensive employment of electronic computers and other means of automation should sharply raise the effectiveness of control, and mainly the reaction speed of commanding officers and staffs of all levels to the combat situation, and should bring troop control into complete accord with the requirements of a modern battle or operation.

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