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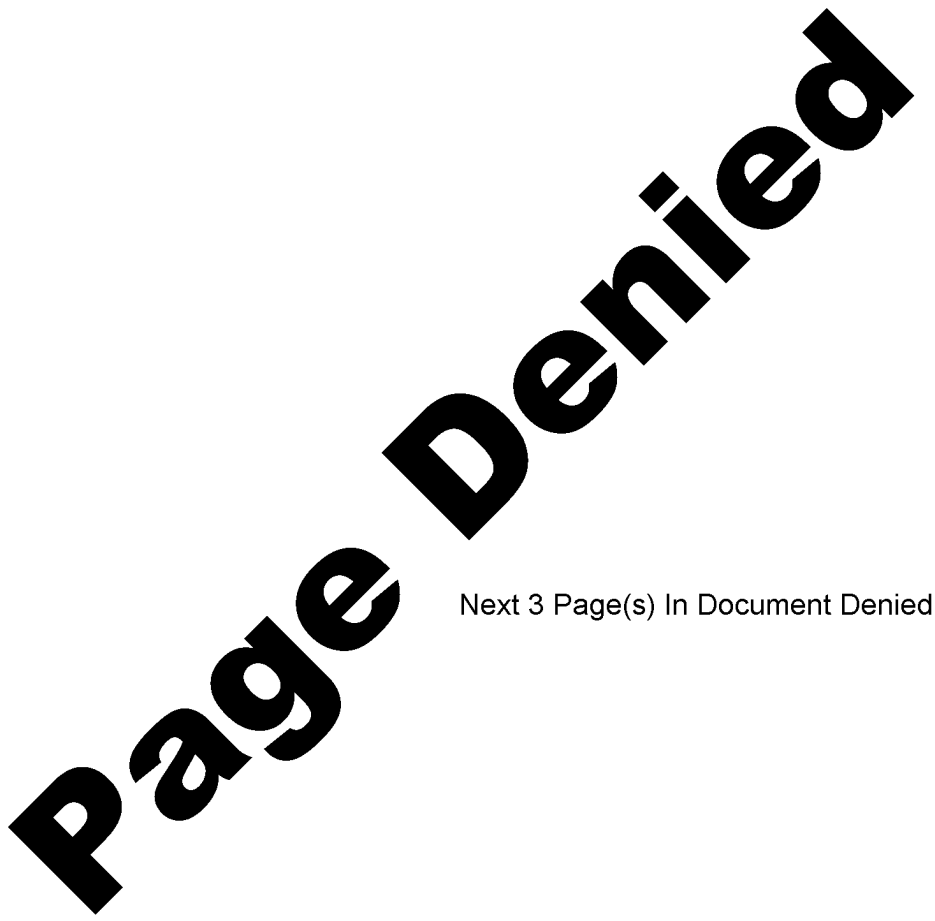

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Evaluation of the Effectiveness of Preemptive Strikes in a Meeting Engagement of a Tank Army

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The article by Marshal of Armored Troops A. Babadzhanyan "A Meeting Engagement of a Tank Army in an Offensive Operation of a Front",* raises the very important question of preparing and conducting a modern meeting engagement with tank formations. This article closely examined and set forth the conditions under which a meeting engagement arises, the scope of such an engagement, and the methods of using nuclear weapons and other means of destruction. Particularly worthy of mention are the concepts regarding the determination of the stages of a meeting engagement and the organization and implementation of preemption of the enemy as the most important condition for the success of such an engagement.

Considering the urgency of this problem, we would like to examine and develop certain concepts and, above all, express our views on the evaluation of the effectiveness of preemptive nuclear and fire strikes.

Obtaining quantitative evaluations regarding preemption is extremely important for making well-grounded decisions, for using forces and means efficiently, and for choosing expedient methods to defeat the enemy with strikes by nuclear, chemical, and conventional weapons, and by actions of tank groupings.

The basic quantitative characteristics of preemptive strikes are the preemption time and the expected result of a nuclear (fire) strike; the effectiveness of the strike is indicated by the extent of damage inflicted on the enemy, and is dependent on the number of missiles expended (artillery ammunition and aircraft bombs). Indeed, it is one thing when the main mass of the means of destruction (for example, 70 to 80 percent) allotted for defeating the enemy is used in preemptive strikes, and quite another when only part of them (for example, 20 to 30 percent) are used. All of this determines the extent of the damage inflicted on the opposing enemy grouping and influences the choice of methods for routing the enemy in a meeting engagement and the use of tank large units.

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*Collection of Articles of the Journal "Military Thought", 1968, No. 3 (85).

On the one hand, a preemptive strike represents a unique race by two groupings advancing toward each other to deliver nuclear and fire strikes; on the other hand, a preemptive strike must be regarded not only as an event of short duration but also as a definite period whose duration will be determined by the time of preemption of the enemy in the delivery of strikes.

The first step in evaluating effectiveness is to determine the preemption time when the troops have to deliver strikes against the enemy. Thus, if a tank army is conducting a meeting engagement with an advancing large enemy reserve grouping, the preemption time will be determined by the conditions under which this engagement arose, particularly by the distance between the two sides; by the tactical-technical characteristics and specifications of the rocket troops, artillery, and aviation; by the range of launch (fire); by the rate at which the troops are approaching each other; by the degree of readiness; by the time needed to deploy the means of destruction from the march. These basic characteristics may be tied together by the following mathematical relationship:

$$t_u = \frac{D - d}{v_n + v_p} + t_p \ , \qquad (1)$$

where t_u = the time of preemption of the enemy in the delivery of strikes;
D = the range of launch (fire) of our means of destruction;
d = the range of launch (fire) of enemy means;
v_n = the speed of advance of our troops;
v_p = the speed of advance of enemy troops;
t_p = the time of deployment of the enemy means of destruction.

In this relationship we assume that we will preempt when $t_u > 0$ (the enemy will preempt when $t_u<0$).

For means of destruction which do not have a significant advantage in range of fire, for example, artillery, the time of preemption is characterized by the difference in the moments at which the two sides open fire:

$$t'_u = t'_p - t'_n \ . \qquad (2)$$

where t'_p and t'_n are the respective moments at which the enemy and our side open fire.

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Since this relationship may be represented as the difference of time in preparation for fire, formula (1) may take the general form

$$t_u = \frac{D - d}{v_\Sigma} + (t_p - t_n) , \qquad (3)$$

where t_n = the time of deployment of means of destruction;
v_Σ = the combined speed with which the two sides are approaching each other.

Having determined the time of preemption, let us proceed to calculate an important index such as the expected result of using the available means of destruction.

The effectiveness of preemptive strikes depends to a great extent on the reconnaissance capabilities, the distribution of the efforts of the means of destruction, their level of readiness, and the combat performance of the available means.

The expected result of the use of rocket troops during the time of preemption may be expressed in the following relationship based on the number of launchers, their performance, and the rate of expenditure of missiles:

$$Q_m = \frac{t_u n_{pu}}{TW} , \qquad (4)$$

where Q_m = the extent of damage inflicted on the objectives struck;
T = the combat performance of a system;
n_{pu} = the number of launchers;
W = the rate of expenditure of missiles for striking one standard objective.

For artillery, the factors in solving this type of problem are the number of various artillery systems, the rate of expenditure of ammunition, and the method of fire. The fire capabilities of each system for a known period of time are determined from reference tables in the appropriate manuals. If the volume of fire tasks is expressed in hectares of reduced area, they may be calculated for one system, or for the entire artillery of an army, according to the formula

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$$Q_s = \sum_{t=1}^{n} N k_i \mu k_q \qquad (5)$$

where N_{ki} = quantity of weapons of each caliber (i = number of systems);
μ_k = coefficient of transition to 122-mm guns;
$q = f(t_u)$ = fire capabilities of one gun.

Since conditions will not always permit the solution of basic tasks in preemptive strikes by the means we have examined (insufficient preemption time or the absence of suitable means of destruction), the question arises of calling on aviation using nuclear bombs as well as conventional means of destruction. The effectiveness with which aviation can be used in a meeting engagement in preemptive strikes against an advancing enemy grouping depends to a great extent on its readiness. In this case, the overall result is determined by the number of aircraft in a state of readiness corresponding to the conditions and by their strike capabilities:

- for delivery aircraft

$$Q'_m = \frac{n_{sn}k_r}{W'},$$

- for aircraft using conventional bombs

$$Q'_s = n_{sb}q',$$

where Q'_m = amount of damage inflicted on objectives struck;
Q'_s = amount of damage inflicted per hectare in a "reduced" area;
n_{sn} = number of delivery aircraft;
W' = rate of expenditure of nuclear missiles (bombs) for striking one standard objective;
k_r = number of missiles (bombs) aboard a delivery aircraft;
n_{sb} = number of aircraft (fighter-bombers and bombers) using conventional bombs;
q = fire capabilities of one aircraft per hectare of "reduced" area.

In operational-tactical calculations, the fire capabilities of one aircraft sortie using conventional weapons are taken as 0.6 of a hectare for fighter-bombers and 0.4 of a hectare for bombers. 50X1-HUM

In making calculations to evaluate the effectiveness of the use of means of destruction in preemptive strikes, it may become necessary to determine the required allotment (number) of rocket troops, artillery, and aircraft for cases in which the volume of tasks to be performed is known, for example, where the objectives to be struck by nuclear weapons have been

determined and the time of preemption has been calculated; i.e., it may be necessary to make an inverse solution of the problem of evaluating effectiveness. In doing this, the necessary data are obtained through the same mathematical relationships after appropriate conversion, when the values to be obtained are, for example, the number of launchers, artillery systems, and aircraft.

Thus, summarizing all of the foregoing, we come to the conclusion that the essence and content of the methodology for evaluating the effectiveness of using means of destruction in a preemptive strike lie in determining the time that will be available to our troops for preempting the enemy in the delivery of nuclear and fire strikes during a meeting engagement; in calculating the expected result of using rocket troops, artillery, and aviation in a preemptive strike; and (as an inverse problem) in establishing the quantity of destruction that must be allotted for carrying out the assigned number of tasks during the time of preemption. The logico-mathematical relationships of the methodology of evaluating the effectiveness of preemptive strikes, as discussed above, are reflected in the algorithm of methodology presented in Sketch 1.

We offer several examples of making calculations for specific conditions of a meeting engagement of a tank army.

The article by Marshal of Armored Troops A. Babadzhanyan points out that in order to defeat an enemy reserve grouping consisting of three to four divisions and two to three Sergeant battalions (to put 50 to 70 percent of the personnel out of action), there may be a need for 50 to 60 nuclear munitions and about the same number of rockets with chemical charges, i.e., a total of about 110 to 120 rockets, of which up to 40 percent are operational-tactical, up to 50 percent are tactical, and the rest nuclear aircraft bombs.

Taking this distribution as our example, we shall demonstrate the capabilities of the use of this quantity of missiles by the organic means of an army and of tank large units in preemptive strikes. We shall assume that missile launches take place at ranges favorable for operational-tactical means (within 200 kilometers), that the rate of advance of each side averages 25 kilometers per hour, and that the average time of deployment of Sergeant subunits is about one hour. Under these conditions, calculations according to formula (1) will show that the total time of preemption for an army rocket brigade (R-300) in relation to a Sergeant missile (d_{max} = 140 kilometers) will equal approximately two hours. But this means that considering the time needed for deployment, a brigade can

complete not more than one launching, or it can expend up to 9 missiles with its full complement, which comprises about 20 percent of the number of allotted operational-tactical missiles. With this number of missiles, army missile means can hardly fully complete, in a preemptive strike, their mission of destroying the enemy operational-tactical strike means. Regarding other objectives--tactical nuclear means, artillery, etc.--an army rocket brigade will have more preemption time (up to four hours) and will be able to make two launchings, or strike about 18 objectives. There is a higher rate of missile use here in a preemptive strike, but, on the other hand, there are also more objectives of this type in the grouping under discussion.

For tactical rockets, the total time of preemption by our tactical means will be 60 to 80 minutes for mounting initial strikes from maximum distances at the same average rate of advance (25 kilometers per hour) and assuming deployment within 30 minutes. Taking the time for deployment and a repeat launching as 35 to 40 minutes, then up to two launchings may take place. This means that in an offensive with three tank divisions in the first echelon, we can use their rocket battalions (nine launchers) to mount a strike with 18 tactical rockets, i.e., we will use only up to 30 percent of the number allotted. The remainder of the rockets will be expended in combat in which our probability of success is equal to that of the enemy.

Such a low coefficient of use of nuclear and chemical rockets in a preemptive strike does not guarantee success in a meeting engagement. As calculations show, the coefficient must be between 70 and 80 percent.

This presents the problem of taking measures to provide for using the main mass of the allotted nuclear and chemical munitions in preemptive strikes. Therefore, in addition to timely arrival at operational decisions, effective reconnaissance, the timely delivery of rockets, and the maintenance of a high degree of readiness of the available means of destruction, there may be a need to call upon the rocket troops of a front or to allot a greater number of aircraft with both nuclear and conventional bombs.

We have examined only individual cases linked with definite conditions of a situation. Under different conditions, the results of calculations will also be different.

Unquestionably, making calculations from formulas and tables demands a considerable expenditure of time, as well as supplementary reference material; but the principle of preemption of the enemy in the delivery of

nuclear and fire strikes obliges us to resolve the problems of combat with enemy means of destruction in the shortest possible time. Methods are therefore needed which will satisfy this urgent requirement.

In order to increase the efficiency of preparing calculations regarding preemption, we may use a nomogram calculated on the basis of the logico-mathematical relationships discussed above. Its general form is represented in Sketch 2. The nomogram makes it possible to calculate the time of preemption of various means of destruction based on their tactical-technical data, launching (firing) ranges, type of actions, and degree of readiness. From these time values it is possible to determine the results of using rocket troops and artillery. The nomogram also offers the possibility of solving inverse problems in determining the necessary allotment of means for mounting fire strikes for a known number of objectives and for a calculated preemption time.

In addition, this nomogram provides for the solution of some calculation problems touching directly on the organization of a meeting engagement, for example, the determination of the time remaining before contact occurs between the troops of the two sides and the distance from the line of possible meeting with the enemy.

The nomogram consists of four charts and several scales. From Charts I and II and Scale IIa, the possible time of preemption is determined; from Chart III, the expected result of using rocket troops and the required number of nuclear means of destruction are determined; and from Chart IV and Scales IVa and IVb, the expected result of the use (or the allotment) of artillery and aviation (when using conventional munitions) is determined. Chart II also serves to calculate the distance from the line of contact and the time at which the troops of the two sides will meet.

We shall use individual examples to examine the methodology of solving problems for the evaluation of the effectiveness of preemptive strikes by means of the nomogram. The course of the solution of typical problems is shown directly on the nomogram, where the procedure for determining necessary indices is indicated by broken lines (for artillery, by broken lines with dots; for an army rocket brigade, without dots), and the sequence of the solution by figures in circles.

Example 1. It is necessary to determine the capabilities of a rocket brigade for mounting preemptive strikes on an enemy grouping which includes Sergeant missiles. Each side is advancing at a speed of 20 kilometers per hour, the time of deployment and preparation for the launch of a Sergeant

missile is assumed to be about one hour, the range of our first missile launchings is about 220 kilometers, and the time for preparing the first launch and carrying out repeat launches averages 1.5 hours.

First, using Charts I and II and proceeding from the maximum range of Sergeant missiles ($d_{max.}$ = 140 kilometers), the range of our army rocket brigades (D = 220 kilometers), and the combined speed of advance of the two sides (v = 40 kilometers), we find on axis t_u (time) of Chart II the time of preemption available to our means of destruction. Taking into account the time needed by the enemy to deploy operational-tactical means and prepare them for launching, the time of preemption is three hours.

Continuing, from Chart III: knowing the time of combat performance of the system (for example, τ = 1.5 hours) and the number of launchers (n_{pu} = 6), we find that under the given conditions, a brigade can make two preemptive launches, and with the assumed number of launchers can expend 12 missiles. If we launch one missile for each typical objective, then a brigade can hit up to twelve important enemy objectives in a preemptive strike.

The time of preemption for artillery is also calculated from Charts I and II, in an analogous sequence. The expected result of artillery fire for this period of time is determined from Chart IV. This chart is designed to express the objectives within the enemy grouping and the volume of the fire tasks in hectares of a "reduced" area, and the guns of the various systems--including 122-mm guns; in using this chart, attention is also paid to the corresponding coefficients taking into account the accuracy of fire, the method of fire, and the explosive power of the projectiles. In this case they are taken as equal to 0.72 for the 130-mm gun, 1.2 for the 152-mm gun, 2.14 for the BM-24, and 2.2 for the BM-21.

Example 2. To determine the fire capabilities of artillery in a preemptive strike if reconnaissance establishes that subunits of 203.2-mm howitzers (towed) are moving into firing position. Our artillery, comprising six battalions of 122-mm guns, is deploying from the march to open fire.

To solve the problem from variance Scale IIa, let us determine the time of preemption in the deployment and preparation for fire of our means ("artillery battalion from the march") and the enemy means ("towed 203.2-mm moving into firing position"). The time is approximately twelve minutes. Continuing, from Chart IV, from this time value (on the axis $t_{u(min.)}$) and the available amount of artillery (N_{122} = 108), we find on axis Q_s that for

the given time of preemption the stated artillery can carry out a fire task covering 32 hectares of a "reduced" area. The transition from the "reduced" area to specific objectives is made by a corresponding conversion table, which it is advisable to have on the reverse side of the nomogram.

When conducting a meeting engagement, it may become possible (or necessary) to use aviation, depending on the situation, the preemption time, and the degree of readiness. The expected result of aviation actions with conventional munitions may be calculated by the same rules as for artillery, using Chart IV and Scale IVb, which shows the number of sorties of fighter-bombers and bombers.

In the above examples, we have examined the procedure for using a nomogram in solving problems to determine the expected result of using means of destruction in a preemptive strike. In calculating the needed quantity of the means of destruction (allocation), we first determine the possible time of preemption according to the same method as for direct problems; then, from the corresponding chart, based on the time available and the required number of strike tasks against the enemy, we find the necessary amount of the means of destruction.

The existence of quantitative data on the capabilities for preemption of the enemy assures qualitative planning of a meeting engagement and makes it possible to choose the most effective combat means for given conditions and to create the necessary grouping of troops and the means of destruction on a timely basis.

However, the results of solving individual and multiple problems connected with the organization of a meeting engagement, the calculation of the time of preemption, and the evaluation of the effectiveness of preemptive strikes, do not provide a ready answer. They only help to "forecast" the results of using available means of destruction under specific conditions and provide quantitative bases for making decisions. All of this must be based on an intelligent combination of logical and quantitative evaluation of the effectiveness with which available forces and means are used.

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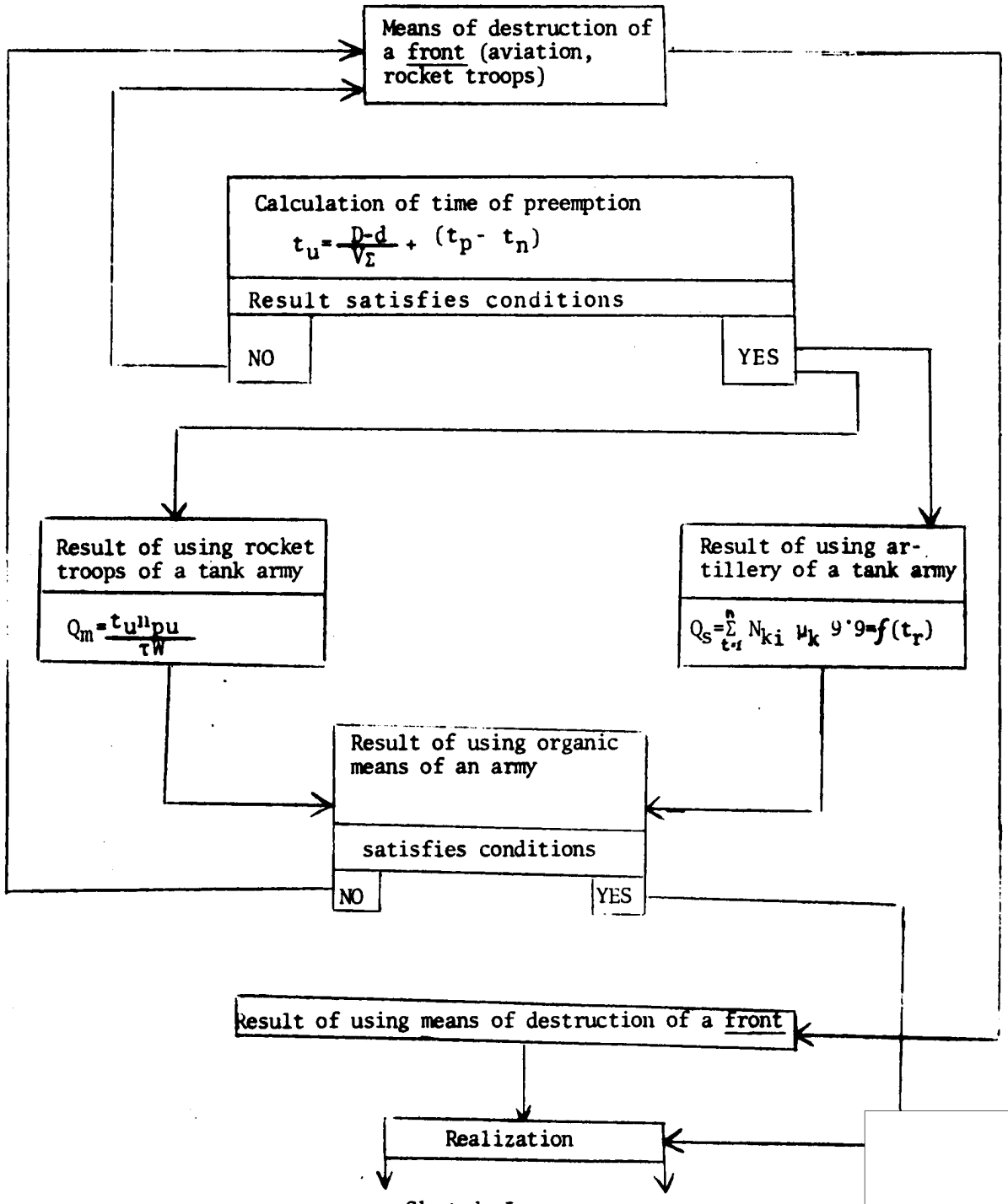
Sketch 1



Sketch I

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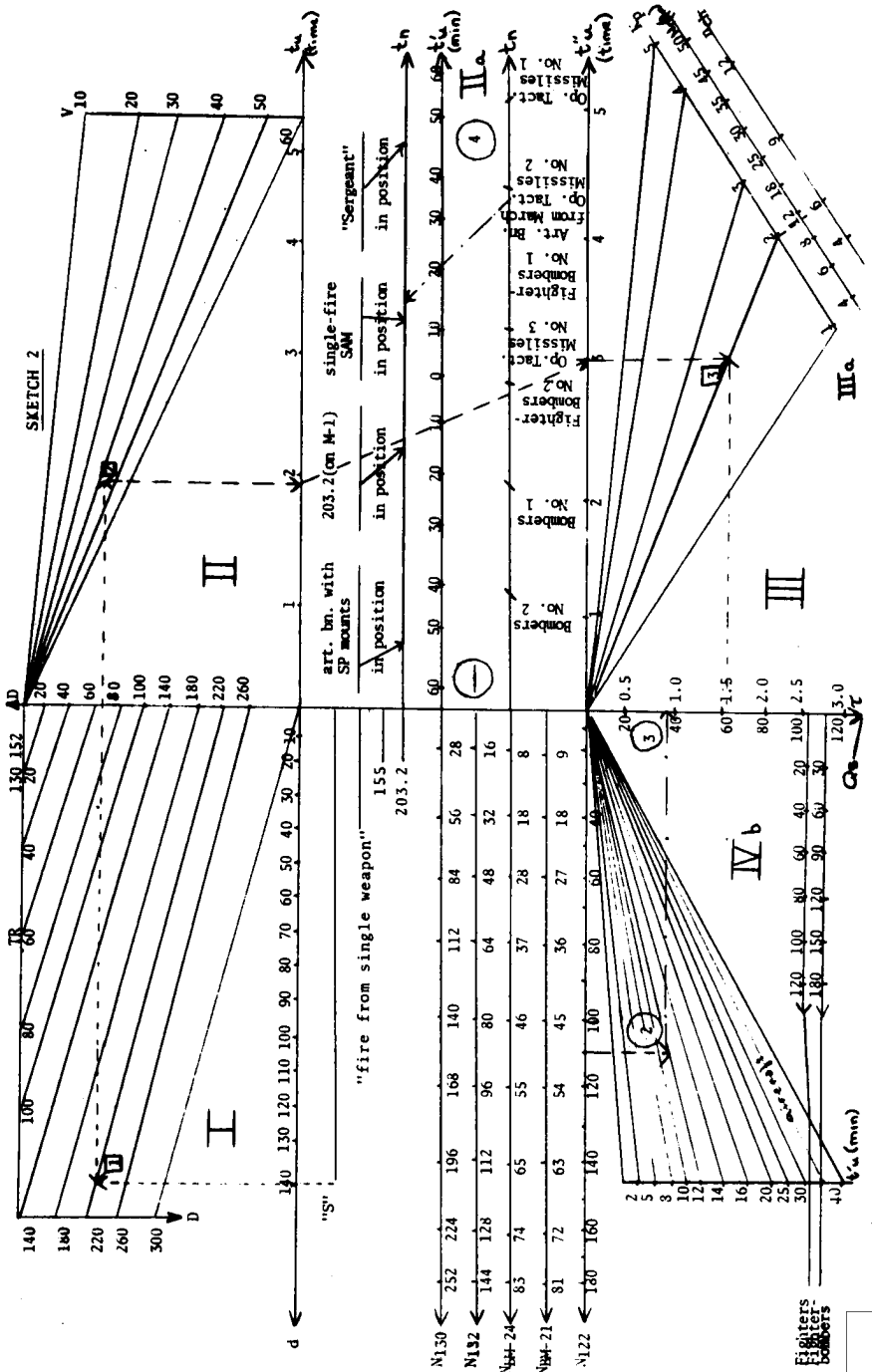
Sketch II



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