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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

13 June 1974

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (USSR): Determining the Quantity of Rockets Needed for a Front 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". This article presents a methodology for calculation of the number of rockets with nuclear and chemical loads needed by the rocket troops of the Ground Forces for a front offensive operation. While these calculations can be done by manual methods or by computer, several factors requiring careful consideration are the possibility of delivering nuclear and chemical strikes against unoccupied areas; the probability of rocket troops achieving the desired damage; and the technical reliability of the rockets being launched. The effects of these factors and others are examined in detail, as are the numerical indices that must be taken into account when performing calculations of this type. This article appeared in Issue No. 1 (83) for 1968.

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]

[redacted]

William E. Nelson
Deputy Director for Operations

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Intelligence Information Special Report

COUNTRY USSR

DATE OF INFO. Early 1968

DATE 13 June 1974

SUBJECT

MILITARY THOUGHT (USSR): Operational-Tactical and Tactical Rocket Requirements for a Front Offensive Operation

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 Colonel A. Sulim. This article presents a methodology for calculation of the number of rockets with nuclear and chemical loads needed by the rocket troops of the Ground Forces for a front offensive operation. While these calculations can be done by manual methods or by computer, several factors requiring careful consideration are the possibility of delivering nuclear and chemical strikes against unoccupied areas; the probability of rocket troops achieving the desired damage; and the technical reliability of the rockets being launched. The effects of these factors and others are examined in detail, as are the numerical indices that must be taken into account when performing calculations of this type.

End of Summary

Comment:

The "P" and "S" used in the formulas were given in the Latin alphabet. There is no information in readily available reference materials that can be firmly associated with the author. 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.

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Operational-Tactical and Tactical Rocket Requirements for a Front Offensive Operation

by

Colonel A. Sulim

Calculating the number of rockets with nuclear and chemical charges needed by the rocket troops of the Ground Forces for a *front* offensive operation as part of a strategic operation in a theater of military operations can be done at the present time either by manual method or by computer. In practice the data thus obtained on the number of rockets required differ little from each other. Therefore, either method can be used by staffs in their preparation and planning for an offensive operation.

But these methods take into account only some of the most important factors in the situation: the nature and size of the targets for destruction, their possible distance from the line of troop contact, and the accuracy of strikes delivered by various rocket systems, in which connection the data obtained fully reflect the true rocket requirements of a *front*.

At the same time, calculations show that *front* rocket requirements for the conduct of an offensive operation also depend to a great extent on other factors. These include:

-- the possibility of delivering nuclear and chemical strikes against unoccupied areas;

-- the probability (reliability) of rocket troops achieving the desired damage;

-- the technical reliability of rockets when performing a launch;

-- the probability of irreplaceable losses of rockets resulting from the use by the enemy of nuclear weapons against the locations of rocket and rocket-technical units.

Let us try to examine in greater detail the effect of each factor on rocket requirements and establish, at least approximately, their numerical indices that must be taken into account when performing calculations of this type.

The probability of strikes hitting unoccupied areas for each class of rocket, against the most important targets for destruction, may be determined by the formula

$$P_{u,p,m} = 1 - P_{s,u},$$

where $P_{u,\ p,m}$ represents the probability of a strike hitting an unoccupied area;

$P_{s,u}$ represents the probability that the target for destruction will not change its position before the moment of the strike.

Here $P_{s,u}$ can be calculated by the simplified formula

$$P_{s,u} = \frac{t_{ts} - t_z}{t_{ts}}.$$

where t_{ts} represents the amount of time the target remains in the same area

t_z represents the average amount of time required to receive intelligence data (the intelligence information time lag), to make a decision, to allocate tasks, and to prepare the rocket launching.

If we consider that the intelligence information time lag when transmitting from onboard an aircraft the intelligence data obtained through visual observation is, based on the experience of exercises, equal to an average of 12 to 15 minutes, and that it takes 2 to 3 minutes to make a decision and allocate the tasks for destroying a single target, then the probability that the target for destruction will not change its position before the moment of the strike ($P_{s,u}$), when waging combat against enemy means of nuclear attack at launch sites, will be as follows for various classes of rockets.

(See table on following page.)

Means of Destruction	Targets for destruction				
	Honest John	Sergeant	Corporal	Pershing	Mace
	Probability that target will not have changed its position by the time of the strike				
R-30	0.35	0.42	0.78	--	--
R-170 and R-300	0.17	0.27	0.72	0.17	0.06
KR-500	--	--	0.46	0	0

The data in the table show that the $P_{s,u}$ for various targets and means of destruction falls within the range of 0.7 to 0.8 for old means of enemy nuclear attack (Corporal), while for new ones (Sergeant and Pershing), from 0.2 to 0.4. From this it follows that under modern conditions, when the enemy has at his disposal what are, on the whole, highly mobile ground means of nuclear attack, the probability of our rockets hitting an unoccupied area when attacking these targets and objectives could reach 0.6 to 0.8 even when using the most effective means of reconnaissance (visual observation from an aircraft).

As for such objectives as tank and motorized infantry battalions, surface-to-air missile batteries, depots of various types, command posts, etc., calculations show that the probability of rockets hitting an unoccupied area when attacking these objectives is small and will amount to 0.05 to 0.1.

Research and the experience of exercises indicate that of the total number of rockets allocated to a front for an offensive operation, up to 40 percent may be expended for the destruction of enemy means of nuclear attack and up to 60 percent for the destruction of a grouping of tanks, infantry, and other objectives. Therefore strikes against unoccupied areas could amount to 30 to 40 percent and more of the total number launched by the rocket troops of the Ground Forces during a front offensive operation. This, of course, is a large number of rockets with nuclear and chemical warheads to be expended ineffectively, a fact which must be taken into consideration.

Our calculations did not take into account strikes by rocket troops of the Ground Forces against dummy enemy objectives, nor strikes delivered for one reason or another against objectives not reconnoitered with sufficient reliability. And such strikes undoubtedly will occur during an offensive operation.

Thus, strikes by rocket troops of the Ground Forces against unoccupied areas in a modern offensive operation of a front (fronts) are not exceptional and must definitely be taken into consideration when calculating the number of rockets required for the operation.

Let us discuss now the calculation of the probability (reliability) of rocket troops achieving the desired damage. During an offensive operation, the rocket troops of the Ground Forces will inflict damage on pinpoint and sizable objectives. It is believed that a pinpoint target subjected to a nuclear strike can either be destroyed or remain undamaged, while the damage inflicted on sizable objectives can range anywhere from 0 to 100 percent.

At the same time, the probability (reliability) of achieving the desired damage can change within broad limits both on pinpoint and sizable objectives. For most sizable objectives the reliability of damage should be between 70 and 90 percent, while for pinpoint objectives (means of nuclear attack) from 90 to 95 percent and higher.

Thus, in individual cases the destruction of single targets (5 to 10 percent), including the enemy means of nuclear attack, will not be achieved. A second strike will therefore require an additional expenditure of rockets with nuclear and chemical warheads that was not provided for when determining requirements for the operation. Consequently, in order for rocket troops to be able to completely fulfil their tasks of destroying pinpoint targets, they must have a certain number of rockets with nuclear and chemical warheads above that calculated for the operation by one of the aforementioned methods.

In the case of sizable objectives, this means that the desired damage may not be achieved by 10 to 30 percent. Advance calculations of the insufficiency of damage to these objectives can only be approximations. Thus, if during a front offensive operation, of the total number of sizable objectives to be destroyed by strikes of the rocket troops of the ground forces, 50 percent are neutralized and the remaining 50 percent are destroyed, then the task may not be fulfilled by 5 to 15 percent.

In order for rocket troops during an operation to be able to inflict damage on sizable objectives, at least at a level no lower than that required for them to be neutralized, they must also have a certain number of rockets with nuclear and chemical warheads (5 to 15 percent) above what was calculated for the operation.

The technical reliability of rockets cannot for various reasons be taken to equal 100 percent, even under peacetime conditions. Experience shows that failures at the launch site can amount to 5 to 7 percent for tactical rockets, and 10 to 15 percent for ballistic operational-tactical missiles.

It may be assumed that during combat operations the number of failures at the launching site will either remain at the same level as in peacetime or increase somewhat. If we accept this number of failures in peacetime as the norm, then it will have to be considered during combat as well.

The main reason for this is that after a failure at the launch site the entire rocket, or at least the carrier-rocket, cannot as a rule be used without repair at an arsenal or at a factory which manufactures them.

Moreover, a certain percentage of rockets after an abnormal launching will be destroyed in the powered flight phase as a result of significant deviations from the required flight trajectory. Therefore rocket troops lacking a reserve of rockets with nuclear and chemical warheads (to cover failures at the launching site, including abnormal launches), will be unable to fulfil their assigned tasks completely.

Probability of irreplaceable losses. At the present time, enemy air defense forces and means are capable of combatting only cruise missiles in the air. Calculations show that the probability of a cruise missile overcoming an enemy air defense system averages about 0.4 to 0.6, provided that at least 4 to 6 missiles are flying at one time in a relatively narrow strip (30 to 40 kilometers). Thus, for the successful fulfilment of their tasks, units armed with cruise missiles must have at least 40 percent of their missiles in reserve solely for the purpose of replacing those lost while on a flight trajectory.

Operational-tactical and tactical ballistic missiles at present cannot be destroyed by air defense means while on a flight trajectory. But the probable enemies are working intensively on the problem of anti-missile defense, not only of the continental United States, but also of the most important theaters of military operations.

At the present time, because of the lack of data on the effectiveness of anti-missile defense, it is still impossible to determine possible losses of ballistic missiles from anti-missile defense means while on a flight trajectory. But it may be assumed that as anti-missile defense means are perfected, and the number of covered objectives increases, these losses will gradually increase.

Our forces will also suffer irreplaceable rocket losses as a result of enemy strikes, primarily with nuclear weapons, against locations of rocket and rocket-technical units, and also when they are on the march.

The probability of a reconnaissance rocket-carrying aircraft (of the RF-4C type) destroying a launcher (PU) in a siting area, for example, may be determined by the formula

$$PU = 1 - e^{-pk}$$

where

k represents the number of reconnaissance rocket-carrying aircraft in the zone of the front with this task during a period of time T;

$P = (1-P_{ob}) \frac{S_r}{S_{poz}} P_{obn} P_u$ represents the probability of destroying a launcher with one reconnaissance rocket-carrying aircraft;

P_{ob} represents the effectiveness of our air defense troops;

S_r represents the area surveyed by an aircraft in one flight;

S_{poz} represents the area in which a launcher may be placed;

P_u represents the probability of destroying a launcher provided it is hit in a reconnoitered area.

Calculations made by using this formula have shown that the probability of a reconnaissance rocket-carrying aircraft destroying a launcher may be taken to equal 0.25 to 0.5. But if the launcher reconnoitered by the reconnaissance aircraft is hit with a ballistic missile strike, the probability of destruction will fall on the average to 15 to 30 percent, since the probability of the launcher not changing its position by the time the strike is delivered is 50 to 60 percent for most enemy ballistic missiles.

Since rocket-carrying aircraft and ballistic missiles (guided missiles and free rockets) will be used during an operation to fulfil this task, in the first approximation the average probability of destroying a launcher in a siting area may be taken to be 0.2 to 0.4.

At the same time, the experience of exercises shows that it was only by the time of the delivery of the first and subsequent massive nuclear strikes that all or almost all the launchers of front troops located in siting areas had rockets with nuclear or chemical charges in place. Such instances during an operation at most exercises came to no more than 2 to 4, that is, in the 10 to 12 days of an operation, only during 2 to 4 partial days did all launchers have rockets in place. All the rest of the time, from 1/3 to 2/3 of the launchers of front rocket troops had rockets in place. This leads us to conclude that losses of rockets with nuclear and chemical charges in siting areas of rocket units could amount to 10 to 20 percent.

As for irreplaceable losses of rockets in rocket-technical units as a result of enemy strikes, these can be estimated only very roughly, proceeding from the following assumptions.

Let us assume that under peacetime conditions front rocket-technical units have about 60 percent of the rockets and warheads needed for an offensive operation. All of them (carrier rockets and warheads) can be brought to a definite level of readiness and transferred to rocket units before the enemy unleashes combat actions. Therefore, the probability of destruction of rockets with nuclear and chemical charges under conditions of a preemptive strike from our side and a meeting strike, may be taken, without significant error, to be equal to zero or close to it.

The remaining 40 percent of the rockets and warheads are prepared in mobile rocket-technical bases and transferred to rocket large units and units in the first 5 or 6 days of the operation (from D2 to D7). Should a front have seven or eight rocket-technical units (mobile rocket-technical bases and separate rocket transport battalions), and allocations for the offensive operation of 300 to 450 rockets with nuclear and chemical charges, during the day each rocket-technical unit could have an average of 3 or 4 missiles. If up to 50 percent of the rocket-technical units are destroyed during an operation, then irreplaceable losses in that case would amount to an average of 15 to 20 rockets and warheads, or about 5 to 10 percent of the number allocated for the operation.

Finally, calculations show that the probability of a rocket being completely put out of action while on the march (either on a launcher or on a ground transport trolley) is insignificant, amounting to 0.02 to 0.03.

Thus, irreplaceable losses on the ground of rockets with nuclear and chemical charges from enemy strikes may amount to 15 to 30 percent, of which 10 to 20 percent occur in rocket units and 5 to 10 percent in rocket-technical units.

In conclusion, it should be stated that the experience of exercises and the practical work of mobile rocket-technical bases have shown that, when preparing rockets, possible defects may exist which must be removed in the factories where they are manufactured. But the number of such missiles is small (up to 5 percent), and therefore need not be considered when determining requirements for an offensive operation.

Calculations and the experience of combat launchings of rockets with nuclear charges have shown that in most cases where strikes are delivered, the yields of the bursts actually obtained are less than the nominal rating. But it is preferable to consider this variation in the rated yield of the burst of a nuclear charge not when determining the number of rockets needed for an operation, but by designating certain targets or objectives for destruction by a nuclear charge of a required yield, since it is much simpler to do it that way.

Thus, when determining the number of rockets with nuclear and chemical charges needed for a front offensive operation by presently known methods, it appears necessary to correct the result by a certain coefficient K_o, taking into account the abovementioned factors.

The size of coefficient K_o depends on the type of rockets and at the present time may be taken to equal: for tactical rockets, 1.5 to 1.8; for operational-tactical ballistic missiles, 1.6 to 1.9; and for cruise missiles, 2.0 to 2.5.

The factors cited above may also be considered in previously developed or newly created mathematical models and algorithms for determining the number of rockets needed for a front offensive operation.