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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

15 September 1978

[redacted]

MEMORANDUM FOR: The Director of Central Intelligence

FROM : John N. McMahon
Deputy Director for Operations

SUBJECT : MILITARY THOUGHT (USSR): Predicting the Combat Losses and Balance of Forces of the Opposing Sides in an Operation

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". The article deals with the use of computers to predict the combat losses and balance of forces of the opposing sides in a front offensive operation. Discussed is a mathematical model that was drawn up of such an operation and the results of the computer analysis of the model indicating the potential level and structure of the losses in weapons and equipment, the influence of the initial nuclear strike on losses, and the status and effect of reconnaissance in the operation. This article appeared in Issue No. 2 (84) 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].

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[redacted]

[redacted]

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COUNTRY USSR [redacted]

DATE OF INFO. Mid-1968

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SUBJECT

MILITARY THOUGHT (USSR): Predicting the Combat Losses and Balance of Forces of the Opposing Sides in an Operation

SOURCE Documentary

Summary:
The following report is a translation from Russian of an article which appeared in Issue No. 2 (84) for 1968 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The authors of this article are General-Mayor of Aviation I. Klimashin, Colonel V. Aleksandrov, Engineer Major S. Selivanov. The article deals with the use of computers to predict the combat losses and balance of forces of the opposing sides in a front offensive operation. Discussed is a mathematical model that was drawn up of such an operation and the results of the computer analysis of the model indicating the potential level and structure of the losses in weapons and equipment, the influence of the initial nuclear strike on losses, and the status and effect of reconnaissance in the operation.
End of Summary

[redacted] Comment:
A Colonel V. Aleksandrov also wrote "Concerning the Problem of Increasing the Readiness of Rocket Troops of the Front for Delivering an Initial Nuclear Strike" in Issue No. 3 (82) for 1967 [redacted]. General-Mayor I. Klimashin and Engineer Major S. Selivanov were also co-authors, along with an Engineer Captain Yu. Fedulov, of an article entitled "Solving Military-Economic Problems by Means of Computers" in Issue No. 2 (81) for 1967 [redacted].

[redacted]

[redacted]

<u>Predicting the Combat Losses and Balance of Forces of the Opposing Sides in an Operation</u>

by

<u>General-Mayor</u> of Aviation I. KLIMASHIN
Colonel V. ALEKSANDROV
Engineer Major S. SELIVANOV

Predicting combat losses of personnel, weapons, and equipment, as well as the balance of forces of the opposing sides in an operation, is one of the most important elements of military prediction. The way in which it is done makes it possible to judge the level of scientific control of troop combat activity. Predicting combat losses and the balance of forces acquires special significance under conditions of a nuclear war, in which the traditional norms and methods of prediction prove to be useless. Consequently, there has arisen the very serious task of finding new, improved methods.

Studies have shown that the mathematical modeling of operations on electronic computers shows great promise in terms of accomplishing this task. Mathematical modeling makes it possible to describe objectively and comprehensively the complex mechanism of conducting operations, as well as to carry out a number of specific tasks and to obtain logically correct and approximately accurate estimates of the course of combat at any stage of its development.

This article examines the basic characteristics of such a military-mathematical model of two-sided warfare which develops within the framework of a <u>front</u> offensive (defensive) operation, and indicates the potential level and structure of the losses in weapons and equipment suffered in combat, the influence of the initial nuclear strike on losses, and the status of reconnaissance. Finally, it makes some recommendations that will enable the operational staffs to take better account of these factors when planning an operation.

All the concrete data cited by us on losses and balances should be considered as merely an illustration of the capabilities of a model-apparatus for studying <u>front</u> operations, one that can also be applied in other situations and in other theaters of military operations when the opposing sides have a different composition and there is a different concept of troop employment.

A front operation is viewed in the model as a single formalized complex system (Figure 1) describing the actions of our attacking troops (Side A) and the enemy's grouping of defending troops (Side B).

The opposing troops are placed in three arbitrary zones that reflect a basic diagram of their operational disposition: the close contact zone; the tactical zone; and the operational zone.

In the first zone, the opponents are not far apart (0.5 to one kilometer). Nuclear weapons are not employed in this zone because of the danger of hitting one's own troops. The zone is characterized by intense antitank warfare and the active use of small-arms and mortar fire. Located in this zone are the forward subunits of tank, motorized rifle (infantry), and artillery divisions. A portion of the artillery from the tactical zone is allowed to be employed in support of the troops in the close contact zone.

Located in the second zone are subunits and units of troops from the battle formations of both the first and second echelons of the tank, motorized rifle (infantry), and artillery large units and units, as well as a part of the army reserves. Also located in the second zone are tactical missile and nuclear artillery subunits and field air defense subunits and units. The depth of this zone, which is determined by the range of the tactical means used for delivering the nuclear weapons and by the range of the heavy artillery, reaches 15 to 20 kilometers. All targets in the tactical zone can be hit by the enemy's nuclear and conventional weapons located in the analagous zone, and also by some of the means in his operational zone. In order to build up efforts and replace losses, provision is made to reinforce the troops in the close contact zone with those drawn from the combat personnel in the tactical zone, with the latter, in turn, reinforced with troops from the operational zone.

The third zone, 300 to 450 kilometers, includes the entire remaining depth of the troop disposition located beyond the range of the means in the enemy's tactical zone. Located in this zone are battle formations of large units and units of army and front reserves, large units and units of army and front missiles, front (tactical) aviation at airfields, air defense means, and all the remaining troops.

Troop groupings of the opposing sides located in an operational zone can be hit by conventional or nuclear weapons employed by army and front missiles and front (tactical) aviation. Part of the fire power in this zone is allocated for striking at enemy targets in the tactical zone. Also permitted in the model is the use of the nuclear and conventional weapons of adjacent units and of the Supreme High Command within the limits of 10 to 20 percent of the means designated for the operation of the given front.

Thus, the formalized diagram of an operation reflects the basic principles of the operational disposition of the troops. The model developed on the basis of this diagram allowed us to take fully enough into account the content of a front operation:

-- the basic characteristics of its concept;
-- the aims, composition, and structure of the forces of the opposing sides, and their operational disposition;
-- the planning of troop actions with respect to time and the main tasks;
-- the decision of the command concerning the distribution and employment of nuclear and conventional weapons to carry out the main tasks;
-- the functioning of reconnaissance and the enemy's air defense countermeasures;
-- the duration of the operation and several other factors significantly influencing the extent of the losses.

A model makes it possible to predict the losses of the main types of weapons and equipment for troops of different composition participating in an operation and to determine the balance of forces of the sides as of any moment of the operation.

We examined three questions in analyzing a <u>front</u> offensive operation with the assistance of the above-mentioned mathematical model.

First -- what irrecoverable losses of basic weapons and equipment due to the enemy's nuclear and conventional weapons might be suffered by the troops of Side A's attacking <u>front</u> during the entire operation under certain conditions.

Second -- against what targets of Side A will the enemy expend his nuclear warheads during the operation and how many of the enemy's nuclear warheads will be destroyed by Side A.

Third -- what balance of forces of the sides (in weapons and equipment) might evolve after a simultaneous exchange of initial nuclear strikes, after the immediate task has been accomplished, and upon the conclusion of the operation.

Studies of the first question showed that the greatest losses (73 to 78 percent) might be suffered by the nuclear weapons delivery vehicles (missiles of all classes and aircraft) and surface-to-air missiles (37.5 percent), since in the operation both sides observe the principle of the swift destruction of all the located means of these classes. Obviously, the number of nuclear warheads possessed by Side B enables it to destroy almost all of Side A's nuclear weapons delivery vehicles.

Tanks might suffer the fewest losses during the operation (14 to 15 percent), which is explained by their ability to withstand the destructive effect of nuclear weapons and by the system of target allocation adopted in the given instance: tanks, along with artillery and motorized rifle subunits, are destroyed after nuclear weapons delivery vehicles and air defense means. A change in the destruction priority for tanks could lead to an increase or a decrease in their losses.*

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* In one of the versions, in which Side B included a part of Side A's tank subunits among the first-priority strike targets, along with the nuclear weapons delivery vehicles, Side A's irrecoverable tank losses increased up to 25 to 30 percent. At the same time, there was a decrease in the losses of some other types of weapons and equipment.

Losses of the remaining types of weapons and equipment during the entire operation fluctuate between 17 and 37 percent.

The average losses from the enemy's conventional weapons (artillery, aircraft) are six to 18 percent of the overall total of weapons and equipment in the hands of the attacking <u>front</u> troops at the beginning of the operation. Very indicative is the distribution of the level of losses according to the main tasks (stages) of the operation. For example, for all classes of missiles (except surface-to-air missiles), losses were 23 to 25 percent after the initial nuclear strike, 29 to 34 percent after the accomplishment of the immediate task, and 17 to 18 percent after the carrying out of the follow-up task. For tanks, the corresponding figures were 1.5 to 2.5 percent, six to nine percent, five to six percent.

This constitutes the answer to the first question.

Studies of the second question made it possible to reveal from what strikes Side A suffered losses. They showed that in the course of the operation about a quarter of the enemy's nuclear warheads are destroyed by the strikes of Side A, while the remainder are used by the enemy in the following way: 17 percent against groupings of nuclear weapons delivery vehicles; 31 percent against air defense means; and 52 percent against artillery, tank, and motorized rifle units and large units, principally in the execution by the <u>front</u> troops of the immediate and follow-up tasks.

The results of a study of the expected total losses at the different stages of an operation were incorporated by us into a table showing the change in the balance of forces of the sides in the course of the operation.

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Designation of the targets	Balance of Forces of the Sides ("A":"B")			
	At start of operation	After initial nuclear strike	After execution of immediate task	At end of operation
Front missile batteries	7.5:1	6:1	6:1	3:0
Army missile batteries	1.2:1	1.2:1	1.2:1	1.5:1
Air regiments	0.8:1	0.8:1	0.8:1	1:1
Tactical missile battalions	0.9:1	0.9:1	0.9:1	0.9:1
Atomic artillery battalions	0:21	0:15	0:8	0:4
Surface-to-air missile subunits	3.7:1	3.7:1	3.7:1	4.1:1
Artillery battalions	2.2:1	2.3:1	2.9:1	2.5:1
Motorized rifle battalions	1.1:1	1.1:1	1.25:1	1.9:1
Tank battalions	1.8:1	1.8:1	2.1:1	3.4:1

The data cited in this table show that the balance of forces remains equal for many classes of targets in the course of the operation. This is explained by the fact that our example assumes the same reconnaissance characteristics and the same destruction priorities for both sides. In order to inflict heavier losses on Side B and to diminish its own losses, the front conducting the offensive must above all improve its reconnaissance, especially of the first-priority destruction targets, i.e., the enemy's nuclear weapons delivery vehicles. In addition, if it is necessary to destroy a larger number of the enemy's tank battalions, a part of them must be included in the list of first-priority targets, especially in the delivery of the initial nuclear strike, since after the strike the attacking side would want to have a more favorable ratio of tanks.

The data obtained on the losses and on the balance of forces of the sides make it possible to foresee the gradually more complicated task of replacing losses in an organized manner, moving up reserves from the depth and committing them to an engagement on a timely basis, and bringing troops up to strength in weapons and equipment. These data allow the operational staffs to plan more precisely the method of carrying out these tasks in an operation.

The above results were obtained in studying one version of conducting an operation. However, it is very important for any operational staff to have the necessary scientifically based initial materials in order to carry out the same tasks in another, more complicated situation. For example, all the concluding data might be entirely different if there is a change in the delivery time of the initial nuclear strike or in the plan for the employment of nuclear warheads because of the inopportune acquisition or reduced amount of reconnaissance data, etc. We therefore consider it necessary to examine the degree of influence of these factors on the extent of losses in an operation.

To estimate the influence of a preemptive delivery of the initial massed nuclear strike, we studied three versions: first -- Side B is the first to deliver a strike; second -- both sides deliver strikes at the same time; and third -- Side A delivers the initial strike. The amount of preemption is one hour. An analysis of the results shows that if Side B delivers a preemptive strike (first version), the losses suffered by the attacking <u>front</u> troops in the motorized rifle, tank, and artillery <u>large</u> units and units will increase one and a half times and more when compared with those in the third version (in which Side A delivers the preemptive strike). In other words, the greater the delay, the greater the losses suffered by the delaying side.

Therefore, it is necessary for operational staffs, in planning operations, to work out measures aimed at thwarting the enemy's preemptive nuclear strike, for example, measures such as the thorough and timely reconnaissance of the enemy's missile/nuclear weapons delivery vehicles, the determination of when the enemy will deliver his initial massed nuclear strike, increasing the readiness of one's own missile/nuclear means for preemptive actions, and others.

One of the most important problems in planning and conducting an operation is determining a plan for the expenditure of nuclear warheads in accordance with the stages of the operation.

It was necessary to learn what change there tended to be in Side A's losses when both sides expended the warheads allocated to them in different ways.

Studies of several versions of expending warheads showed that the most favorable version for Side A (as for Side B) is the one that is more closely coordinated with reconnaissance data.

Consequently, during an operation, the front commander and staff must establish a rational correlation between the flow of incoming reconnaissance data about enemy targets and the capability of their own fire means to swiftly destroy the detected targets. This particularly underlines the need for the operational staffs, in planning the expenditure of nuclear warheads, to take careful account of their reconnaissance capabilities. A disproportion between the number of nuclear warheads and the plan for their expenditure, on the one hand, and reconnaissance capabilities, on the other, is not permissible, since it leads to unnecessary losses and the additional expenditure of materiel resources. Therefore, the necessary conditions for the successful planning and conduct of an operation are the rational correlation of the flow of incoming reconnaissance data about first-priority enemy targets and the capability of one's own fire means to destroy the detected targets, as well as the availability of a reserve of nuclear warheads and their delivery vehicles.

The process of planning requires an estimate of the reconnaissance capabilities of the opposing sides. For this reason, studies were made with respect to the influence of the effectiveness of the sides' reconnaissance and control (that is, the quality of their reconnaissance and control) on the extent of the losses suffered by Side A. Assumed during the studies were various indicators of the quality of reconnaissance.* The change in the level of losses of the main types of weapons and equipment in the first group of troops (rocket troops and aviation) and in the second group (motorized rifle, tank, and artillery troops) are shown in derived form in Graphs 1 and 2.

Graph 1 shows the changes in losses for Side A in relation to the derived indicator of the quality of its reconnaissance.** It can be concluded from an analysis of the graph that an improvement in the quality of Side A's reconnaissance and control will lead to a reduction of its losses by a factor of 1.5 to 2.5 in comparison with the basic version. This is particularly evident for the weapons and equipment of the second group of troops. It is thus necessary to take all steps to improve the reconnaissance and control system.

Graph 2 shows the relationship of Side A's losses to the derived indicator of the quality of the enemy's (Side B's) reconnaissance and control. An analysis of the losses of the attacking front troops shows that the improvement by the enemy of the quality of his reconnaissance and control leads to an increase in the losses of weapons and equipment suffered by the first group of Side A's troops, that is, the first-priority strike targets, while the losses of the second group decrease. This is explained by the redistribution of Side B's warheads principally to destroy targets in Side A's first group that have been detected by reconnaissance. These results confirm the importance and necessity of taking measures to disrupt enemy reconnaissance: the camouflaging of one's own troops; warfare against the enemy's technical reconnaissance means; etc.

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* Understood by quality of reconnaissance and control is the kind of state and use of reconnaissance and control means that makes it possible to acquire a definite percentage of reconnaissance data about the sides' targets in each of the time segments being examined and to achieve the readiness of the means of destruction for the timely delivery of a strike against located targets. Assumed as an indicator of quality in this research is the average percentage of located targets of each class (in the time segment under examination).

** Taken as the derived indicator of the quality of reconnaissance and of control is the coefficient of change in the average percentage of located targets covered in the time segment under examination compared with the basic version (which is the same for all classes of targets).

Our studies make it possible to draw the following conclusions.

The figures obtained through computers on the levels and structure of the losses of weapons and equipment enable the staffs to plan more precisely operations and measures for the replacement of losses and to take timely measures for raising the effectiveness of the employment of forces and means in a battle and operation.

It is perfectly obvious that the above figures on losses, which were obtained by solving several tens of versions,* are not equally applicable to all operations, but the revealed consistent pattern and the causality of losses hold good for any situation. The task is to employ the developed apparatus (model) for a thorough study of front and army operations so as to equip command personnel and operational staffs with up-to-date means for seeking and working out more effective solutions that ensure the reliability and depth of scientific prediction.

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* It takes 10 to 20 minutes to solve one version on an M-20 computer.

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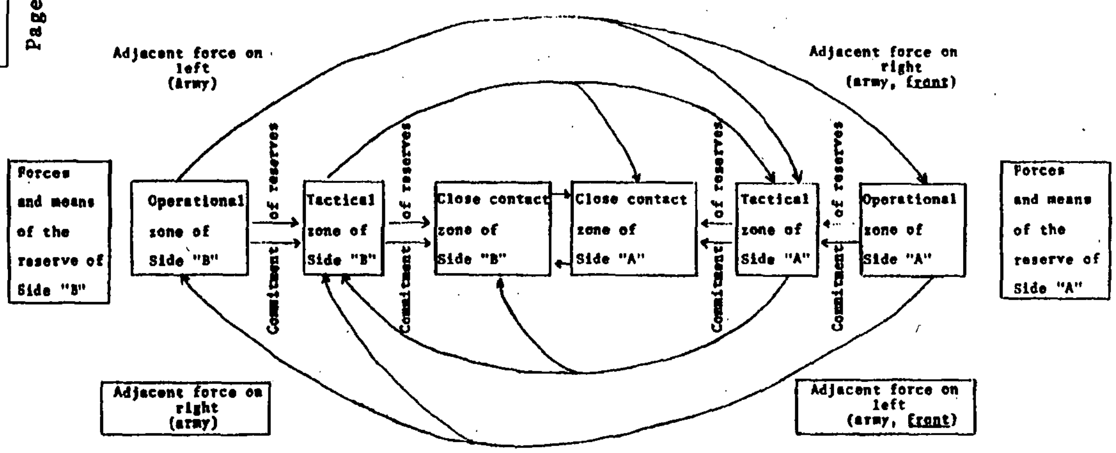

Figure 1. Formalized Diagram of a Front Operation

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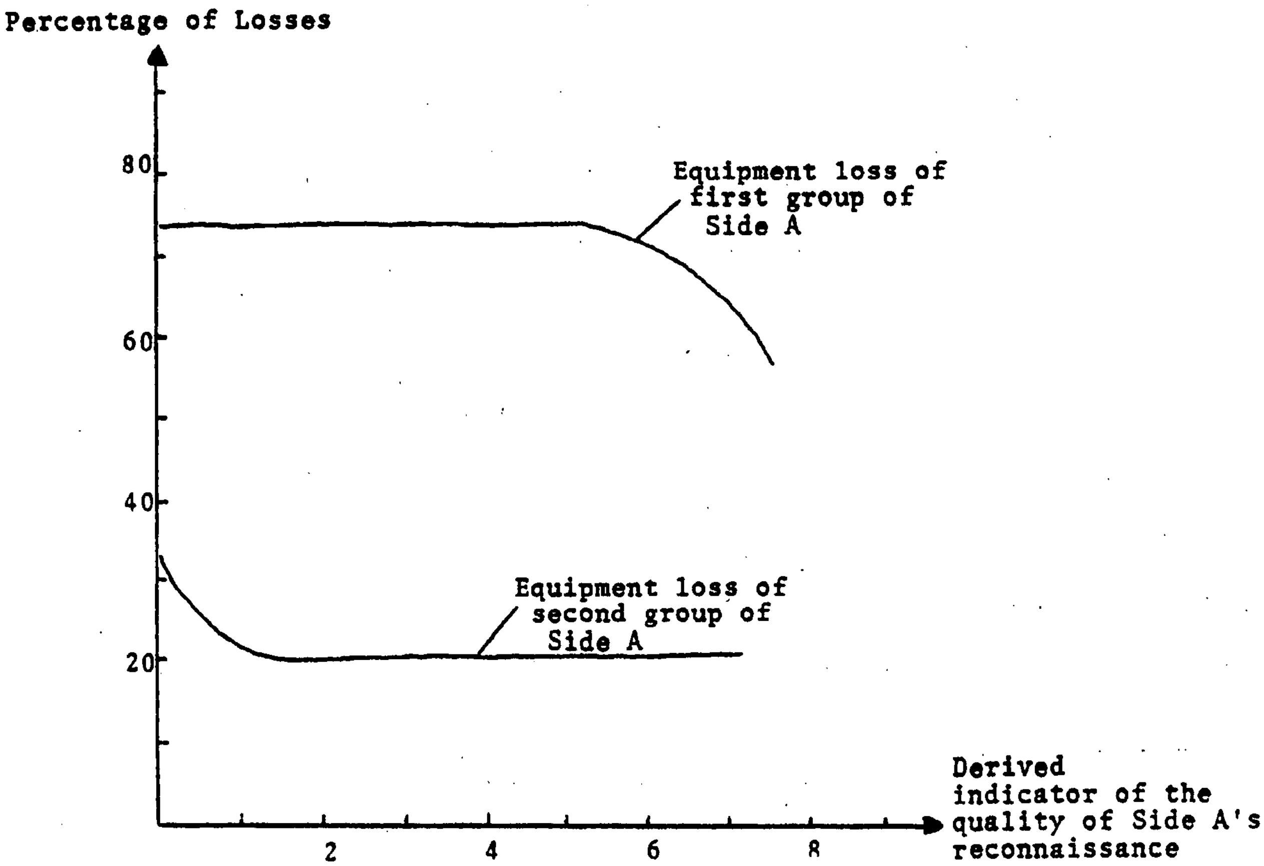
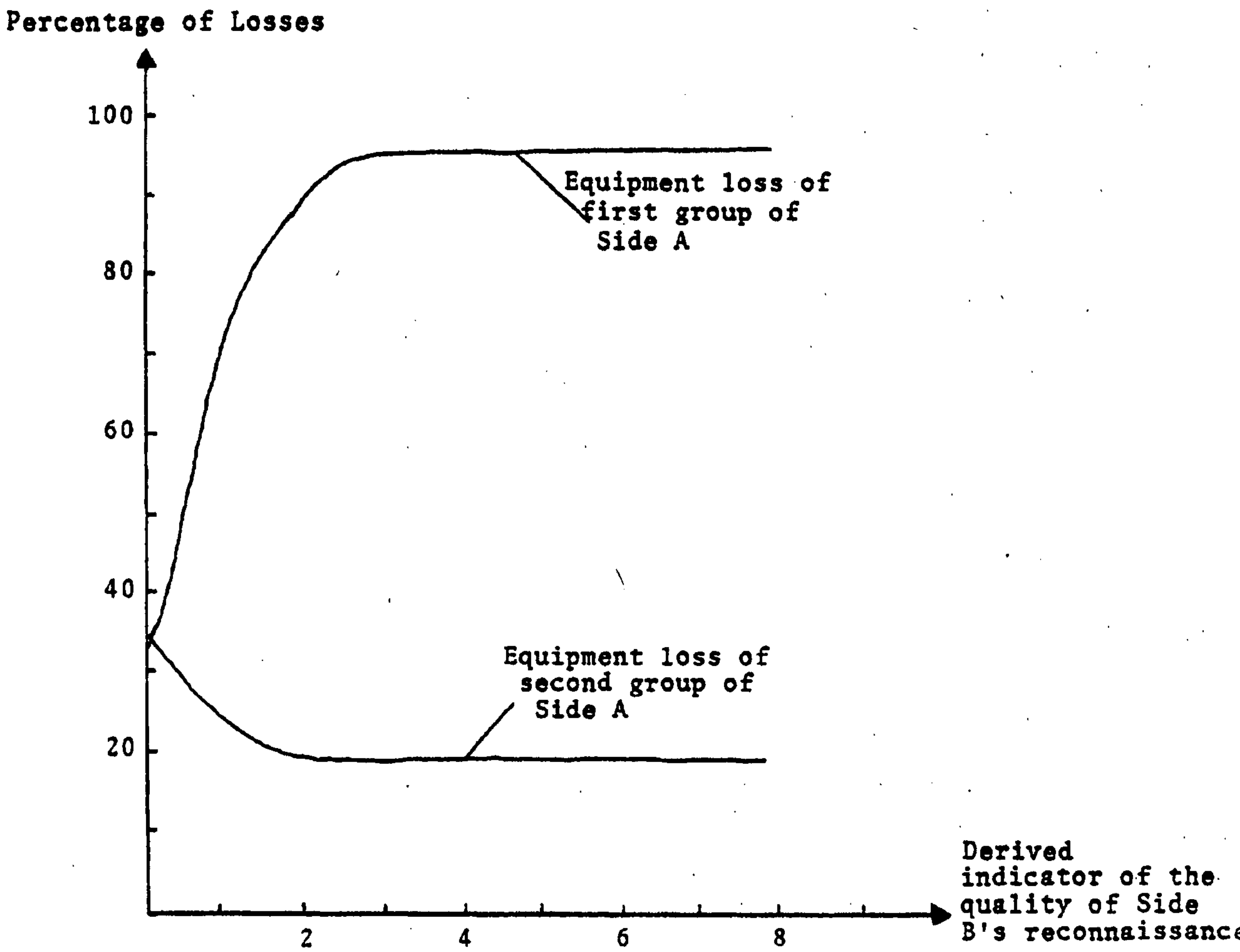

Percentage of Losses
80
60
40
20
Equipment loss of first group of Side A
Equipment loss of second group of Side A
2
4
6
8
Derived indicator of the quality of Side A's reconnaissance

Graph 1


Percentage of Losses
100
80
60
40
20
Equipment loss of first group of Side A
Equipment loss of second group of Side A
2
4
6
8
Derived indicator of the quality of Side B's reconnaissance

Graph 2