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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

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2 January 1974

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (USSR): Formulas for
Determining Artillery Ammunition
Expenditures and Reserves

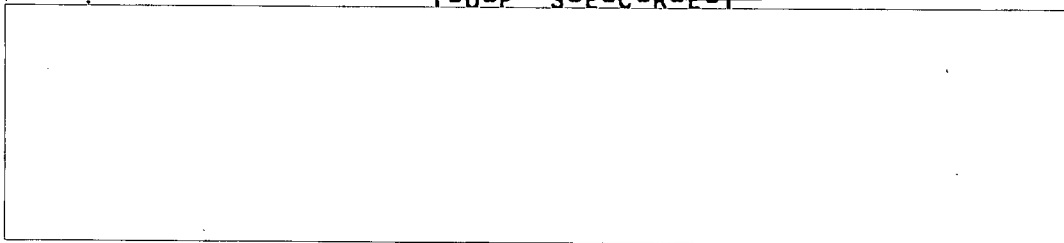
1. The enclosed Intelligence Information Special Report is part of a series now in preparation based on the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". This article presents some simple formulas for establishing the amounts of artillery ammunition to be stockpiled for each type of gun, including emergency reserves. It is primarily a statement of artillery ammunition stockpile and expenditure data for World War II. This article appeared in Issue No. 1 (89) for 1970.

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 William E. Nelson
Deputy Director for Operations

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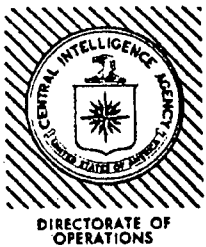
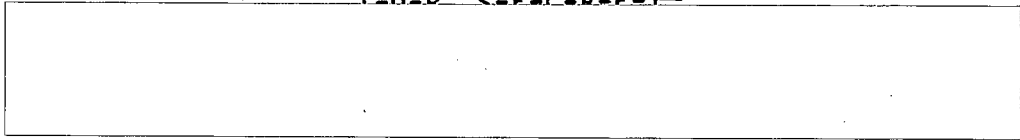
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Intelligence Information Special Report

COUNTRY USSR



DATE OF INFO. Early 1970

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SUBJECT

MILITARY THOUGHT (USSR): Determining Norms for the Stockpiling and Expenditure of Artillery Ammunition

SOURCE Documentary

Summary:

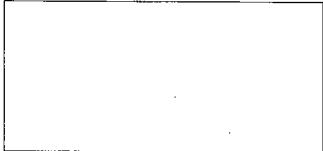
The following report is a translation from Russian of an article which appeared in Issue No. 1 (89) for 1970 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The author of this article is Colonel-General of Artillery (Retired) I. Volkotrbenko. This article presents some simple formulas for establishing the amounts of artillery ammunition to be stockpiled for each type of gun, including emergency reserves. It is primarily a statement of artillery ammunition stockpile and expenditure data for World War II.

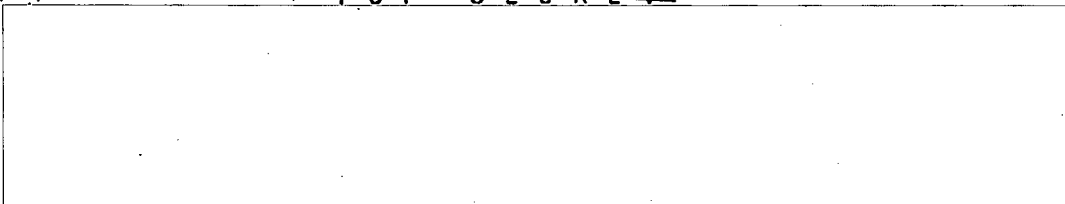
End of Summary



Comment:

Col.-Gen. Volkotrbenko wrote an article about the 50th anniversary of the Second Cavalry Army, Red Star, 15 July 1970. He is commandant of the Penza Higher Artillery Engineering Order of Star School. Military Thought has been published by the USSR Ministry of Defense in three versions in the past -- TOP SECRET, SECRET, and RESTRICTED. There is no information as to whether or not the TOP SECRET version continues to be published. The SECRET version is published three times annually and is distributed down to the level of division commander.





Determining Norms for the Stockpiling and
Expenditure of Artillery Ammunition

by

Colonel-General of Artillery (Retired) I. Volkotrbenko

The vast expenditure of artillery ammunition during the last war gave rise to the necessity of developing scientifically based norms for the peacetime stockpiling of ammunition and of properly preparing industry to produce it in wartime.

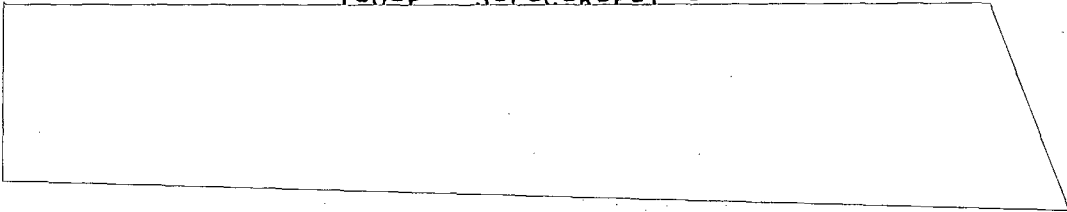
Let us briefly review the history of this problem. A Special Resolution of the Defense Committee of the USSR Council of People's Commissars, dated 29 April 1938, established appropriate norms for mobilization reserves of ammunition. These norms specified the expenditure per single gun per year of warfare: the requirements per gun for two months of warfare in the European Theater and for three months in the Far East, and the emergency reserves per gun to be kept with the troops.

Specifically, the mobilization reserve norms for two months of warfare were fixed at the level of 1100 rounds each per 76-mm regimental, battalion, and mountain gun, and per 122-mm howitzer. In addition, emergency reserve norms were fixed at 240 rounds per 76-mm gun and 160 rounds per 122-mm gun.

Corresponding norms were established for all types of weapons, including small arms. Ammunition stockpiling was carried out in accordance with these norms on the eve of World War II; by 1941 the stockpiling rates (as percentages of the norms established for two months of warfare plus emergency reserves kept with the troops) constituted:

- in rounds for 45-mm and 76-mm guns -- 130 and 80 percent;
- in rounds for 122-mm howitzers and 152-mm gun-howitzers -- 70 percent;
- in rounds for 82-mm and 120-mm mortars -- 44 and 9 percent;





- in rounds for 37-mm and 85-mm antiaircraft guns -- 25 and 20 percent.

As can be seen, the stockpiling of mortar and antiaircraft artillery rounds was very limited. If one adds to this that, instead of having the established 15 percent of all rounds for 76-mm guns as armor-piercing, only 1.5 percent were in this category, and that there were no hollow-charge or subcaliber rounds at all, then the ammunition stockpiling miscalculation becomes manifest. We cite these figures to demonstrate the urgency of this problem, which deserves our serious attention in peacetime.

Let us proceed to analyze ammunition expenditures during World War II. Initially, let us review the ratio of various artillery systems and calibers with respect to the total number of guns and mortars on hand during the entire war, and also the amount of ammunition of various calibers shipped relative to the total amount of ammunition shipped during the entire war (Table 1).

Table 1

Type and caliber of gun	Ratio, in percentages		
	Guns to total amount	Ammunition expenditure to total expenditure	Amount shipped to total amount
Antiaircraft guns of all calibers	17	17.4	8
45- and 57-mm antitank	30	20	5
76-mm of all systems	36.7	45.1	30
122-mm howitzers	9.7	10	26
122-mm guns	1.4	1.8	6
152-mm of all systems	4.8	5.4	22
203-mm and larger	0.4	0.3	3



[REDACTED]

From the above table it can be seen that there was little difference (within 10 percent) in the ratio between the guns of one type (caliber) or another and their ammunition expenditure; and in the large-caliber guns this difference was expressed in tenths of a percent.

As regards the amounts shipped, the volume of ammunition shipped for large-caliber guns (122-mm, 152-mm, 203-mm, and larger), whose ratio to the number of guns was 6.6 percent and to ammunition was 7.5 percent, constituted 31 percent of the total amount shipped.

Similar calculations made for mortars show a large ratio of 82-mm and 120-mm caliber mortar rounds, and the principal ratio for small arms ammunition falls mainly to rifle and submachinegun rounds. If one assumes that the entire expenditure of artillery, mortar, and small arms ammunition constituted 100 percent, then the ratio by types of weapons is as follows:

- artillery ammunition, 59 percent;
- mortar rounds of all calibers, 29 percent; and
- small arms ammunition, 12 percent.

Consequently, in actuality there was no uniform ammunition expenditure according to types and calibers of weapons; therefore, when those responsible for the planning determine the total expenditures for all types of armaments, they will commit an error which can lead to shortages of certain types of ammunition and to considerable surpluses in others. This rule, verified by World War II experience, has not been rendered obsolete even for modern conditions.

Let us analyze the yearly expenditure of ammunition and mortar shells during World War II and then compare it to the expenditure norms developed by the Defense Committee of the USSR Council of Ministers (Table 2).

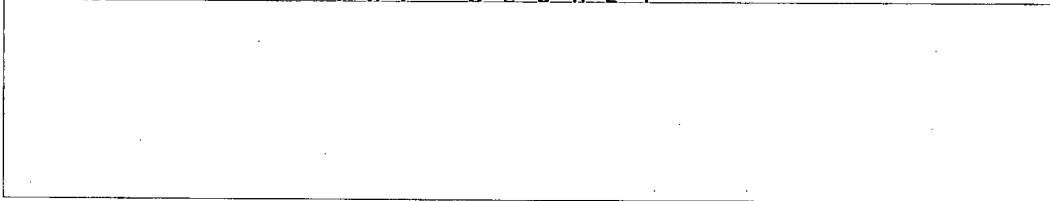
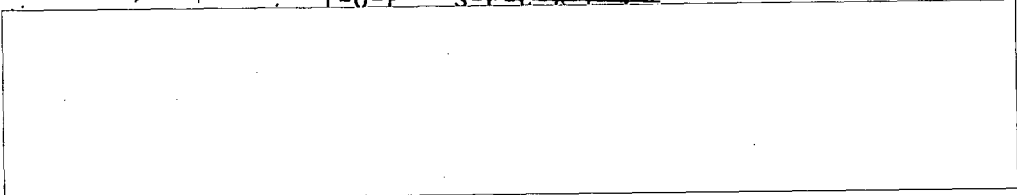


Table 2

Type of weapon	Expenditure norm per year of warfare (for 1 weapon)	Expenditure for 1 weapon by year				
		1941 (half year)	1942	1943	1944	1945 (4 months)
45-mm guns	6000	552	267	406	471	315
76-mm regimental and battalion guns	6600	353	500	893	726	500
122-mm howitzers	5400	317	751	326	761	370
122-mm guns	4800	242	1647	1130	1031	675
152-mm howitzer and gun-howitzers	5000	184	1007	1075	880	417
203-mm howitzers	3000	22	110	270	210	210
37-mm AA guns	7500	700	1127	736	606	476
85-mm AA guns	5000	200	825	371	697	385
50-mm mortars	14400	82	113	193	104	9
82-mm mortars	10000	224	160	522	848	940
120-mm mortars	7200	70	140	346	734	560
Submachineguns	33600	2	550	800	600	325
12.7-mm large caliber machineguns	30000	1956	1420	1320	850	500

From the table it is evident that the expenditure norms established by the Defense Committee were on the whole manifestly excessive and that the war amended them





substantially. What was the reason for this? Perhaps because of disproportions in the delivery of armaments and ammunition by industry? It turns out that this was not the case.

If one takes the weapons and ammunition on hand at the beginning of the war, then during the war industry delivered six times as many artillery weapons and seven times as many mortars. All of the ammunition delivered during the war was more than six times as much (compared to what was on hand at the beginning of the war).

So there can be no talk about disproportions in deliveries. In our opinion, the following are the reasons: miscalculations in the amount of various models of guns on hand in the army and miscalculations in the capabilities of industry, i.e., the non-dialectical approach to the solution of this complex problem. If, for example, we take the 120-mm mortars, then, proceeding from the number of them on hand in 1944 and the established expenditure norms, industry should have delivered up to twelve million mortar rounds a month; but deliveries of these were limited to only two million. And for 76-mm caliber guns, according to the number of guns on hand and to the established norms, industry should have delivered twenty-four million rounds per month, but deliveries amounted to four million rounds. As can be seen in Table 2, even this amount was not needed. During World War II ammunition expenditures varied for different systems, and this factor was taken into account in the requisitions placed with industry.

We shall cite the scale of ammunition deliveries (in combat units of fire) relative to delivered weapons. For every gun produced for the war, industry delivered ammunition (in combat units of fire) as follows:

Caliber of guns and mortars

45-mm	76-mm	122-mm howitzers	122-mm guns	152-mm	37-mm AA gun	85-mm AA gun	50-mm	82-mm	120-mm
5.4	11	18	36	38	11	15	2	7	13



These figures once again confirm the need for a differentiated approach when determining ammunition expenditure norms.

Let us proceed to the question of determining the norms for stockpiling and expending ammunition in modern warfare.

An analysis of extensive factual data on ammunition expenditures during wartime permits drawing up some theoretically valid norms for the stockpiling of ammunition reserves in peacetime. To determine expenditures according to types of artillery, a differentiated approach must be set down as the basis of these norms. First of all, we believe that requirements for the first two or three months of a war should not be confused with the requirements for a year of war, as the former must be stockpiled in peacetime while the latter are to be produced during the war. Stockpiling norms and the amounts of reserves in peacetime may be computed in accordance with the following formulas:

-- for the Western Theater $N = 2kh + NZ$;

-- for the Eastern Theater $N = 3kh + NZ$,

where N -- stockpiling norm per single gun,

kh -- monthly requirement according to General Staff Academy norms

(expenditure for a front operation throughout the entire depth);*

NZ -- norm for regiment and division mobile reserves.

* In the book "A Front Offensive Operation Throughout the Entire Depth of a Theater of Military Operations", published by the Military Academy of the General Staff in 1967, ammunition expenditures for an operation are set forth as follows: for artillery -- more than 6 units of fire; for tanks -- 8 or 9 units of fire; for antiaircraft artillery -- 10 to 12 units of fire; and for small arms -- 4 to 6 units of fire. Considering that the operation is planned to last eighteen to twenty days, one can conditionally assume that the total requirements for the operation are equal to the requirements for a month of warfare. Since industry requires at least two months to set up wartime production,

Having determined the norm for each caliber, the total requirement for every type of weapon listed has to be calculated according to this formula:

$$P_s = (N_z K_o + (N_v \cdot K_o))$$

where P_s -- total requirement in shells for every caliber to be in storage in peacetime;

K_o -- expected number of weapons of a given caliber;

N_z -- norm per single gun in the Western Theater;

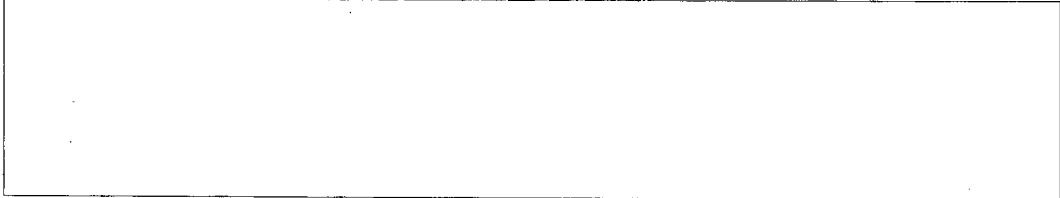
N_v -- norm per single gun in the Eastern Theater.

It must be assumed that the monthly requirement for mobilization and emergency reserves will be larger than the average annual monthly requirement for a year of combat, as has already been mentioned above.

Analyzing the average annual requirements for 1942, 1943, and 1944 by main calibers, we obtain:

- 120-mm mortars -- 480 rounds -- 6 units of fire;
- 122-mm howitzers -- 780 rounds, rounded off to 800 -- 10 units of fire;
- 122-mm guns -- 1270 rounds, rounded off to 1200 -- 15 units of fire;
- 152-mm howitzers (gun-howitzers) -- 970 rounds, rounded off to 960 -- 12 units of fire;
- 37-mm AA guns -- 900 rounds, rounded off to 1000 -- 5 units of fire;
- 85-mm AA guns -- 630 rounds, rounded off to 700 -- 6 units of fire;
- rounds for submachineguns -- 650, rounded off to 900 -- 3 units of fire.

it follows that mobilization reserves of ammunition should meet the requirements for two months of warfare in the Western Theater and for three months in the Eastern Theater, plus the requirements for troop emergency reserves (NZ).



Taking into account that in a nuclear/missile war ammunition expenditures will not exceed that of World War II, let us dwell on these figures. In this case the requirement for a year of warfare will be expressed by the following formula:

$$G_p = K_h K_o \text{ for each caliber,}$$

where G_p -- requirement for a year of warfare for each caliber;

K_h -- average yearly requirement;

K_o -- expected number of guns per year for every type of weapon.

When K_h is applied to antiaircraft artillery rounds, it takes a factor of 2. In this case the monthly manufacturing program will equal:

$$M_p = \frac{G_p}{12},$$

where M_p -- monthly requirement.

However, this requirement apparently will not be satisfied and therefore one should consider the "coefficient of satisfaction", which will equal:

$$K_u = \frac{M_p}{M_v},$$

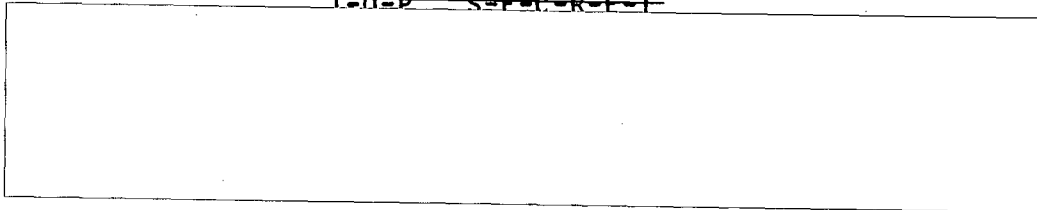
where K_u -- coefficient of satisfaction,
 M_v -- monthly industrial capabilities.

If the coefficient of satisfaction is less than one, it should be amended:

$$P = M K_u,$$

where P -- feasible monthly deliveries.





This article contains a brief digression into the history of ammunition stockpiling and expenditure during World War II; and, using this as a basis, several recommendations have been made which are applicable to modern conditions and which, in our opinion, will allow us to avoid errors committed in the past.

