

THE GENERAL BOARD  
United States Forces, European Theater

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REPORT  
ON  
AMMUNITION SUPPLY FOR FIELD ARTILLERY

MISSION: Prepare Report and Recommendations on  
Ammunition Supply for Field Artillery.

The General Board was established by General Orders 128, Headquarters European Theater of Operations, US Army, dated 17 June 1945, as amended by General Orders 182, dated 7 August 1945 and General Orders 312 dated 20 November 1945, Headquarters United States Forces, European Theater, to prepare a factual analysis of the strategy, tactics, and administration employed by the United States forces in the European Theater.

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THE GENERAL BOARD  
UNITED STATES FORCES, EUROPEAN THEATER  
APO 408

STUDY OF AMMUNITION SUPPLY FOR FIELD ARTILLERY

Prepared by:

Brig-Gen J. D. Balmer- - - Chief, Artillery Section  
Col L. J. Compton- - - - Executive, Artillery Section  
Col J. P. Daley- - - - - Artillery Section  
Lt Col U. P. Williams- - - Artillery Section

Principal Consultants:

Brig Gen J. F. Uncles, 014914, Commander, 34th Field Artillery Brigade.  
Col C. Brewer, 03539, Commander, 46th Field Artillery Group.  
Col A. L. Campbell, 05542, President Field Artillery Board.  
Col K. LeV Davis, 019386, Assistant Artillery Officer, VI Corps.  
Col B. Furuholmen, 015725, G-3 Section, 12th Army Group.  
Col R. T. Finn, 016237, Executive Officer, 32d Field Artillery Brigade.  
Col C. I. Hutton, 018177, Artillery Officer, 2d Armored Division.  
Col N. M. Lynde, 017730, Assistant Ordnance Officer, First Army, Ordnance Officer, Fifteenth US Army.  
Col E. T. Owen, 015488, Executive Officer, Division Artillery, 26th Infantry Division.  
Col J. W. Russey, 07464, Commander, 349th Field Artillery Group.  
Col J. C. Strickler, 016445, Commander, 79th Field Artillery Group.  
Col P. H. Weiland, 08418, Commander, 40th Field Artillery Group.  
Col J. R. Winn, 019491, Executive Officer, XIX Corps Artillery.  
Lt Col E. R. Bruce, ASN Unknown, Commander, Armored Field Artillery Battalion, 6th Armored Division.  
Lt Col R. L. Cardell, 018505, Commander, 937th Field Artillery Battalion.  
Lt Col S. W. Gooch, 019455, Commander, 744th Field Artillery Battalion.  
Lt Col L. M. Del de Riener, 017640, Commander, 252d Field Artillery Battalion.  
Lt Col H. F. Gagne, 0316189, G-4 Section 12th Army Group.  
Lt Col R. C. Hockman, ASN Unknown, Commander, 495th Field Artillery Battalion.  
Lt Col Howell, ASN Unknown, Commander, 515th Field Artillery Battalion.  
Lt Col H. J. Hubbard, 019459, S-3 Division Artillery, 84th Infantry Division, and Commander, 325th Field Artillery Battalion.  
Lt Col R. B. Partridge, 020204, Executive Officer, 179th Field Artillery Group.

Lt Col J. C. Rosborough, 0179173, Commander, 107th  
Field Artillery Battalion.

Lt Col E. D. Russell, ASN Unknown, Commander, 309th  
Field Artillery Battalion.

Lt Col H. L. anders, 019445, Commander, 284th Field  
Artillery Battalion.

Lt Col F. G. Stritzinger, 017186, Commander, 752d  
Field Artillery Battalion.

Major C. A. Bealer, ASN Unknown, S-4 Division Artil-  
lery, 78th Infantry Division.

Major W. E. Farber, ASN Unknown, S-4 Division Artil-  
lery, 36th Infantry Division.

Major R. B. Garlock, 0453487, Ordnance Ammunition  
Officer, Fifteenth US Army.

Major R. S. Geiger, 024845, S-3, 93d Armored Field  
Artillery Battalion.

Major W. F. Kenney, ASN Unknown, S-3, 375th Field  
Artillery Battalion.

Major W. G. Raoul, ASN Unknown, S-3, 494th Field Artil-  
lery Battalion.

Major N. M. Smiley, ASN Unknown, S-4 Division Artil-  
lery, 100th Infantry Division.

Major Phelan, ASN Unknown, S-3, 991st Field Artillery  
Battalion.

Major B. T. Whited, ASN Unknown, S-4, 179th Field  
Artillery Group.

Major Norman C. wait, 0377628, Ammunition Division,  
Ordnance Section, European Theater of Operations.

Captain J. S. Colson, 01548701, Ammunition Division,  
Ordnance Section, European Theater of Operations.

Captain R. C. Hawley, 0480395, Ammunition Supply  
Officer, 11th Armored Division.

Captain Miller, ASN Unknown, Assistant S-3, 575th  
Field Artillery Battalion.

Captain B. C. Stone, 0497283, Ammunition Division,  
Ordnance Section, European Theater of Operations.

Captain C. S. VanValkenburgh, ASN Unknown, S-4, 283d  
Field Artillery Battalion.

STUDY OF AMMUNITION SUPPLY FOR FIELD ARTILLERY

PART ONE

AMMUNITION REQUIREMENTS VERSUS SUPPLY

CHAPTER 1

INTRODUCTION

1. The Purpose of This Study is to examine field artillery ammunition supply in the European Theater of Operations, to evaluate the means and the methods employed, and to recommend those changes in means and methods which, if employed in the future, should assure a more satisfactory ammunition supply. The study is divided into four major parts: a discussion of ammunition requirements as contrasted to actual supply, a discussion of methods of command control of ammunition, a discussion of the physical means of supply, and a final part giving conclusions and recommendations based on the preceding three parts.

2. The Purpose of Part One of this report is four-fold; first, to demonstrate that there were army-wide, army-group-wide and theater-wide shortages of field artillery ammunition; second to determine the causes for these shortages; third, to show the effect of shortages; fourth, to show the action taken to alleviate shortages.

3. The Presentation of Part One is chronological. The subdivision into chapters is not in accordance with phases of the tactical campaign but rather in accordance with phases of the ammunition supply situation.

CHAPTER 2

LONG RANGE PLANNING ESTIMATES

SECTION 1

THE DETERMINATION OF A EUROPEAN THEATER OF OPERATIONS

DAY OF SUPPLY

4. History. In a forecast of ammunition expenditures, the essential element, and the one most difficult to determine, is the predicted rate of expenditure in rounds per weapon per day. For this theater, the first effort to delineate these probable rates of expenditure was set forth in a study "Recommended Ammunition Day of Supply". This study which originated in the Office of the Chief Ordnance Officer, Headquarters Service of Supply, European Theater of Operations, was forwarded to the War Department by Headquarters European Theater of Operations, 9 January, 1944.

The recommended European Theater of Operations Day of Supply was never approved by the War Department. However, this day of supply was used as a basis for the ammunition estimates made in January and April 1944, and undoubtedly this day of supply furnished the major background for the European Theater of Operations Day of Supply published by the War Department, 10 June 1944.<sup>1,2,3</sup>

#### 5. Definition of the Recommended Day of Supply.<sup>1</sup>

Although the War Department defines the Day of Supply as "the estimated average expenditure of various items of supply per day in campaign", this January recommended European Theater of Operations Day of Supply was not a prediction of the average expenditures of ammunition in the European Theater. The following is quoted from the original study:

"The recommended Day of Supply can be defined as 'the average expenditure of large forces engaged in a major operation against an enemy of equal strength and ability during periods of continuing operations when most of the forces are engaged in battle for an average of 20 days per month, and in contact with the enemy, but not in battle, for 10 days per month'. It is not considered within the scope of this report to estimate the number of months per year that will be fought at this rate."

The study did not make any estimate of the number of battle days per month which would occur in this theater. The recommended European Theater of Operations Day of Supply was a technical estimate of probable expenditures under an arbitrary set of conditions, and not, necessarily, the conditions which did exist in the European Theater of Operations.

#### 6. Basis of the Recommended Day of Supply.<sup>1</sup>

The rates recommended were based upon US expenditures in North Africa and Sicily, upon British expenditures in the Middle East, in North Africa, in Sicily and in Italy during September 1943, upon British supply rates and upon the European Theater of Operations Unit of Fire. (The European Theater of Operations Unit of Fire published by the theater 10 December 1943, represented the opinion of veterans of North Africa and Sicily; it was "the amount of ammunition which may be expected to be expended in \*\*\* 2½ days of average combat"). The rates used in analyzing past expenditures were the rates at which ammunition would have been fired had each campaign been fought at the rate of 20 battle days a month. To quote from the study: "For example the El Alamein offensive started on 23 October 1943, the breakthrough was complete by 6 November, and the British pursued the Germans to the Mareth Line with no further battles. This action involved 17 days battle so the expenditures for October, November and December were treated as if they had occurred in 17/20 of one campaign month or 25 days (composed of 17 days battle and eight days in contact but not in battle)."

#### 7. Validity.<sup>1,2</sup>

The study embraced all available information. It had two unavoidable but major weaknesses: first, despite the system of eliminating non-battle days, the battle days considered were largely battle days of pursuit-type or desert-type warfare; second, and worse,

experience data for the 8-inch howitzer, the 8-inch gun and the 240mm howitzer were practically non-existent. The table below highpoints these weaknesses..

COMPARATIVE RATES

(In rounds per gun per day)

	(1) WD Day of Supply 10 Nov 1943 <sup>4</sup>	(2) Recommended ETO Day of Supply 29 Dec 1943 <sup>1</sup>	(3) ETO Day of Supply 10 June 1944 <sup>2</sup>	(4) Recommended ETO Day of Supply 3 March 1945 <sup>5</sup>	(5)* Per cent Change from 29 Dec 1943 to 3 Mar 1945
3-inch Gun (TD)	10	10	13	6	-40%
105mm How M2, M7	30	40	40	45	+12%
4.5-inch Gun	20	25	25	28	+12%
155mm How, M1	20	20	25	35	+75%
155mm Gun M1, M1918	15	15	25	25	+67%
8-inch How	10	12.5	18	25	+100%
8-inch Gun	10	10	10	15	+50%
240mm How M1	5	7	7	15	+114%

\* Note: Throughout this study the recommended European Theater of Operations Day of Supply, 3 March 1945, is taken as an acceptable standard: It represents the consolidated opinion of 6th Army Group, 12th Army Group and Headquarters European Theater of Operations after nine month of combat. It is taken as a more accurate summary of theater opinion than later recommendations which represented a conscious effort to cut requirements in view of the expected German collapse.

8. Types of Ammunition. Proposed percentages by types differed in several respects from the War Department Day of Supply of November 1943. Major variations were:

	War Department	ETO Recommendation
3-inch Gun	50% APC 50% HE	25% APC 75% HE
105mm How, M2	0% WP 0% Colored Smoke	5% WP 2% Colored Smoke
155mm How, M1	0% WP 0% Colored Smoke 50% Green Bag Charge 50% White Bag Charge	5% WP 2% Colored Smoke 25% Green Bag Charge 75% White Bag Charge

Particularly noted should be the request for white phosphorus. Even in the spring of 1945 white phosphorus for the 105mm howitzer was still rationed at less than the percentages recommended in January 1944.<sup>7</sup>

## SECTION 2

### THE JANUARY 1944 EXPENDITURE FORECAST

9. History. In January 1944 the War Department cabled the Theater:

"To assist in determining appropriate ammunition requirements, request carefully considered estimate \*\*\*\* of anticipated expenditures for initial equipment weapons in your theater. It should reflect average level of activity of all initial weapons expected to be in the entire theater, excluding reserve weapon stocks."<sup>8</sup>

Headquarters European Theater of Operations proposed that 1st US Army Group make the estimate for all US ground forces. However, 1st US Army Group replied by recommending that the Chief Ordnance Officer, Headquarters Service of Supply European Theater of Operations prepare the answer based on the study for the recommended European Theater of Operations Day of Supply.<sup>9</sup> As a result, Ordnance Service of Supply was charged with the actual preparation of the estimate.<sup>10</sup> The estimate as prepared by Ordnance Service of Supply was approved by Headquarters European Theater of Operations and was cabled to the War Department, 22 January 1944.<sup>3</sup>

10. Analysis of the January Estimate.<sup>2</sup> In the mythical campaign described in the then recommended European Theater of Operations Day of Supply, the expenditures could be calculated easily by the formula:

$$\text{Amount expended} = \text{Number of days in period} \times \text{average number of weapons deployed} \times \text{European Theater of Operations recommended Day of Supply.}$$

Ordnance Service of Supply, in effect, said to G-3 Headquarters European Theater of Operations, "The European Theater of Operations recommended Day of Supply is for a campaign in which 20 out of every 30 days are battle days. How many battle days per 30 day month will there be in the coming campaign?"

G-3 Headquarters European Theater of Operations answered: Second quarter of 1944 40 battle days out of 30, third quarter 17 battle days out of 30, fourth quarter 14 battle days out of 30. The answer was actually expressed in percentages of the ordnance campaign month of 20 battle days in 30; second quarter 200%, third quarter 85%, fourth quarter 70%

The peculiar figure for the second quarter (40 battle days in 30 days) was assigned to protect the estimate if the landing occurred in May instead of June. It really provided for two ordnance standard battle months. Since the safety factor proved so ample no further discussion of the second quarter estimate is included.

In the estimate for the third and fourth quarters, G-3's answer really resulted in the use of a greatly reduced day of supply. Note in the tables below the rates actually used to predict artillery expenditures:

### Rates of Expenditure

Rounds per weapon per day for each weapon deployed

#### Third Quarter

(1) Weapon	(2) Recommended ETO Day of Supply 29 Dec 1943	(3) Rate used in January estimate (2) x .85	(4) Recommended ETO Day of Supply 3 Mar 1945	(5) % change from Jan- uary 1944 estimate to 3 Mar. 45
3-inch Gun	10	8.50	6	-29%
105mm How M2, M1	40	34.00	45	+32%
4.5-inch Gun	25	21.25	28	+32%
155mm How, M1	20	17.00	35	+106%
155mm Gun	15	12.75	25	+96%
8-inch How	12.5	10.62	25	+135%
8-inch Gun	10	8.50	15	+76%
240mm How	7	5.95%	15	+152%

#### Fourth Quarter

(1) Weapon	(2) Recommended ETO Day of Supply 29 Dec 1943	(3) Rate used in January estimate (2) x .70	(4) Recommended ETO Day of Supply 3 March 1945	(5) % change from Jan- uary 1944 estimate to 3 Mar 1945
3-inch Gun	10	7.00	6	-14%
105mm How M2, M1	40	28.00	45	+61%
4.5-inch Gun	25	17.50	28	+60%
155mm How, M1	20	14.00	35	+150%
155mm Gun	15	10.50	25	+128%
8-inch How	12.5	8.75	25	+176%
8-inch Gun	10	7.00	15	+114%
240mm How	7	4.90	15	+206%

The inadequacy of the rates used is marked. As a production guide to the War Department estimates based on them could only result in underproduction.

SECTION 3

THE MARCH 1944 REVISED EXPENDITURE FORECAST

11. History.<sup>2,11</sup> On 1 March 1944, alarmed by the rise in ammunition expenditures in Italy during December 1943 and January 1944, the War Department requested the theater to review its estimates. The old estimates were reviewed by Ordnance Service of Supply, G-3 Headquarters European Theater of Operations and the Artillery Section, Headquarters European Theater of Operations.

Ordnance Service of Supply stated "Estimates and the 'Recommended European Theater of Operations Day of Supply' 29 December 1943 were based on two thirds of theater weapons being committed to action, and one third held in reserve." (In other words, 20 battle days in 30). Ordnance pointed out that had only two thirds of the weapons in Italy been committed to action expenditures would have been consistent with the European Theater of Operations Day of Supply. As Ordnance expressed it, "If G-3 contemplates a different ratio of action to reserve weapons, this must be considered in estimating ammunition requirements".<sup>12</sup>

The Artillery Section stated that, in its opinion, the European Theater of Operations Day of Supply was too small because it was normal for artillery weapons to be in action more than two thirds of the time. It was pointed out that in Italy in January 1944 the average artillery weapon was in action 1.3 times as much as the average representative infantry weapon (30 calibre machine gun, 60mm mortar, 81mm mortar). The artillery maintained that, if the estimate was correct for infantry weapons, it must be too small for artillery weapons.<sup>2</sup>

In accord with the artillery recommendation it was decided that in the revised estimates, estimates for the 105mm howitzer would be multiplied by 1.2 and the estimates for larger artillery weapons would be multiplied by 1.3. In effect, G-3 used different activity factors for artillery:

G-3 Factors<sup>13</sup>

	General Weapons	105mm How	4.5-inch Gun and larger
Third quarter factor	0.85	1.00	1.10
battle days in 30	17	20	22
Fourth quarter factor	0.70	0.85	0.90
battle days in 30	14	17	18

In addition to this introduction of increased expenditure rates for artillery items, the revised forecast was based on a later, and much accelerated estimate of the cannon deployment on the continent.<sup>2</sup>

The new forecast resulted in artillery expenditure estimates generally from 160 to 200% of the January estimates.<sup>2</sup>



12. Analysis of the March Estimate.<sup>2,13</sup> Note in the tables below the increase in the rates used:

### Third Quarter

(1) Weapon	(2) Recom- mended ETO Day of Supply 29 Dec 1943	(3) Rate used in January 1944 estimate	(4) Rate used in March 1944 estimate	(5) Recom- mended ETO Day of Supply 3 Mar 1945	(6) % change from March 1944 to 3 March 1945
3-inch Gun	10	8.50	8.50	6	-29%
105mm How M2,M7	40	34.00	40.00	45	+12%
4.5-inch Gun	25	21.25	27.50	28	+2%
155mm How, M1	20	17.00	22.00	35	+59%
155mm Gun	15	12.75	16.50	25	+51%
8-inch How	12.5	10.62	13.75	25	+82%
8-inch Gun	10	8.50	11.00	15	+36%
240mm How	7	5.95	7.70	15	+95%

### Fourth Quarter

(1) Weapon	(2) Recom- mended ETO Day of Supply 29 Dec 1943	(3) Rate used in January 1944 estimate	(4) Rate used in March 1944 estimate	(5) Recom- mended ETO Day of Supply 3 Mar 1945	(6) % change from March 1944 to 3 March 1945
3-inch Gun	10	7.00	7.00	6	-14%
105mm How	40	28.00	34.00	45	+32%
4.5-inch Gun	25	17.50	22.50	28	+24%
155mm How	20	14.00	18.00	35	+94%
155mm Gun	15	10.50	13.50	25	+85%
8-inch How	12.5	8.75	11.25	25	+12%
8-inch Gun	10	7.00	9.00	15	+67%
240mm How	7	4.90	6.30	15	+138%

The rates used in the March estimate were still low but were a distinct improvement over the January rates. The low rates were partially offset by the too high troop deployment used in making the estimate. A comparison of forecasted deployment to actual deployment illustrates this point.

## Forecasted Deployment Versus Actual Deployment

Weapon	Third Quarter		Fourth Quarter	
	Forecast <sup>14</sup>	Actual <sup>15</sup>	Forecast <sup>14</sup>	Actual <sup>15</sup>
105mm How M2, M7	1139	1045	1819	1545
4.5-inch Gun	108	73	164	147
155mm How	497	453	788	649
155mm Gun	256	198	314	242
8-inch How	112	83	144	125
8-inch Gun	20	14	24	24
240mm How	56	34	60	58

### SECTION 4

#### VALIDITY OF THE FORECASTS

13. Forecasts Contrasted with Facts. Both the January estimate and the March estimate can be converted to rounds by multiplying the number of War Department Days of Supply requested by the number of rounds in the War Department Day of Supply by the average number of weapons to be in the theater each period as predicted for the March estimate.<sup>2</sup> The March 1 troop flow is used in both cases to bring both estimates to a common point of time. Even if the estimate had not been revised, in March the War Department would have been using March knowledge of troop flow in interpreting the January estimate.

In the table below the estimates are derived as explained above. The rounds actually fired are taken from 12th Army Group Artillery Ammunition Expenditure records.<sup>15</sup>

Forecast versus Fact Table

	Third Quarter		
	January Estimate Rounds	March Estimate Rounds	Actually Fired Rounds
105mm How M2, M7	2251000	4248000	2044000
4.5-inch Gun	98000	274000	90000
155mm How, M1	561000	976000	597000
155mm Gun, M1	212000	388000	216000
8-inch How	61000	143000	45000
8-inch Gun	6800	19800	4200
240mm How	16200	39000	12100

Fourth Quarter

	January Estimate Rounds	March Estimate Rounds	Actually Fired Rounds
105mm How M2, M7	3355000	5586000	3929000
4.5-inch Gun	151000	336000	229000
155mm How	414000	1295000	971000
155mm Gun	264000	396000	332000
8-inch How	107000	151000	102000
8-inch Gun	7600	19800	7800
240mm How	21300	34500	20300

14. Interpretation. From July through December 1944, ammunition for the weapons listed was rationed almost all of the time. During the last half of October ammunition was in such short supply that (to take the extreme case) one army (Third) reduced its expenditures to one or two round per gun per day.<sup>15</sup> The columns headed "Actually Fired" must be used to measure inadequacy, of supply. Since the rounds actually fired were inadequate, any quantity less than those shown is even more inadequate. The January estimate provided ammunition in approximately the amounts actually fired; the January estimate, was, therefore, entirely inadequate. The March estimate provided for expenditures considerably greater than the actual expenditures. We have no way to determine absolutely whether or not the supply as outlined in the March estimate would have been sufficient. We do know that had ammunition been supplied to the guns in the quantities forecasted in March, the shortages that did occur would have been greatly ameliorated.

CHAPTER 3

ARTILLERY AMMUNITION SUPPLY

6 June - 31 July 1944

SECTION 1

Requirements D to D plus 90

15. May 10th Agreed Rates.<sup>16</sup> From February to May 1944, three headquarters, First Army, 1st US Army Group, and Headquarters European Theater of Operations made estimates of the ammunition requirements for the forthcoming operations. 1st US Army Group's estimates were substantially those of First Army extended to cover troops other than First Army and to include reserve buildup for the Army Group through D+90. In contrast, as late as 4 May, Headquarters European Theater of Operations made estimates which had little relation to the estimates prepared by the tactical commands.<sup>16,17</sup> Finally, on 10 May,

the three headquarters reached an agreement. For the period D to D/30, First Army's estimates were accepted by all three. For the period D/30 to D/90 the three headquarters agreed on a new planning rate. The table below contrasts the previous rates and the agreed rates; in addition it shows that the agreed rates were the closest approach to date to the day of supply recommended 3 March 1945. It will be noted that in some cases the agreed rates were higher than either of the previous rates. These higher rates were a result of a review of requirements by 1st US Army Group, First Army and Third Army.

Forecasted Expenditures D/30 to D/90  
in rounds per gun per day

Weapon	1st US Army Group Rates  (1/3 unit of fire per day)	ETOUSA Rates  (.85 ETO Day of supply)	Agreed Rates  10 May 1944	Recommended ETO Day of Supply 3 March 1945
3-inch Gun	16 2/3	8.50	10	6
105mm How M2	44 1/3	34.00	45	45
4.5-inch Gun	25	21.25	30	28
155mm How	26	17.00	25	35
155mm Gun	16 2/3	12.75	20	25
8-inch How	16 2/3	12.75	20	25
8-inch Gun	11 2/3	12.75	15	15
240mm How	8 1/3	8.50	10	15

The amount of ammunition to be landed on the continent by D/90 was limited by the class V tonnage lift available (approximately 490,000 long tons). The agreed rates, however, forewarned Headquarters European Theater of Operations that, in the opinion of tactical commands, artillery ammunition would probably constitute a higher proportion of the total class V supply than heretofore contemplated by Headquarters European Theater of Operations. Furthermore, the agreed rates, when used by Headquarters European Theater of Operations to substantiate requests to the War Department, were an additional warning to the War Department of the still rising demands for artillery ammunition.<sup>18,19,20</sup>

By the end of May the theater had assurance from the War Department that the initial theater requirements would be met. The known situation prior to D day can best be summarized by an extract from a Headquarters European Theater of Operations cable to 1st US Army Group, First Army and Third Army dated 31 May 1944:

"Based on information from the New York Port, it is now possible to assure you that your total requirements D to D plus 70 of virtually all types of ammunition will be laid down on the far shore when desired."<sup>21</sup>

16. Tactical and Supply Estimates.<sup>17</sup> During the planning period, 1st US Army Group and First Army became apprehensive of Headquarters European Theater of Operations ammunition supply planning. Extracts from a memorandum to General Eisenhower from General Bradley dated 14 May 1944, highlight this apprehension:

"1st US Army Group recently received a letter from Headquarters European Theater of Operations, indicating certain probable shortages of ammunition, and asking that predicted expenditures be reexamined in the light of availability. While it did not appear reasonable to color actual requirements in accordance with supply, the rates were checked thoroughly to assure that more ammunition had not been requested than was actually going to be needed.

"It was apparent, however, from the Headquarters European Theater of Operations letter, that information given to the theater over the period since February of this year had not been taken into account in arriving at the theater estimate of requirements. The anticipated expenditures listed by Headquarters European Theater of Operations were entirely different from the actual estimates of First Army, and the actual amounts requisitioned for our supply."

This apprehension, born during the spring of 1944, affected ammunition supply during at least six months of the campaign. The First Army and, later, 12th Army Group feared failures in the ammunition supply in the Communication Zone. Lack of confidence in supply agencies threw a shadow over most ammunition supply planning.

17. Special Requirements. During the planning period First Army initiated a number of special requirements. Among these were requirements for 4.5 inch High Explosive with a smoke pellet to assist observation (this round was a standard British item), requirements for colored smoke shell (or colored smoke canisters) for the 105mm howitzer M2, the 155mm howitzer and the 155mm gun, and requirements for illuminating shell for the 3 inch gun, the 155mm howitzer and the 155mm gun.<sup>22</sup> Many of these requirements were never met. The 4.5 inch requirement was partially met from British stocks from June through September. Thereafter neither the British High Explosive with smoke pellet nor an acceptable substitute, white phosphorus, was available.<sup>23,24</sup> Colored smoke for the 105mm howitzer M2 was in good supply from 1 September 1944 on: the original theater requirements (reflecting troop demands) were greatly overstated.<sup>15,25</sup> An adequate supply of colored smoke canisters for the 155mm howitzer became available in the fall of 1944. As for colored smoke for the 155mm gun, even base ejection smoke shell for this weapon was not available until February 1945.<sup>24</sup> Three inch gun illuminating shell first became available at the guns in late November.<sup>15</sup> When availability was good expenditures averaged roughly 2.5 rounds per gun per month.<sup>26</sup> No illuminating shell for the larger calibres was ever available.<sup>23</sup>

18. Defective Ammunition.<sup>27</sup> The 105mm howitzer ammunition available for initial operations belonged to

many and, usually, small lots. Tests showed that variations between lots (and sometimes within lots) were so great that indiscriminate use of this ammunition would considerably impair close support of infantry. By test firing an effort was made to group ammunition lots into categories of lots which would have approximately the same ballistic qualities. In this firing, certain particularly non-standard lots were rejected. Despite the fact that approximately 800,000 rounds were classified, the net result was almost nil, since the supply of classified ammunition was insufficient to meet requirements and the troops had to accept classified, unclassified, and rejected ammunition. (For further discussion see Part Three this study).

## SECTION 2

### AMMUNITION SUPPLY FOR THE INITIAL LANDING

19. Estimate of Expenditures.<sup>28</sup> The First Army's estimate of expenditures for artillery and tank destroyer units during initial operations on the continent was, in general:

<u>Day</u>	<u>Omaha Beach</u>	<u>Utah Beach</u>
D	2/3 U/F per day	1 U/F per day
D/1, D/2	1 U/F per day	1 U/F per day
D/3 to D/5	2/3 U/F per day	2/3 U/F per day
D/6 to D/8	1/2 U/F per day	1/2 U/F per day
D/9 and thereafter	1/3 U/F per day	1/3 U/F per day

It was estimated that, in addition to the above, the following amounts would be expended:

#### Omaha Beach

D	1/2 U/F	for 105mm SPs
D/1	1/2 U/F	for 155mm How, 1/4 for 155mm Gun
D/2	1/6 U/F	for 155mm Gun
D/3	1/3 U/F	for 155mm How, 155mm Gun
D/4	Normal	
D/5	1/6 U/F	for 155mm Gun
D/6	1/6 U/F	for 4.5-inch Gun
D/7	1/6 U/F	for 4.5-inch Gun
D/8	Normal	
D/9	1/6 U/F	for 4.5-inch Gun

Utah Beach

D	1/6 U/F	for 105mm How
D/1	1/2 U/F	for 155mm Gun, 155mm How
D/2	1/2 U/F	for 155mm Gun
D/3	1/3 U/F	for 155mm How, 155mm Gun
D/4	1/3 U/F	for 155mm Gun
D/5	1/3 U/F	for 155mm Gun
D/6	1/6 U/F	for 4.5-inch Gun, 155mm Gun
D/7	1/6 U/F	for 4.5-inch Gun, 155mm Gun
D/8	1/6 U/F	for 4.5-inch Gun
D/9	1/6 U/F	for 4.5-inch Gun

The unit of fire used was: 105mm How 133 rounds, 4.5-inch Gun 75 rounds, 155mm How 78 rounds, 155mm Gun 50 rounds, 8-inch How 50 rounds.<sup>29</sup>

20. Comparison of Estimates and Facts.<sup>30</sup> The value of the estimates may be gauged by comparing the estimates for one beach with the expenditures for that beach. The table below shows the comparison of expected expenditures and actual expenditures for the VII Corps landing on Utah Beach. The expected expenditures were derived by applying the rates shown above to the planned troop flow.<sup>31</sup> The expenditures are those reported by VII Corps Artillery.

Expenditures VII Corps  
(Total Rounds)

Day	105mm How		4.5" Gun		155mm How		155mm Gun		8" How	
	pre-dict-ed	actu-al	pre-dict-ed	actu-al	pre-dict-ed	actu-al	pre-dict-ed	actu-al	pre-dict-ed	Actual
D	8379	637		--	936	--	200	--		--
D/1	9576	5249		--	1404	25	300	--		--
D/2	14364	9492		--	936	939	300	82		--
D/3	9597	10508		--	1872	1339	200	56		--
D/4	12768	9232		--	1872	1595	600	149		--
D/5	12768	16913		--	2496	1791	600	20		--
D/6	9596	13803	600	--	2340	1374	400	155		--
D/7	9596	11284	600	--	3276	2575	400	122		--
D/8	9596	11196	600	--	3276	2844	300	455	300	--
D/9	6384	6599	450	254	2184	1833	400	370	200	--
Total	102543	94923	2250	254	20592	14315	3600	1409	500	--

The predictions exceeded the actual expenditures. Generally this was true because weapons landed later than planned. Those weapons which were ashore fired at approximately predicted rates. The special rates for certain weapons for certain days appear, in retrospect, to be an effort to attain an impossible accuracy; in every case the special rates made the forecast less accurate. The over-estimate was immaterial since the excess ammunition simply went to swell the necessarily slim continental reserves.

### SECTION 3

#### HISTORY OF AMMUNITION SUPPLY 6 JUNE TO 31 JULY 1944

21. Comments of the Artillery Section, First Army<sup>32</sup> on ammunition supply are concisely summarized in Annex 8 to the First Army Report of Operations. Extracts follow:

##### AMMUNITION SUPPLY

"Artillery units came ashore initially with as much ammunition as they could carry. In most cases this was in excess of basic load with the exception of the initial assault forces whose complete trains did not come ashore.

"Ammunition did not arrive at the planned rate although there are no evidences of serious initial curtailment of fire due to lack of artillery ammunition. During these first days, naval gunfire was able to give good support to the ground troops and artillery fires were generally not heavy with the exception of the separate armored battalions.

\* \* \* \* \*

"Restrictions were imposed on 15 June as ammunition stocks were far below target levels due to a number of factors including a three day period of bad weather which practically stopped delivery of ammunition from ship to shore, unbalanced tonnage, and creation of excessive unreported unit dumps at many artillery positions. Ammunition fired prior to the date of rationing was considerably below anticipated expenditures, consequently, had stock levels been established as planned there is no indication that restrictions would have been necessary.

"During the period of bad surf conditions, air delivery from the United Kingdom was instituted and was instrumental in the building up of ammunition stockage, particularly 155mm howitzer shells, supply of which had fallen to a low level.

"Expenditures from 4 July to 15 July inclusive reflect the most continuous heavy firing by First Army artillery units in operations to 1 August. During these twelve days, a degree of control was exercised, and unrestricted firing was not permitted. The Army Commander required that units generally conform on a corps-wide basis to one unit of fire for attack, 1/2 unit of fire for each subsequent day of attack and 1/3 unit of fire for a normal day of firing. This period involved a succession of limited attacks by all four corps through difficult hedgerow terrain which



was highly favorable for defense. In addition, "morale" firing by new divisions and increased depth and width of concentrations fired to compensate for poor observation both tended to increase overall expenditures. Due to these and other factors, including shipping delays in the delivery of ammunition off the beaches, depot stocks of ammunition became insufficient to sustain the 4-15 July expenditure rate. Consequently, on 16 July a strict rationing program was initiated in order to rebuild First Army ammunition reserves. In the case of 105mm howitzer ammunition the depot level had dropped to 3-1/2 units of fire. During the period 16 July to 24 July expenditures were considerably less than the amount rationed. Light supporting fires only were used during this period, while the bulk of the artillery was on a silent policy from new positions occupied for operation COBRA.

"D Day for operation COBRA, 25 July, and the subsequent two days, 26 and 27 July reflected slightly increased expenditures. However, expenditures from then to the end of the period were light. The attack was most successful, resulting in a breakthrough and general withdrawal by the enemy along the entire front.

"It will be noted that, regardless of the intensity of operations, First Army expenditure reports show savings during the periods when rationing was in effect. It is emphasized that this must not be construed to mean either that ample ammunition was always made available or that these savings might not have been fired on remunerative targets. Some savings will invariably accrue when ammunition is rationed. Moreover, the tighter the ration the greater will be the percentage of saving, since a suitable reserve must be maintained continuously by all subordinate echelons against an unpredictable emergency late in the ration period.

"Another point of significance is the fact that ammunition expenditures will invariably be light during periods of rapid movement or during the exploitation stage of a successful operation. This principle is demonstrated clearly by the expenditure rates following the COBRA breakthrough."

22. The Causes of Rationing. Initially, as shown above, rationing was a direct result of shortages which, for most major items, were caused not by non-availability in the theater but rather by inability to move available supplies across the beaches. Once rationing started, the urge to ration was accentuated by distrust of future supply. First Army Ordnance Section says in Annex 13 to the First Army Report of Operations:<sup>22</sup>

"In assuming reserve build-up during this period, it was necessary to consider ammunition on manifest from the United States to the United Kingdom. Information on ammunition enroute was meager. Lack of this information probably caused undue restrictions in the authorized expenditure rates." Some idea of the confusion existing because of lack of information can be gained by comparing ammunition figures used by 12th Army Group, by First Army, and by the Communication Zone. 12th Army Group figures

are the basic figures for the Army Group's first ammunition allocation (effective 1 August 1944);<sup>33</sup> First Army's figures are from a letter dated 27 July 1944 to the Commanding General, Communication Zone, subject: "Status of Critical Ammunition Items, this date";<sup>34</sup> Communication Zone figures are from a carrier sheet, Office of the Chief of Ordnance, Headquarters European Theater of Operations, dated 3 August 1944.<sup>35</sup> The carrier sheet is an analysis of the First Army letter quoted above. In each case, the quantities shown purport to be the quantities which that headquarters believed would be available in the period shown. For comparison of certain items, the last column gives the approximate quantity actually delivered on the continent during the period 28 July to 27 August. This figure was derived by adding the artillery expenditures reported during the period 28 July -- 27 August to the amount of ammunition reported available on the continent in Communication Zone and Field Force Depots 27 August 1944.<sup>15, 36, 37.</sup>

Total Ammunition Available in the ETO (In rounds)

	12th Army Group Predicted Availability from 29 July to 28 Aug 1944	First Army Predicted Availability from 27 July to 26 Aug 1944	ETO Ordnance Predicted Availability from 2 Aug to 1 Sept 1944	Actually Available 28 July to 27 Aug 1944
105mm How M2	3,075,000	1,988,000	4,529,000	2,450,000*
4.5-inch Gun	121,000	83,000	190,000	115,000
155mm How M1	562,000	290,000	905,000	404,000
155mm Gun M1	110,000	169,000	358,000	107,000
8-inch How	51,000	42,000	121,000	55,000
240mm How	20,500	17,000	40,000	17,500
8-inch Gun	11,000	8,000	11,000	7,500
76mm Gun (HE)	**	384,000	840,000	**
3-inch Gun (HE)	**	418,000	808,000	**

\* Approximation. Basic figures for the 105mm howitzer, M2 did not include base ejection smoke shell or high explosive antitank shell.

\*\* Figures not available.

The field forces' figures while not accurate were far more accurate than the optimistic predictions of the theater. Fat predictions followed by lean deliveries further increased the field forces' apprehension.

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23. The Effect of Rationing can be judged by extracts from a 12th Army Group observer's report, dated 1 August 1944, dispatched from Headquarters XIX Corps:

"Ammunition Shortages:

"Orders now limit amount of ammunition for mortars and artillery. Every answer as to the reasons for the shortages has been: 'Poor planning and underestimation as to the amount of ammunition that would be required in Normandy.'"

"Executive Officer, XIX Corps Artillery

"In one day we put the 30th Division over two river crossings and they advanced 6000 yards, the greatest advance this division had made up to that time and suffered only 300 casualties. However, we caught hell for using so much ammunition. \* \* \* \* \*. To repel the attack at the Anzio beachhead, the artillery there used up to 60,000 rounds in one day. We can save our own troops a lot of casualties and it's a cheap way to win. It takes twenty minutes to make an artillery shell, but it takes 20 years to make a doughboy. It is true that some of the artillery fire may be wasted and fall on nothing, but our fires are generally observed and we set them down on call as indicated in our fire plans. On the days that we had the ammunition to shoot, the troops made progress. When we didn't have the ammunition they didn't make much progress.

"Executive Officer, Division Artillery, 30th Division:

\* \* \* \*. Our troops \* \* \* \* have to have the artillery support to go forward. After all why economize on ammunition when it should be plentiful. Economize on lives. Our fires have been observed and its not of much use to put a small amount of ammunition down on a German position because all we do is neutralize him and he picks up afterwards and sets up again. The thing to do is to destroy him burn up his equipment, then you won't be bothered with him any longer. We need more phosphorous for this, we could use 20% but we are limited to 2% \* \* \*. Whoever estimated the ammunition requirement based it on the African and Sicilian experience. In this Normandy country we could use 10 times the amount."

During this period rationing did not adversely affect the final outcome of any major tactical operation. Rationing did increase the flesh and blood cost of tactical success.

24. Evaluation of Expenditures. Restricted ammunition expenditure rates ordinarily are valuable for study only as an indication that the desirable expenditure rate is in excess of the restricted rates. Some indication of the amount of ammunition needed in offensive action against a well-organized enemy can be gleaned from the following expenditures which tactical troops said were inadequate.<sup>32</sup> (for the basis of the restrictions see comments of the Artillery Section, First Army in paragraph 21 above)

See chart on following page.

WEEKLY EXPENDITURES

Period	Ave.* Guns on Con- tinent	Ave.Total Rds per day Period	Re-		Percentages				
			Ave. % U/F	Re- stric- tions for Period	HE	WP	NC	HCBE	
WEAPON - 105mm How									
2-8 Jul	460	55	170,710	44%	180,000	79%	16%	3%	2%
9-15 Jul	588	80	328,600	64%	253,000	87%	11%	14%	0.4%
WEAPON - 155mm How, M1									
2-8 Jul	278	41	79,597	55%	66,000	97.5%	2%	0.5%	27%
9-15 Jul	310	53	116,053	71%	90,000	97.8%	1.2%	1%	27%
WEAPON - 155mm Gun, M1									
Fuze									
2-8 Jul	106	29	21,807	58%	17,700	97%	3%	99%	1%
9-15 Jul	108	32	24,049	64%	20,900	97%	3%	98%	2%
WEAPON - 155mm Gun, M12									
2-8 Jul	31	19	4,087	26%	4,600	97%	3%	98.5%	1.5%
9-15 Jul	36	25	6,755	50%	6,200	96.4%	3.6%	98.8%	1.2%
WEAPON - 4.5" Gun									
2-8 Jul	36	29	7,404	39%	7,700	100%	-	46%	53%
9-15 Jul	36	33	8,371	44%	8,700	100%	-	52%	48%
WEAPON - 8" How									
Fuze Charge									
HE M51 M67 M1 M2									
2-8 Jul	36	15	3,758	30%	5,100	100%	98%	2%	26%
9-15 Jul	36	20	5,256	40%	5,600	100%	97%	3%	22%
WEAPON - 8" Gun									
Fuze Charge									
HE M51 M67 M9 M10									
2-8 Jul	6	21	753	60%	500	100%	94%	6%	27%
9-15 Jul	6	10	424	28%	610	100%	93%	7%	41%
WEAPON - 240mm How									
HE M51 M67									
2-8 Jul	12	16	1,310	64%	1,140	100%	100%	-	-
9-15 Jul	12	5	406	20%	1,190	100%	100%	-	-

\* Column now headed "average guns on continent" was headed "average guns in action." The "average guns in action" reported above is exactly equal to the "average guns on continent" as derived from First Army's reported build-up of artillery weapons.<sup>22</sup>

CHAPTER 4

ARTILLERY AMMUNITION SUPPLY

1 AUGUST - 9 OCTOBER 1944

SECTION 1

12TH ARMY GROUP SUPPLY PICTURE<sup>36,39,40</sup>

25. State of Supply. On 1 August, 1944, First Army relinquished command control of ammunition to 12th Army Group and control of rear area supply installations to Communication Zone. The fast-developing headlong pursuit operations with the attendant lengthening supply lines soon resulted in dwindling supplies to the guns and, almost as serious, a complete lack of exact information either as to the existing status of supply or as to the probable status in the immediate future.

26. Rationing. 12th Army Group rationed artillery ammunition by prescribing limitations on expenditures.

These limitations on expenditures had little meaning after the second week in August. Although 12th Army Group continued to restrict expenditures based on continental availability as reported by Communications Zone, the amount of ammunition available to the armies and, therefore, the ammunition expenditures were governed almost entirely by transportation. During the month of August the rapidity of movement and the paucity of targets so reduced expenditures that the small amount of ammunition moved forward was sufficient. In September, the stiffening opposition resulted in increased expenditures which in turn resulted in ammunition shortages.

## SECTION 2

### AMMUNITION SUPPLY TO THE ARMIES

27. First Army Supply, August 1944.<sup>39</sup> Extracts from the Ammunition Supply Report, France, 1 - 31 August 1944, prepared by the First Army Ordnance Ammunition Officer for the Ordnance Officer present a picture of First Army's supply.

"Small Arms and mortar and light and medium Field Artillery ammunition comprised the major part of the month's expenditures. After the destruction of the Seventh Army (German), the Army Group Commander directed that 240mm howitzer, 8-inch gun, and 8-inch howitzer would be withdrawn from action until such time as the Germans could offer sufficient resistance to require their use. The withdrawal of these units from action made available to the Army Ordnance Officer a considerable number of Field Artillery vehicles and personnel as truck companies."

"It was necessary to exploit every conceivable resource in Army in order to keep even minimum stocks on hand. The supporting agencies of Communications Zone were entirely unpredictable in their delivery of supplies and in general delivered 30% of First Army's requirements."

"During the month, all necessary ammunition in replacement of expenditures was made available to the troops. The Army stock level was reduced from 157,000 tons to 12,000 tons.

"As of the end of the period it appears that an Army level of about 12,000 tons will be sufficient until organized resistance is again met."

28. Third Army Supply, August 1944.<sup>36</sup> Extracts from the Third Army Artillery Section After Action Report present a clear picture of Third Army's artillery ammunition supply for this period. (VIII Corps, which was involved in siege operations, is not considered).

"6 August. Artillery ammunition was rationed to the Army by 12th Army Group. The Army however did not consider it necessary or desirable to impose rationing upon the several corps because of the light expenditures in the mobile situation and because it was desirable to assist the rapid advance by unrestricted ammunition expenditure when support was needed.

"Throughout the period (August) despite the distances involved, basic ammunition loads could be maintained so that at no time was there any real shortage of artillery ammunition to hamper the conduct of the operation. This was made possible partly by the relative lightness of ammunition expenditures as a whole, partly by the untiring efforts of the artillery supply elements and of Ordnance."

29. First Army Supply, September 1944<sup>40</sup> is summarized by the Ammunition Officer, First Army: "First Army and the entire 12th Army Group, having moved more than 400 miles without stopping, was not properly prepared with reserve supplies to mount a full-scale coordinated attack upon reaching the Siegfried Line at any time during September. Because of the tremendous drain on transportation facilities over the extended distance from the supply base, it was not possible to bring sufficient supplies forward fast enough to continue the large scale offensive." In the last half of September dwindling supply from the Communications Zone began to affect First Army severely. To again quote the First Army Ammunition Officer: "After First Army turned over the responsibility for operation and stock control of the rear Continental areas to Communications Zone on 1 August, the Army Ordnance Officer was not provided with a constant flow of information as to availability of ammunition stocks in the rear. Obviously there were many complicating factors in the rear areas because of the widespread nature of the operations being supported which militated against proper stock accounting in the rear. However, the condition was so bad that starting at mid-month and growing continually worse, requisitions by Army against Communications Zone for fast-moving artillery items of ammunition were zeroed at Communications Zone. It was not until these requisitions were disapproved that the Army Commander was able to determine probable future availability. In short, it was not until the stocks were zero that the Army Commander was provided with stock information."

For the first 21 days of September First Army did not ration ammunition. However, as the front solidified, expenditures rose and started to pass receipts. First Army promptly imposed a ration which was more stringent than the 12th Army Group ration: First Army knew that the Communications Zone was not physically delivering the ammunition which Communications Zone reported to 12th Army Group as available to the Army Group.

30. Third Army Supply, September 1944<sup>36</sup> Third Army's problems paralleled First Army's. The following quotations from the Third Army Artillery Section show the trend from fast movement and low expenditure to slow movement, large expenditures, and ammunition shortages.

"6 September. Ammunition shortages became increasingly critical. The Ammunition Supply Point in support of XX Corps had a fair supply with the exception of 4.5-inch Gun ammunition and all types of fuzes, especially T105. However, the Ammunition Supply Point in support of XII Corps was virtually devoid of all types of artillery ammunition and fuzes.

"10 September. Ammunition supply continued to be critically short, especially in rear of XII Corps.

"11 September. The ammunition situation continued

critical but large incoming shipments due to arrive within two days were expected to relieve the situation.

"16 September. The general artillery ammunition supply situation, with the exception of 4.5-inch Gun ammunition and T105 fuzes, was more satisfactory than it had been for some time as a result of incoming shipments. That the shortage had been maintained at the critical level and had never become dangerous could be attributed only to the continued close supervision of expenditures by all artillery commanders and to the diligent and unceasing efforts of Army and subordinate ordnance echelons.

"Throughout the period (September) the fullest exploitation of our artillery was unquestionably seriously hampered by the prolonged scarcity of ammunition. However, close and constant supervision of expenditures by all commanders insured that the maximum benefit was realized in relation to ammunition expended."

31. Ammunition Supply for the Siege of Brest.<sup>41</sup> In mid-August, as the rest of 12th Army Group streamed eastward, VIII Corps moved westward to clear the Brittany Peninsula; the major operation involved was the capture of Brest (V99). The need for another major port gave this operation top priority in the Army Group. VIII Corps functioned first under Third Army, then under 12th Army Group, finally under the newly operational Ninth Army. The supply problem was, at best, difficult; the supply of an artillery-heavy corps which had moved 130 airline miles at right angles to the main supply lines at a time when those supply lines already stretched several hundred miles. Command or staff liaison was difficult: on 25 August, the day of the initial attack on Brest, the airline distance between the Command Posts of VIII Corps and Third Army was more than 300 miles, between VIII Corps and 12th Army Group, over 160 miles. For the operation VIII Corps originally requested that a reserve of three units of fire be maintained until the operation was completed. "This plan was disapproved and a plan covering a definite period was required. A request for a 10-day period was submitted and called for the following amounts of ammunition:

	<u>Rounds</u>
105mm How M2	223,000
155mm How	64,300
155mm Gun M1	19,200
155mm Gun M12	9,600
4.5 inch Gun	14,400
8 inch How	6,000
240mm How	1,500
3 inch Gun	2,100"

Ammunition supply to VIII Corps was unpredictable, erratic and, at times inadequate. The gravity of the situation four days after the initial attack on Brest can be judged by this extract from a 12th Army Group letter, 29 August 1944 to the Commanding General, Communications Zone:<sup>42</sup>

"It is desired that you take the necessary action to ship to VIII Corps by the fastest means available and as quickly as possible, the reserve ammunition shown in column 1 of the inclosure. Further it is desired that the

Flow of the daily maintenance begin at once. Transportation to take care of this requirement has priority over a like amount of transportation for any other destination."

The need throughout the operation was speed: speed in initial planning, speed in emergency remedial action to overcome unforeseen deficiencies. The need for speed was a major handicap when it was imposed on a rapidly expanding, heavily burdened supply system. In view of the supply difficulties it is not surprising that the Commanding General VIII Corps Artillery reported, "The activity of the Corps Artillery between 29 August and 7 September was considerably curtailed by a shortage of ammunition"; or that he further reported, "The ammunition expenditure figures do not give a true picture as to the requirements needed per day. Due to an insufficient supply in the Ammunition Supply Point a severe rationing policy was necessary." VIII Corps expenditures for the siege of Brest were:

<u>Weapon</u>	<u>Number of Guns</u>	<u>Rounds per Gun per Day</u>	<u>Total Rounds</u>
105mm How M2	133	78	270,493
155mm How M1	84	43	91,547
155mm Gun M1	24	31	18,613
155mm Gun M12	24	15	9,955
4.5 inch Gun	24	25	14,861
3 inch Howitzer	24	19	11,528
240mm Howitzer	12	11	3,153
8 inch Gun	12	6	1,608

The "Report on the Artillery with the VIII Corps in the Reduction of Brest" makes the following summary on ammunition:

#### "Ammunition.

"Daily expenditure of ammunition of heavier calibers is large and must be provided for in the original ammunition plans.

"The ammunition supply agency must approve the plan and be able to carry it out. A balanced supply of all types and calibers, as well as balanced rounds, must be available. At one time there was a difference of 16,000 rounds between projectiles and powder charges for the 155mm howitzer in the Ammunition Supply Point.

"This operation was definitely handicapped by an inadequate supply of ammunition. There were times when the Ammunition Supply Point was out of many types and calibers. Balanced rounds were not brought into the Ammunition Supply Point so that plans for expenditure of ammunition could not be made in advance.

"There is a need for an illuminating shell in an operation of this nature where hostile troops use naval craft for shifting their forces or for evacuation. These ships move at night and cannot be taken under fire effectively unless some form of illumination is provided for the artillery.

"A great shortage of white phosphorus smoke shell definitely affected the operation. This ammunition is very



effective in attacking casemates and pillboxes and the enemy fear its use.

"The T-105 fuze is very effective in destroying concrete providing it is properly used. The using personnel must be thoroughly familiar with the necessity for a high terminal velocity, which can be obtained only by the use of the higher charges. Ranges must be such that the proper terminal velocity is obtained.

"The unit of fire is too small."

While the ammunition available at Brest was less than desirable, the amount used was a severe drain on theater artillery ammunition stocks particularly in the heavier calibers. A comparison of expenditures and availability shows this:

	Expended at Brest 22 Aug- 19 Sep	Expended <sup>15</sup> by First and Third Armies 22 Aug-19 Sep	Total remaining* on continent 19 Sep or to be landed by 30 Sep
3-inch How	11,523	11,211	17,800
3-inch Gun	1,608	0	4,600
240mm How	3,153	3,100	7,400

\*These figures are derived from statements in the following:

Letter, 12th Army Group to Commanding General, Communications Zone (Forward), dated 16 September 1944, subject: "Items of Ammunition in Critical Short Supply."<sup>44</sup>

Artillery Expenditure Records, First, Third, and Ninth Armies.<sup>15</sup>

Carrier Sheet, 12th Army Group from Artillery to G-3, G-4,<sup>45</sup> Ordnance, dated 8 September 1944, subject: "Recommended Ammunition Allocation for the Period 110600 September to 190600 September 1944."

32. Ammunition Supply 6th Army Group. Although the initial ammunition supply of 6th Army Group was not a responsibility of the European Theater of Operations, it is interesting to note how closely its troubles paralleled those of 12th Army Group.

In a letter dated 17 September 1944 to the Artillery Officer, 12th Army Group, the Artillery Officer Seventh Army said, "Thus far this has been a G-4 war with little use of any artillery except divisional but we may be coming up against something harder soon. If so, we are going to be in a hell of a fix for ammunition."<sup>46</sup> This was an exact summation of the situation. In a report on ammunition supply from 15 August 1944 to 30 September 1944, 6th Army Group states:<sup>47</sup>

\* \* \* \* \*

"The amount of ammunition planned for the early phases of the operation were adequate.

"The rapid advance of the troops inland made a difficult transportation problem and the troops did not receive all of the ammunition that they might have used.

"During the latter half of September, resistance stiffened, causing an increased demand for artillery ammunition, so that the tonnage of ammunition reaching the front line units was barely sufficient to support the pressure it was desired to maintain against the enemy. No ammunition tonnage was available to create stocks in the forward areas, other than small Ammunition Supply Points."

\* \* \* \* \*

6th Army Group, like 12th Army Group, faced a mammoth transportation problem due to extended supply lines; fortunately, the 6th Army Group problem was not as greatly aggravated by limitations of port and beach discharge.

## CHAPTER 5

### ARTILLERY AMMUNITION SUPPLY

10 OCTOBER - 31 DECEMBER 1944

#### SECTION 1

#### AMMUNITION CRISIS 10 OCTOBER 1944

33. State of Supply 12th Army Group. By 9 October 1944 resupply of artillery ammunition to 12th Army Group had reached a state of almost complete collapse. A conference was held attended by the ammunition officers of First, Third, and Ninth Armies, representatives of G3, G4, Ordnance, and Artillery 12th Army Group, a representative of Communications Zone, and a representative of Headquarters European Theater of Operations. The results of the conference are summed in a 12th Army Group carrier sheet from the Artillery Section to G-3, dated 10 October 1944.<sup>48</sup>

"Ammunition availability figures presented by Communications Zone as a basis for the next allocations have been drastically reduced as compared to those submitted eight days ago. (This has occurred previously, see Inclosure #1.) Ordnance Communications Zone representative explains this in part by the failure to unload six ammunition ships which were assumed to be unloading at the last ammunition meeting.

"As previously predicted on several occasions \* \* \* \* ammunition stocks on the continent are rapidly approaching exhaustion \* \* \* \*. This is in spite of the fact that expenditures have been far less than we had any right to expect and far less than was predicted for this period. With expenditures which could have reasonably been expected, the present situation would have arisen fully a month ago. It has reached a crisis now due to two things:

1. Failure to unload ships as planned. (Ordnance Communications Zone representative states that six ships were withdrawn from berths in order to unload troops on orders from higher headquarters)

2. Authorization to First Army to accumulate five units of fire reserve.

"Ammunition stocks on the continent have now become so depleted as to dictate the following procedure:

1. Cancel all allocations and redistribute remaining ammunition to the armies in accordance with the tactical situation. This will entail transferring ammunition from the First Army in some cases because the authorization to the First Army to accumulate five units of fire has served to draw most of the remaining ammunition into that area.

2. Make the best possible estimate of the time it will take for ammunition ships off shore to be unloaded and processed to the armies. Advise the armies that the stocks allocated in a above must be made to last until this critical date, which according to Ordnance Communications Zone representative will be about 7 November. Note that this date does not provide for anything but filling the pipeline to the army depots. It does not provide for unloading, classifying, and moving the ammunition from the army depots to the guns; it does not provide for the accumulation of any reserves in Communications Zone or armies. It is therefore probable that major offensive operations could not be effectively resumed from the ammunition supply standpoint until sometime after 7 November.

"It is therefore recommended:

1. That Communications Zone be immediately directed to unload a minimum of 12 ammunition ships daily until further orders.

2. That all ammunition on the continent be redistributed\* \* \* \* \* advising the armies that no resupply is in sight prior to 7 November.

3. That a credit system as prescribed in Paragraph 72, Field Manual 100-10, be instituted at the earliest practicable date. \* \* \* \* \*

Inclosure #1 was:

"The following figures show the ammunition available to 12th Army Group for the periods indicated. These figures are based on statements by Communications Zone to the Army Group Ordnance. The vast variations in the numbers are not caused by expenditures but by the absolute unreliability of ammunition availability figures furnished by Communications Zone.

	11 Sep to 19 Sep	19 Sep to 27 Sep	27 Sep to 5 Oct	5 Oct to 13 Oct	13 Oct to 21 Oct
61mm Mortar Lt	655,000	256,002	298,000	477,000	120,000
105mm How M2	2,222,000	1,302,000	1,462,000	1,388,000	564,000
155mm How	213,000	231,000	200,000	262,000	92,000
155mm Gun	144,000	122,000	89,000	117,000	21,000"

34. Basic Reasons for the 12th Army Group Ammunition Crisis were Failure to discharge sufficient critical Class V supplies on the continent and inability to move sufficient tonnages of the critical items into forward areas available to armies. Graphically these failure are pictured below.

ORDNANCE GROUND FORCE AMMUNITION TONNAGE DISCHARGE<sup>49</sup>

NORTHERN, FRANCE

(Total for all Ports and Beaches)

Weekly Discharge

LONG TONS

70,000  
60,000  
50,000  
40,000  
30,000  
20,000  
10,000

10 17 24 1 8 15 22 29 5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 2 9 16 23 30  
June July Aug Sep Oct Nov Dec

TONNAGE OF GROUND FORCE AMMUNITION<sup>50</sup>

In forward Depots and Army Stocks  
NORTHERN, FRANCE

LONG TONS

240,000  
222,000  
200,000  
180,000  
160,000  
140,000  
120,000  
100,000  
80,000  
60,000  
40,000  
20,000

1 8 15 22 27 6 12 20 26 3 8 17 24 1 8 15 21 27  
Sep\* Oct Nov Dec

\*Ninth Army at Brest not included.

35. Corrective Action was prompt, drastic and effective. First step on 11 October was to issue a new retro-active restriction on expenditures to extend from 050600 October to 070600 November.<sup>51</sup> The ammunition considered available for this allocation was only that actually in field force depots, in transit, and the unobligated balances in

the Communications Zone depots. The purpose of this step was to prevent the immediate dissipation of the extremely meager ammunition stocks. The result was the most stringent rationing ever enforced on our troops. The second step was a commitment by Communications Zone (and fulfillment of the commitment) to unload on the continent an average of 6000 tons of ammunition a day.<sup>52</sup> The third step was an arrangement to move ammunition to forward depots at an accelerated rate.<sup>53</sup> The fourth step was institution of a credit system under which no ammunition was issued to armies without a previous credit allocation from 12th Army Group.<sup>54</sup> This, with its attendant bookkeeping, gave 12th Army Group at all times reliable up-to-date information as to the status of ammunition. The fifth step was for the Army Group to allocate only that ammunition which was in forward depots (O-609 Soissons (S89), O-610 Liege (K42), O-611 Verdun (U26)) or which was practically certain to arrive in forward depots during the allocation period. This guaranteed that allocations were based on ammunition and not wishful thinking. As a last step 12th Army Group began (6 November) to forecast to each army the probable supply of critical items of ammunition to that army in the following thirty days.<sup>55</sup> These forecasts, revised each ten days, gave armies some chance to plan. The system as instituted did not guarantee adequate ammunition; it did guarantee that what ammunition was available could be made available to the guns and it did guarantee to the armies some information as to the future of their ammunition supply.

36. Tactical Effect of the Crisis.<sup>56</sup> The scarcity of ammunition made it imperative that 12th Army Group cease large scale offensive action. However, available ammunition was so distributed that certain offensive actions could continue. Inasmuch as the corps involved in these offensives were in First and Ninth Armies the available ammunition was allocated approximately First Army 60%, Ninth Army 25%, Third 15%. The shortage, naturally, was most severe in Third Army. The table below is an eloquent testimonial to the rationing employed by that army.

AMMUNITION EXPENDITURES  
October  
(Total Rounds)

	XII Corps		XX Corps	
	010600 to 080600	150600 to 220600	010600 to 080600	150600 to 220600
105mm How	35951	2325	56062	576
4.5-inch Gun	2241	172	3265	0
155mm How	6031	512	10717	41
155mm Gun M1	3584	178	1168	472
155mm Gun ML2	--	--	1691	315
8-inch How	1311	212	1060	179
8-inch Guns	--	24	153	42
240mm How	163	27	543	8

The price of such stringent rationing is shown clearly in the After Action Report of the Artillery Section, Third Army. 36

"12 October. Orders were received from 12th Army Group severely restricting the ration of all field artillery ammunition through 7 November. The reduction was so sharp that both corps were found already to have expended virtually all ammunition of all calibers for the entire period.

"15 October. Artillery commanders of all echelons strained every resource to conserve ammunition and at the same time attack and destroy otherwise lucrative targets.

"XXI Corps Artillery issued a directive limiting the use of field artillery ammunition to fire on such counter-attacks as endangered the battle position of the supported unit, to counterbattery on active enemy batteries and to observed fires on especially profitable targets. Plans were made to employ tank destroyers, tanks and heavy anti-aircraft artillery, the ammunition for none of which was rationed, as artillery together with captured weapons and ammunition. Interdiction, harassing and searching fires were to be confined to these secondary weapons.

"19 October. Our field artillery confined its fire to registration. Effective results were obtained with the secondary weapons being employed as artillery.

"XXI Corps Artillery fired a time-on-target mission upon an enemy troop concentration at Amanvilliers (U7664) which, from the variety of weapons used, reflected the strenuous attempts of artillery commanders to deliver effective fires despite the strict limitation of ammunition expenditures. This mission was fired by tank destroyers, tanks, 105mm gun-howitzers (German), 76.2mm guns (Russian), 88mm guns, captured 155mm Schneider howitzers, 90mm anti-aircraft guns and 155mm guns (M1)."

37. 6th Army Group Supply October 1944 never reached the same acutely critical stage as was reached by 12th Army Group. However, 6th Army Group was forced to use October as a saving period in preparation for its planned November offensive. 6th Army Group states:

\*\*\*\*\*

"During October the transportation capacity increased and constant pressure was placed on ammunition movement in order to provide the required build-up of ammunition for the offensive to be launched in mid-November. The rate at which the necessary ammunition could be accumulated in the forward areas determined the date when this major coordinated attack could be launched. Although constant pressure against the German Forces was being maintained, expenditures were held to the minimum during this period in order to expedite the ammunition build-up.

"During this period the Army Group held no true reserve of ammunition forward of Base Depots. Some small quantities of ammunition were not allocated, but these were regarded as hedges against inaccuracies in availability

figures. The creation of an Army Group Reserve at this time was impracticable because:

1. All available tonnage out of Southern Ports was allocated to the Armies to build up supplies for current and immediate future needs.

2. Armies were being supplied out of the Southern Ports and no Communication Zone Section stocks had yet been built up in the forward areas. No tonnage could yet be spared for building such forward dumps.

3. Any reserve held by the Army Group could only have been held in the Southern Ports and with a rail travel time of 7 - 10 days to the Armies it would have been unwieldy to segregate an Army Group Reserve.

4. A backlog of unloaded ammunition ships at this time, in effect, provided a reserve."

\*\*\*\*\*

## SECTION 2

### AMMUNITION EXPENDITURES NOVEMBER-DECEMBER 1944

38. Availability 12th Army Group. Although by the time of the largescale November attacks (Third Army 3 November, First and Ninth Armies 16 November) all armies had 5 units of fire reserve for most major items, and although resupply was better than at any time since Normandy, the daily maintenance received by armies still limited their expenditures. The First Army Ordnance Ammunition Officer reported:<sup>57</sup> "Until 16 November, ration to the Corps was meager. During the latter half of the month, availability was sufficient to allow VII Corps, while on the attack, to fire a reasonable amount of nearly all items. At the same time, however, ammunition available to V and VIII Corps was inadequate." The Artillery Section, Third Army, reported:<sup>36</sup> "Ammunition expenditures for the week ending at 120600", (November) "embracing only four days of the XII Corps attack and three days of the XX Corps attack, amply reflected the heavy fighting in both Corps but were indicative only of ammunition availability." As of 19 November, Artillery Section, Third Army, reported: "In the seven-day period ending at 0600, artillery with both XII and XX Corps did its most active firing since the two corps were committed in August. Nevertheless artillery ammunition was still not available in the amounts required by the operation. Expenditures therefore reflect not so much the requirements of the weeks fighting but rather the availability of ammunition." The rates at which Third Army was firing the week ending 190600 November were:

<u>Weapon</u>	<u>Rounds per gun in army per day</u>
105mm How M2	45.5
4.5-inch Gun	53.3
155mm How M1	26.8
155mm Gun M1	39.8

<u>Weapon</u>	<u>Rounds per gun in army per day</u>
155mm Gun M12	4.8
8-inch How	18.6
8-inch Gun	4.8
240mm How	3.8

39. Expenditures and Availability 12th Army Group, November. The effect of availability on expenditures can be judged by comparing the amounts of ammunition forecast to armies with the amounts actually expended.

Total forecast to Armies by 12th Army Group (less amounts definitely not credited) 7 November - 30 November 1944 <sup>58</sup>	12th Army Group Ex- penditures 7 November- 30 November 1944 <sup>15</sup>
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105mm How M2	1,154,000	1,157,000
4.5-inch Gun	34,000	89,000
155mm How M1	425,000*	259,000
155mm Gun M1 & M2	103,000	96,000
8-inch How	26,000	37,000
8-inch Gun	170**	2,500
240mm How	3,400**	6,100

\*Of this amount over half (245,000 rounds) was to be available sometime during the period 200600 - 300600 November. The late crediting of such a high proportion probably explains the low expenditures for the 155mm howitzer.

\*\*From 200600 November to 300600 November, as a result of early delivery of ammunition forecasted for December, Armies actually were credited with 1660 rounds for the 8-inch Gun and 2415 rounds for the 240mm howitzer over and above those shown above.

40. Trend of Expenditures 12th Army Group.<sup>15</sup> Expenditures in Ninth Army reached a peak in the week ending 25 November 1944 then dropped abruptly as that army closed on the Roer River. Ninth Army's resupply was cut severely during the last half of December in order to increase resupply to First and Third Armies.<sup>59</sup> Third Army's expenditures, which were relatively high the week ending 190600 November, dropped slightly as that army turned north toward the "Bulge". (Expenditures of 155mm howitzer ammunition were notable exception. Apparently due to increased availability they were higher throughout December than they had been in November). The drop in Third Army's expenditures during the latter half of December was undoubtedly due to the wholesale movement of artillery units and to the complete reorientation of supply lines. First Army's expenditures which had reached an interim high the week ending 190600 November increased greatly as that army entered the



Battle of the "Bulge". This was notably true of the lighter calibres--those used to the greatest extent in the highly fluid situation. First Army, itself, did not restrict expenditures during the period 17 - 31 December. However, lower echelon supply problems did not permit absolutely unrestricted expenditures. The Ordnance Ammunition Officer First Army reported: "During this period when no control was exercised by army, expenditures for the 105mm howitzer M2 were 66 rds/gun/day; the 155mm howitzer 43 rds/gun/day; these conservative expenditures indicating that supply discipline is being maintained by Corps and Divisions." 60

#### 41. Availability 6th Army Group. 47

"At the beginning of this period ammunition had been built up in forward areas permitting the launching of the coordinated offensive planned for mid-November. To start this battle, ammunition as follows, per piece, was available to the Armies:

<u>Type</u>	<u>Rounds Per Piece</u> <u>7th Army</u>	<u>Rounds Per Piece</u> <u>1st French Army</u>
105mm How	1526	1179
155mm How	585	848
155mm Gun	820	510
8-inch How	428	715

All of this ammunition had not yet reached the forward area but it was now possible to move the balance forward by the time it would be required.

"It is well to note at this point that up until the receipt of the paraphrase of AGWAR Message WX 58633 all ammunition expenditure planning had been on the assumption that the War Department was capable of supporting the operation with a War Department approved Mediterranean Theater of Operations Day of Supply per weapon.

"On 11 November a paraphrase of AGWAR Message WX 58633 was received. This message indicated that beginning in January the ammunition support available from the War Department would be considerably less than the European Theater of Operations or the Mediterranean Theater of Operations day of supply, particularly in the 105mm howitzer and the 155mm howitzer, which constitute the bulk of the artillery support. This message was received first with incredulity and then with amazement. The Armies under 6th Army Group had just been reinforced and were now fully deployed prepared to strike powerful blows at the enemy. The available resupply predicted for the first four months of 1945 as compared to the European Theater of Operations and Mediterranean Theater of Operations days of supply is tabulated as follows:

<u>Type</u>	<u>ETO day</u> <u>of Supply</u>	<u>MTO day</u> <u>of Supply</u>	<u>Resupply potential</u> <u>average 1 Jan to</u> <u>30 April</u>
105mm How	40	50	18

<u>Type</u>	<u>ETO day of Supply</u>	<u>MTO day of Supply</u>	<u>Resupply potential average 1 Jan to 30 April</u>
155mm How	25	35	15
155mm Gun	25	30	15
8-inch How	20	25	13
240mm How	7	15	5.5 11.0*
8-inch Gun	15	15	14

\*5.5 for January, February, 11.0 March, April.

It can be seen from the above that the possible artillery support would be greatly reduced under these resupply rates. Reduction amounting to 64% for the 105mm howitzer, 57% for the 155mm howitzer, and 50% for the 155mm gun. The effect of these drastic reductions in expected ammunition supply had a tremendous effect on the planning of operations."

#### 42. Expenditures 6th Army Group.<sup>47</sup>

"6th Army Group launched its major offensive on 13 November 1944 when Seventh Army began the attack. Expenditures reached a high level throughout Seventh Army for 3 to 5 days. After the line was broken and the exploitation initiated, expenditures dropped considerably. The Artillery Officer of Seventh Army exercised rigid control over artillery ammunition within the Army because it was anticipated that the fight and pursuit would continue, and that, upon reaching the Siegfried Line and the Rhine, artillery ammunition in large quantities would be required to permit immediate attack to overcome these obstacles.

"In the First French Army, which started its attack on 14 November 1944, expenditures immediately reached a high scale and continued at a very high rate several days after the progress of the troops had stopped. Lavish expenditure on the part of First French Army continued unabated until 21 November 1944 and then it slackened only slightly. At this point it became necessary to inform the Commanding General First French Army that all available ammunition that could be supplied to it for current operations had been made available, and that it was not possible to support continuously such expenditures. By 28 November 1944, it became necessary to furnish some additional ammunition to the First French Army from the meager reserves held by 6th Army Group. It also was necessary to make considerable quantities of ammunition available to First French Army that constituted part of the December supply. Henceforth until 31 December 1944 artillery ammunition was allocated to the First French Army for specific operations only in order to prevent excessive consumption from destroying the offensive power of the Army Group as a whole."

The highest average expenditure rates ever attained by 6th Army Group were those for the allocation period 11

November - 20 November 1944. The average expenditures during this period were approximately:

<u>Weapon</u>	<u>Rounds per weapon per day</u>	<u>Number of Weapons</u>
105mm How	49	64.8
4.5-inch Gun	49	36
155mm How	27	372
155mm Gun	22	132
8-inch How	14	60
8-inch Gun*	3.5	4
240mm How	10.2	6

\*Weapon first employed this period. Maximum reached in erasing the Colmar pocket, 1 February to 10 February 1945, 10.6 rounds per gun per day for four guns.

"Analysis of the ammunition position of the Army Group as of 10 December revealed that, provided First French Army was placed in a defensive role along the Rhine, sufficient light and medium artillery ammunition would be available to support a continuance of the Seventh Army's penetration of the Siegfried Line and the crossing of the Rhine and a move toward Kassel (C20). For the heavy artillery the desired quantities of ammunition would not be available, and under the predicted resupply rates would never be available, consequently any operations undertaken must accept the handicap of restricted heavy artillery support!"

By 16 December, Seventh Army was making excellent progress through the Siegfried Line. "The artillery ammunition available to Seventh Army was sufficient to continue the penetration, close to the Rhine, cross, and defend a bridgehead." When, as a result of the German Ardennes offensive, Seventh Army took over two corps sectors from Third Army, the Seventh Army offensive was necessarily shelved temporarily. "The First French Army had reached the Rhine except for the Colmar pocket".

From 16 December to 31 December 1944 the 6th Army Group was saving ammunition in anticipation of a resumption of its offensive.

### SECTION 3

#### THEATER AMMUNITION SHORTAGES

43. Reason for the Shortages. As was noted previously, ammunition shortages at the front prior to November were caused by inability to unload ammunition on the continent and by inability to transport ammunition from rear areas to the using troops. On 2 October 1944 there were "afloat en-route from the New York Port, off the United Kingdom, and off beaches, 201,000 tons of ammunition." <sup>61</sup>The unloading schedule instituted in October rapidly ate into this back-

log. The amount unloaded in the latter part of October was in excess of the amount received by the theater in the same period. Inasmuch as the unloading schedule was geared to the requirements of the tactical commands this meant that shortages would occur due to non-availability in the theater. 62

44. Corrective Action. The Commanding General, European Theater of Operations, took vigorous action to state to the War Department the exact nature and the degree of the ammunition shortage. Such action included the return to the United States of Major General H. R. Bull, the Assistant Chief of Staff G-3 of Supreme Headquarters Allied Expeditionary Force. General Bull reported on this liaison visit in a memorandum dated 3 December 1944 of which this is an extract: 63

"Immediately after our arrival in the United States the supply situation in critical ammunition items was explained orally in general terms directly to the Chief of Staff.

"It was then presented in detail to the Commanding General, Army Service Forces, who placed his staff and the staff of the Chief of Ordnance at work to determine how the supply could be augmented. The figures from the Theater were reconciled with War Department figures and full agreement was reached with respect to supplies on hand en-route. The Army Service Forces and the Ordnance Department found some additional ammunition which through rapid reconditioning could be made available without delay. They also ascertained that a speed-up in delivery time, with a consequent shrinkage of the pipeline, would result immediately in an augmented flow to the Theater. While this requires special handling for all ammunition, it is believed feasible of accomplishment.

"In addition, steps were taken to increase production which developed substantial increases in 105mm ammunition during the months of December and January. These increases are to be accomplished through a final all-out assembly effort which will utilize all components on hand, even though it may result in some unbalance in production lines. It is believed that the War Department has made every effort within its power to make available additional ammunition and that the increases which have been obtained represent the ultimate at this time. The augmented supply was obtained without diversion from other theaters, and such diversion would have added comparatively small quantities to the European Theater of Operations at the expense of operations elsewhere.

"Predictions can not be made with respect to deliveries after 1 May, as strong measures are underway to bring in facilities now under construction at the earliest possible date and to provide further facilities. It is believed, therefore, that the production figures from 1 May on will be substantially better than previously indicated. Estimates as to production beyond 1 May will be provided by the War Department as soon as these estimates have been revised to record the effects of the present production drive."

45. Ammunition Substitutions. One method of meeting ammunition shortages deserves special notice; the substitution of non-standard types of ammunition for non-available standard types. This substitution had started in August and received added impetus during the fall of 1944. Among the substitute items furnished the theater were: 15

<u>Weapon</u>	<u>Standard Item</u>	<u>Substitute Item</u>
155mm How M1	HE M107	HE M1A1
		HE M102
155mm Gun	MPM105	MP M1A1
		HE M101
8-inch How	HE M106	HE M1A1 (a round originally designed for the model 1888 8-inch gun)
		HE M103
8-inch Gun	HE M103	HE M Series
		AP M103

These projectiles were better than nothing. They reduced ranges, increased dispersion and decreased casualty effect. Particularly undesirable was the 8-inch howitzer High-explosive Shell M1A1 which practically changed an accurate artillery piece into an area fire weapon.

46. Theater Ammunition Position 31 December 1944.<sup>64</sup> By 31 December 1944 it was obvious that production in the Zone of Interior was insufficient to meet requirements as stated by the tactical commands. 12th Army Group, 16 December 1944, had stated its requirements in terms of a "long range maintenance rate of supply" which if maintained for a period of not less than six months would meet the maintenance (but not reserve) requirements of 12th Army Group. We can judge the state of supply, 31 December 1944, by comparing this rate with the actual maintenance rate of supply at which Headquarters European Theater of Operations told Army Groups ammunition would be available to them during the period 1 January to 1 May 1945

<u>Weapon</u>	<u>Type of ammunition</u>	<u>Theater Maintenance Rate* 1 Jan-1 May 1945. Rounds per gun per day.</u>	<u>12th Army Group Desired Maintenance Day of Supply 16 Dec. 1944. Rounds per gun per day</u>
3-inch Gun	HE NC	8.90	5.00
	HE RC	3.30	2.50
	APC	6.80	2.00
	WP	-	0.50
76mm Gun	HE NC RC	8.30	7.00

Weapon	Type of ammunition	Theater Main-	12th Army Group
		tenance Rate* 1 Jan-1 May 1945, Rounds per gun per day.	Desired Mainte- nance Day of Sup- 16 Dec 1944. Rounds per gun per day.
76mm Gun	APC	5.10	2.00
	WP	-	1.00
90mm Gun T&AT	HE HC RC	15.80	9.00
	AT APC	6.80	2.40
	WP	-	.60
105mm How M2	HE	26.00	40.05
	WP	1.10	3.15
	HC	1.70	0.90
	HEAT	0.80	0.09
4.5-inch Gun	HE	17.20	26.60
	WP	-	1.40
155mm How M1913M1	HE	19.50	30.03
	WP	2.70	1.98
	HC	1.00	0.66
155mm Gun M1913M1	HE	13.00	23.25
	WP	0.20	1.25
	HC	0.10	0.50
8-inch How	HE	5.50	25.00
8-inch Gun	HE	11.90	10.00
240mm How	HE	4.50	15.00

For most major types availability was one third to two thirds of stated requirements. Lack of production in the Zone of the Interior made continued ammunition rationing inevitable.

\*Usually referred to in correspondence as "the SHAEF rate" or "the SHAEF maintenance rate".

## CHAPTER 6

### ARTILLERY AMMUNITION SUPPLY

1 JANUARY - 9 MAY 1945

SECTION 1

AMMUNITION EXPENDITURES 1 JANUARY - 9 MAY 1945

47. Allocation of Supplies - 12th Army Group.<sup>65</sup> As has been shown, shipments to the theater were insufficient to meet requirements of either army group. 12th Army Group created artificial shortages along part of the front in order to improve the supply of units engaged in major offensive actions.

An outline of 12th Army Group's allocations follows:

<u>PERIOD</u>	<u>Average Percentage of incoming ammunition allocated to Army</u>			<u>Remarks</u>
	<u>First</u>	<u>Third</u>	<u>Ninth</u>	
300600-Dec-300600 Jan	46.7	43.3	10.0	First and Third Armies counter-offensive on the Ardennes. Ninth preparing for Roer crossing.
300600 Jan-190600 Feb	31.5	30.0	38.5	First and Ninth Armies preparing to cross Roer River. Third Army piercein, Siegfried Line.
190600 Feb-110600 Mar	31.5	34.5	34.0	First, Third and Ninth Armies drive to Rhine.
110600 Mar-310600 Mar	34.5	34.5	23.5	Rhine Bridgeheads. 15% of 110600 Mar-210600 Mar allocation held as Army Group reserve.
010600 Apr-210600 Apr	33.7	33.7	32.6	Fifteenth US Army supplied approximately 0.2 unit of fire per day. Remainder divided as shown.
210600 Apr-010600 May	33.3	33.3	33.3	

48. Ammunition Expenditures - 12th Army Group. From 1 January 1945 to 1 April 1945, 12th Army Group was engaged in the drive to the Rhine and the crossing of the Rhine. During this period artillery expenditures closely approximated the inflow of ammunition to the Army Group as the table below shows:

Theater Maintenance<sup>64</sup>  
 Rate 1 Jan 1945.  
Rounds per gun in  
 Army Group per day.

12th Army Group<sup>15</sup>  
 Expenditure Rate.  
Rounds per gun in  
 active army per day.

Weapon

105mm How	29.6	23.1
4.5-inch Gun	17.2	17.5
155mm How	23.4	20.4
155mm Gun M1	13.3	12.1
155mm Gun M12	13.3	19.8
8-inch How	5.5*	13.0
8-inch Gun	11.9	3.7
240mm How	4.5	4.3

\*This rate was based on a large number of weapons which were never deployed, hence it is deceptively low.

From 1 April 1945 until 9 May 1945 as German resistance disintegrated, expenditures dropped rapidly so that at the end of April the ammunition reserves available to armies reached their peak.

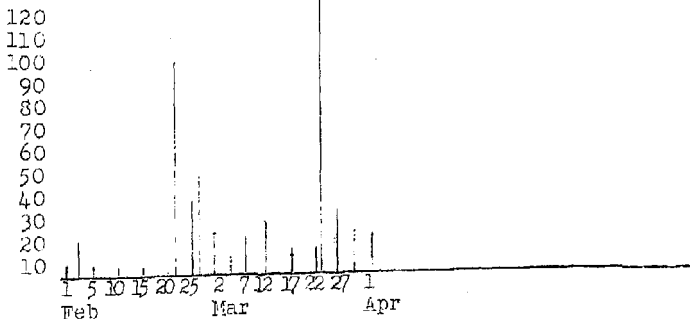
49. Outstanding Examples of Shrewd Rationing.<sup>15</sup> Ninth Army's operations prior to and during the Roer and the Rhine Rivers crossings present us with two outstanding examples of skillful rationing. In each operation Ninth Army hoarded ammunition prior to the crossing, then poured forth its savings in a very short period in order to achieve maximum possible artillery support at the most critical period. The chart below indicates the rationing policy pursued by Ninth Army.

#### NINTH ARMY

Expenditures of 105mm Howitzer Ammunition<sup>15</sup>

1 February - 1 April 1945

Rounds per gun in army per day	Roer River Crossing	Rhine River Crossing
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50. Ammunition Expenditures Ninth Army Rhine River Crossing, 66,67 The most overwhelming artillery support delivered by any army in the European Theater of Operations in a single action was that delivered by Ninth Army Artillery in support of the Rhine River crossing. The expenditures indicate the terrific firepower which can be unleashed when there is sufficient ammunition. The assault crossing was made by the 30th Infantry Division, 240200 March and by the 79th Infantry Division, 240300 March. Fires included a one hour preparation and a three hour schedule of prearranged fires. From noon the day prior to the attack to noon the day of the attack the Ninth Army Artillery (including the 141st AAA Battalion employed in an artillery role) fired 498 counterflak and neutralization missions, 996 harassing and interdiction missions, 314 counterbattery missions, 43 destruction missions and 2346 close support and miscellaneous missions--a grand total of 4697 missions.

The ammunition expended from 240100 March to 250000 March (preparation and first day of the attack) was:

<u>Field Artillery</u>	<u>XIII Corps</u>		<u>XVI Corps</u>		<u>XX Corps</u>		<u>34 FA Brig</u>		<u>Army</u>			
	<u>Rds</u>	<u>R/G</u>	<u>Rds</u>	<u>R/G</u>	<u>Rds</u>	<u>R/G</u>	<u>Rds</u>	<u>R/G</u>	<u>Rds</u>	<u>R/G</u>	<u>Gun</u>	
25-pr	-	-	6757	563.0	-	-	-	-	6757	563.0	12	
105H M2	11391	82.5	31669	267.0	4734	29.2	-	-	97794	160.2	606	
4.5G	1172	97.7	5911	164.2	-	-	-	-	7083	147.5	48	
155H	5125	61.0	34371	207.5	1246	34.6	-	-	44842	155.5	288	
155G M1	2143	89.3	12015	333.8	-	-	5062	1401	19220	200.5	96	
155G M12	85	7.1	2206	133.9	-	-	-	-	2291	63.6	36	
8H	931	38.8	15503	143.0	-	-	-	-	9514	113.2	84	
8G	-	-	-	-	-	-	-	812	135.2	812	135.2	6
240H									1829	101.7	18"	
3G									13225			
76G									920			
90G									522			
75G German									135			
83G German									163			
Total									210007			

The total weight of the projectiles at the target was 6470 tons. The packed complete rounds weighed 9350 tons.

The effectiveness of this artillery fire can be judged by the following extract from "Report of Interrogation of Prisoners of War", Headquarters Ninth Army, No. 202, dated 25 March 1945.

"Following the jump-off of our offensive across the

Rhine in the Ninth Army sector, accompanied by an intensive artillery barrage on forward positions and enemy artillery emplacements, Prisoners of War soon began to pour in. The first few hundred reached Army cage within a hours after capture, many still being in a stunned or dazed condition from the artillery pounding to which they had been subjected. "Hellish" - "Terrifying" was all some of them could say at first. One officer Prisoner of War apologized for seemingly incoherent answers, saying his head still felt thick and numb from his recent ordeal. Others who had recuperated from the first shock, expressed professional admiration for the barrage, using such terms as 'Prima' (first rate) and 'Holossal'. Artillery officers in particular attributed their plight to the destruction of communication facilities by our artillery barrage. They sent runner after runner to make contact with the infantry and with their headquarters but the runners did not return and no radios were available. Some artillery officers stated they kept waiting for their own infantry to fall back, thereby giving them a warning of the approach of our forces, but suddenly they found themselves flanked and captured by US troops, without even seeing their own infantry."

51. Ammunition Expenditures 6th Army Group, 1 January - 3 February 1945. During early January 6th Army Group planned to conserve ammunition. However, the German offensive against Seventh Army thwarted the savings plan. In stopping this offensive Seventh Army was forced to use not only all ammunition accruing to it under the Theater Maintenance Rate (See paragraph 48) but also half of its share of the 6th Army Group Reserve. (The reserve authorized by the theater to each army group was 27 days supply at the Theater Maintenance Rate). Despite this, the offensive against the Colmar pocket began 20 January. Available to First French Army Artillery (from First French Army stocks and from 6th Army Group reserve) and to engaged Seventh Army Artillery (from Seventh Army stocks) were the following amounts of ammunition:

<u>Weapon</u>	<u>Rounds per Weapon</u>
105mm How M2	700
155mm How	400
155mm Gun	250
3-inch How	100

The attack on the south flank of the pocket soon bogged down. The ammunition set up for the French was quickly expended. By 25 January to insure availability in case of counterattacks, 6th Army Group was forced to authorize movement of 105mm howitzer and 155mm howitzer ammunition to the gun positions of First French Army; the authority to expend was retained by the Commanding General, 6th Army Group.

"The attack on the north flank of the pocket was reinforced by XXI Corps and by additional artillery. This required further commitment of the 6th Army Group reserve. However, XXI Corps skillfully accomplished its mission with the ammunition resources given it". The pocket was eliminated 3 February 1945.

52. Ammunition Expenditures 6th Army Group, 9 February - 9 May 1945. On 1 February, the G-3 Artillery Officer, 6th Army Group reported: "There will be insufficient ammunition available to properly support a major offensive by Seventh Army until at least 30 days after the elimination of the Colmar pocket. Then the ammunition available in the heavy calibers will be insufficient unless supplemented from outside 6th Army Group. Operations during the saving period must not require ammunition in excess of  $\frac{1}{2}$  SHAEF's rate.\*"

"Accordingly ammunition was allocated on the following basis for the period 1 February to 10 March:

$\frac{1}{2}$  SHAEF Rate\* to First French Army

$\frac{1}{2}$  SHAEF Rate\* to 44th AAA Brigade (Alps Front)

SHAEF Rate\* to Seventh Army

"Unallocated ammunition was held under Army Group control to rebuild the Army Group Reserve and create stocks for future offensive action.

"After the conclusion of the Colmar Pocket Operation, 3 February 1945, the expenditures of First French Army along the Rhine dropped to very low levels. The First French Army was able to save and build up a considerable stock of ammunition from its reduced allocations during the period 11 February to 30 March. However, it was necessary to forbid general artillery duelling across the Rhine and the small expenditures were limited to harassing fire and in support of patrol actions.

"The ammunition available to Seventh Army for its attack on 15 March was as follows:

Type	Number of Weapons	Rounds per Gun	
		Min. Desired	Available
105mm How	317	1200	1133
155mm How	336	800	692
4.5-inch Gun	36	800	500
155mm Gun	126	660	578
240mm How	18	500	255
3-inch How	72	600	346
3-inch Gun	4	500	664

"In order to make this much ammunition available all of the Army Group's savings and all unallocated amounts due the Army Group to include 31 March were allocated to Seventh Army. It was estimated that a 20 day battle would have to be fought. It was considered that the above amounts of ammunition would be sufficient for this battle, and would provide sufficient ammunition for an immediate crossing of the Rhine as soon as it was reached and for defense of a bridgehead. In the event that the German resistance crumbled west of the Rhine and the advance became rapid after

\*Theater Maintenance Rate.

passing the Siegfried Line the ammunition would be sufficient to provide for considerable fighting beyond the Rhine. The amounts of light and medium artillery ammunition were sufficient. The amounts of heavy artillery ammunition were not as great as was desired but they accumulated so slowly that it was unprofitable to delay the operation longer in order to accumulate the heavy artillery ammunition.

In early March, 6th Army Group had to divert some ammunition to the operation to open the port of Bordeaux (O66) and some ammunition (over and above the regular allocation of one half the theater maintenance rate) to troops engaged in cover operations on the Franco-Italian frontier.

"Due to the collapse of German resistance west of the Rhine the expenditure of the large quantities of ammunition that had been expected west of the Rhine and in crossing the Rhine had not occurred. Therefore, the ammunition position of Seventh Army was excellent at the end of March. In the ammunition allocations from the period 1 - 10 April very little ammunition was allocated to Seventh Army and the First French Army was given the full SHARP rate for its gun list as it was scheduled to cross the Rhine and advance to the South and East from Speyer-Germesheim (RA3-RA7) Area. The unallocated ammunition was held under Army Group control inasmuch as it was not certain whether these resources would have to be thrown behind Seventh Army or First French Army. The immediate needs were amply taken care of by the amounts on hand and the allocations for 1 - 10 April.

"During April the advance of both Armies was rapid and the requirements for available ammunition could easily be met. The principal ammunition problem was one of truck transportation to move the requirements forward from railheads. The disintegration of the German Army reduced the requirements for artillery ammunition and this condition continued until the cessation of hostilities. The expenditures for the period 1 April to 7 May decreased."

## SECTION 2

### AMMUNITION DAY OF SUPPLY FOR THE EUROPEAN THEATER OF OPERATIONS

53. Reinvestigation of the Day of Supply.<sup>6</sup> Throughout the entire campaign the Day of Supply was under review by the Ammunition Division, Office of the Chief of Ordnance, European Theater of Operations. However, insofar as most artillery ammunition was concerned, pure statistical studies based on expenditures were of limited value since both the amounts and the types expended were so greatly affected by availability. The best basis for a Day of Supply was, therefore, the consensus of opinion of tactical commands. In January and February 1945 Headquarters European Theater of Operations reinvestigated the Day of Supply and by a letter 3 March 1945, subject: "Ammunition Day of Supply" to the Adjutant General, Washington DC, recommended a new ammunition Day of Supply for the theater. The recommendations as regards artillery items are shown below:

"RECOMMENDED DAY OF SUPPLY FOR ETOUGA

	10	11	12	13
Weapon & Type Ammunition	12th A Gp Recommen- ed Rate	30LOC* Recommen- ed Rate	6th A Gp Recommen- ed Rate	Recommen- ed Day of Supply ETOUGA
90mm Gun AT	10	10	10	10
HE w/M48	75%	75%	75%	75%
APC	20%	20%	20%	10%
HVAP	-	-	-	10%
WP (Smoke)	4%	4%	3%	5%
HC (Smoke)	0	1%	2%	-
75mm How (Pk-Fd-Sp)	20	15	20	15
HE w/M48	62%	85%	68%	63%
HE w/M54	27%	05%	23%	25%
HE AT	3%	1%	2%	3%
WP (Smoke)	7%	8%	7%	8%
Canister	1%	1%	-	1%
76mm Gun T&AT	6.0	6.0	10.0**	4.0
HE (NC) w/M48	55%	60%	65%	55%
HE (RC) w/M48	15%	-	5%	12%
APC	10%	30%	10%	13%
HVAP	10%	-	10%	12%
WP	10%	7%	4%	7%
HC	0	3%	2%	1%
Illuminating	To be stockpiled			
3" Gun AT	8.0	6.0	10	6.0
HE (NC) w/M48	50%	80%	55%	55%
HE (RC) w/M48	25%	0	25%	25%
APC	10%	15%	7.5%	7.5%
HVAP	10%	-	7.5%	7.5%
Illuminating	To be stockpiled			
WP	5%	4%	5%	5%
HC	0	1%	0	0

Weapon & Type Ammunition	12th A Gp Recommend- ed Rate	SOLOC* Recommend- ed Rate	6th A Gp Recommend- ed Rate	Recommend- ed Day of Supply ETOUSEA
105mm How M2, M4, M7	45	55	50	45
HE w/M48	70%	90%	74.4%	70%
HE w/M54	20%	)	18.6%	20%
HE AT	0.5%	0.5%	.2%	.5%
WP (Smoke)	7%	7.5%	4.0%	7.5%
HC (Smoke)	2%	1.5%	2.0%	2%
Colored Smoke	0.5%	0.5%	0.8%	.5%***
105mm How M3	20	20	20	20
HE w/M48	75%	90%	77%	75%
HE w/M54	14%	)	7%	13%
HE AT	2%	1%	1%	3%
WP	7%	7%	14%	7%
HC	2%	2%	1%	2%
4.5" Gun	28.0	30	40	28.0
HE	95%	95%	95%	95%
WP (Smoke)	5%	5%	5%	5%
Prop Charge M8 (S)	60%	60%	60%	60%
" "	40%	40%	40%	40%
155mm How M1, M1918	35	35	40	35
HE	91%	95%	93%	93%
WP (Smoke)	6%	4%	4%	6%
HC (Smoke)	3%	1%	2%	1%
Illuminating	To be stockpiled			
Prop Charge M4A1 (WB)	90%	90%	90%	90%
Prop Charge M3 (GB)	10%	10%	10%	10%
Colored Smoke Canisters -	-	-	1%	.5%****
155mm Gun M1, M1918	25	30	35	25
HE	91%	93%	90%	91%
WP (Smoke)	6%	5%	8%	7%
HC (Smoke)	3%	2%	2%	2%

Weapon & Type Ammunition	12th A Gp Recommend- ed Rate	SOLCC* Recommend- ed Rate	6th A Gp Recommend- ed Rate	Recommend- ed Day of Supply ETOUSA
AP	Recommend Stockpiling			
8" How (HE)	25	25	30	25
Prop. Chg. M2 (WB)	75%	75%	85%	75%
Prop. Chg. M1 (GB)	25%	25%	15%	25%
8" Gun (EE)	15	15	20	15
Prop. Chg. M9 (BG)	35%	20%	20%	30%
Prop. Chg. M10 (WB)	65%	80%	80%	70%
240mm How (HE)	15	15	25	15

\* Southern Lines of Communication.

\*\* Tank only.

\*\*\* Colored smoke canister to be over and above the days of supply - 50% red - 25% green - 25% violet.

\*\*\*\*Canisters (Colored Smoke) to be over and above the day of supply - 50% red - 25% violet - 25% green!

Although the amounts of some items of this Recommended Day of Supply were later reduced by the theater, such reductions were made in anticipation of an early end to the war and, with that in mind, were intended to ease production problems in the Zone of the Interior. It is therefore believed that these later reduced figures should not be considered as correct expressions of theater opinion. The "Recommended Day of Supply", 3 March 1945, should be accepted as the final opinion of the European Theater of Operations as to the amounts and types of artillery ammunition needed in this theater.

54. Overestimation of Requirements. The covering letter to the 3 March 1945 recommendations makes this statement: "Recommendations on items which have been in adequate supply are in line with expenditures with many resultant reductions in the War Department Day of Supply, thus allowing greater production efforts to be concentrated on those heavy artillery items now in short supply." This statement is recognition of a cause of ammunition shortages not previously discussed in this study, i.e., previous overestimates of requirements for certain types of ammunition results in a waste in production facilities and in a waste in transportation facilities. Where either production or transportation is limited, overestimation of requirements for one item automatically lessens the supply of more desirable items. The table below shows selected items whose stocks on hand and on manifest, 20 April 1945, were not justified by previous expenditures. Overproduction of these and similar items and the transportation of these items undoubtedly contributed to shortages in faster moving items. The slowness of correction of overestimation is also shown by the table. Note the large increases in stocks on hand between 20 September 1944 and 20 April 1945.

	Expenditures <sup>26</sup> June 1944 to 20 Sept 1944	Total on hand <sup>23</sup> in this theater 20 Sept 1944	Expenditures <sup>26</sup> June 1944 to 20 Apr 1945	Total on hand <sup>23</sup> in and enroute to theater 20 Apr 1945
75mm Gun	526,000	2,193,000	1,940,000	3,072,000
76mm Gun	102,000*	1,253,000	919,000	1,625,000
3-inch Gun	297,000	1,222,000	1,625,000	2,867,000
90mm AA & AT Gun	169,000	1,022,000	1,422,000	3,109,000

\*Weapon late being deployed. Highest monthly expenditure 207,803 rounds 20 March 1945 to 20 April 1945.

## CHAPTER 7

### RESUME OF ARTILLERY AMMUNITION SUPPLY

6 JUNE 1944 - 9 MAY 1945

55. Recapitulation. Artillery ammunition was in short supply in the European Theater of Operations. The original theater estimate of expenditures in January 1944 was entirely inadequate. Subsequent estimates were not met by production in the Zone of the Interior. Shortages at the guns were caused by:

a. Insufficient discharge over the beaches or through the ports, June through October 1944;

b. Inability to move ammunition from the ports and beaches to the armies, August through October 1944;

c. Inability of the Zone of the Interior to meet requirements, November 1944 through March 1945.

A contributing cause was overestimation by the theater of requirements for certain types of antiaircraft, tank and tank destroyer ammunition.

56. The Effects of the Ammunition Shortage have been adequately summarized by 6th Army Group. That summary, quoted below, can be accepted as a statement of the experience of all tactical commands in the European Theater of Operations:<sup>47</sup>

\* \* \* \* \*

"Artillery ammunition like other combat resources directly affects the magnitude, scope, and timing of operations that can be conducted. When ammunition supplies are short it has the effect of making it not possible to employ all the troops simultaneously in an offensive role; it restricts the timing of operations because ammunition must be accumulated to launch a major action; it reduces the possibility of taking immediate advantage of weaknesses in the enemy's dispositions; it has an undesirable psychological effect on troops and commanders; and it precludes the use of artillery in deceptive maneuvers and restricts its use to support



of the actual attack only. The most critical factor in regard to expenditures is future supply. If the resupply rate is low then operations must be spaced far apart whereby the enemy gains time to dig in. A large amount of ammunition is always required to make a breakthrough. 6th Army Group experienced all these effects during the period of the operations."

\* \* \* \* \*

"A precise quantitative evaluation of the effect of the inadequate ammunition supply cannot be made, but it is the opinion of this Headquarters that a supply in general approximately 1/3 greater than that furnished would have saved many lives and shortened the war."

\* \* \* \* \*

"It will be noted that the ammunition available to 6th Army Group for the period of the operation, 265 days, did not equal any of the days of supply that were either approved or recommended by either the European Theater of Operations, the Mediterranean Theater of Operations, or the War Department. The fact that the campaign was successful must not be taken as proof that the supply of artillery ammunition was enough. There may be possibility for discussion as to what a proper day of supply should be, but the history of the campaign is incontrovertible proof that the amount furnished was not enough. A larger artillery ammunition supply in the hands of our skilled Field Artillery would have reduced our casualty list, killed more Germans, and brought the fighting to a quicker end. To take the view that the supply furnished was enough is to place a price in dollars and sweat on men's lives.

\* \* \* \* \*

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33. Memorandum, Artillery Section, 12th Army Group, undated, subject: "Background for 1st Allocation", file 471/1, Artillery Section, The Theater General Board.
34. Letter, Headquarters First Army, dated 27 July 1944, subject: "Status of Critical Ammunition Items, This Date", to Commanding General, Communications Zone, file 471/1, Artillery Section, The Theater General Board.
35. Carrier Sheet, Office of the Chief of Ordnance, ETOUSA, dated 3 August 1944, subject: "Ammunition Supply", file 471/1, Artillery Section, The Theater General Board.
36. Artillery Section After Action Report, Third Army, 1 August 1944 - 9 May 1945.
37. 12th Army Group Ordnance Report of Availability, 270600 August 1944, file 471/1, Artillery Section, The Theater General Board.
38. Documents and Comments on Shortages of Artillery Ammunition and the Effects of Such Shortages on Artillery Fire, file 471/1, Artillery Section, The Theater

General Board.

39. Report, Office of the Ordnance Officer, Headquarters First Army, dated 30 September 1944, subject: "Ammunition Supply Report, France, 1 - 31 August 1944", file 471/1, Artillery Section, The Theater General Board.
40. Report, Office of the Ordnance Officer, Headquarters First Army, dated 25 October 1944, subject: "Ammunition Supply Report, Western Europe, 1 - 30 September 1944", file 471/1, Artillery Section, The Theater General Board.
41. Report on the Artillery with VIII Corps in the Reduction of Brest.
42. Letter, Headquarters 12th Army Group, dated 23 August 1944, subject: "Ammunition for VIII Corps", file 471/1, Artillery Section, The Theater General Board.
43. Memorandum, Ordnance Section, Headquarters 12th Army Group, dated 10 September 1944, subject: "Status of Ammunition Supply to VIII Corps", file 471/1, Artillery Section, The Theater General Board.
44. Letter, Headquarters 12th Army Group, dated 16 September 1944, subject: "Items of Ammunition in Critical Short Supply" to Commanding General, Communications Zone (Forward), file 471/1, Artillery Section, The Theater General Board.
45. Inclosure to Carrier Sheet, Artillery Section, Headquarters 12th Army Group, dated 8 September 1944, subject: "Recommended Ammunition Allocation for the Period 110600 September to 190600 September 1944", to G-3, G-4, and Ordnance, file 471/1, Artillery Section, The Theater General Board.
46. Letter, Office of the Artillery Officer, Headquarters Seventh Army, dated 17 September 1944, to Artillery Officer, 12th Army Group, file 471/1, Artillery Section, The Theater General Board.
47. Study, Headquarters 6th Army Group, subject: "The Effect of Ammunition Supply on Operations of 6th Army Group - World War II, D-Day (15 August 1944) to 7 May 1945".
48. Carrier Sheet, Artillery Section, 12th Army Group, dated 10 October 1944, to G-3, file 471/1, Artillery Section, The Theater General Board.
49. Letter, The General Board, dated 28 September 1945, subject: "Request for Statistical Information", to Control Division, Headquarters Theater Service Forces (Rear), file 471/1, Artillery Section, The Theater General Board.
50. Extracts from 12th Army Group Weekly G-4 Report, file 471/1, Artillery Section, The Theater General Board.

51. Letter, SHAEF, G-3 Administrative Representative with 12th Army Group, dated 9 October 1944, subject: "Report on Ammunition Meeting", file 471/1, Artillery Section, The Theater General Board.
52. Carrier Sheet, Current Operations, G-4 Division, SHAEF, dated 15 November 1944, subject: "Recapitulation of Daily Ammunition Tonnages Unloaded on the Continent", file 471/1, Artillery Section, The Theater General Board.
53. Extract from Memorandum, Ordnance Section, 12th Army Group, dated 5 November 1944, subject: "G-4 Periodic Report", file 471/1, Artillery Section, The Theater General Board.
54. Letter, Headquarters, 12th Army Group, dated 21 October 1944, subject: "Supply of Ordnance Ammunition", file 471/1, Artillery Section, The Theater General Board.
55. Extract from Daily Journal, Ordnance Section, 12th Army Group, dated 5 November 1944, file 471/1, Artillery Section, The Theater General Board.
56. Extract from Report, G-4 Section, 12th Army Group, dated 31 July 1945, subject: "Field Force Logistics", file 471/1, Artillery Section, The Theater General Board.
57. Report, Office of the Ordnance Officer, Headquarters First Army, dated 16 December 1944, subject: "Ammunition Supply Report, Western Europe, 1 - 30 November 1944", file 471/1, Artillery Section, The Theater General Board.
58. Allocation letters, Headquarters 12th Army Group, dated 6 November, 21 November, 4 December 1944, subject: "Ammunition Supply".
59. Extracts from Ordnance Section, 12th Army Group, worksheet for credit request 47 (undated), file 471/1, Artillery Section, The Theater General Board.
60. Report, Office of the Ordnance Officer, Headquarters First Army, dated 24 January 1945, subject: "Ammunition supply report, Western Europe, 1 - 31 December 1944", file 471/1, Artillery Section, The Theater General Board.
61. Carrier Sheet, Current Operations Branch, G-4 SHAEF, dated 2 October 1944; subject: "Ammunition Supply for 12th Army Group", file 471/1, Artillery Section, The Theater General Board.
62. Study, Headquarters Communication Zone, ETOUSA, dated 17 October 1944, subject: "Report on Ammunition in Short Supply", file 471/1, Artillery Section, The Theater General Board.
63. Memorandum, Assistant Chief of Staff, G-3 SHAEF, dated 3 December 1944, subject: "Critical Ammunition Items", file 471/1, Artillery Section, The Theater General Board.

Theater General Board.

64. Memorandum, Headquarters 12th Army Group, undated, subject: "Maintenance Day of Supply Rate", file 471/1, Artillery Section, The Theater General Board.
65. Table extracted from records, Headquarters 12th Army Group, subject: "Division of Incoming Ammunition Between Armies", file 471/1, Artillery Section, The Theater General Board.
66. Extract from Headquarters Ninth Army, "FA and TD Information Summary Number 84", dated 25 March 1945, file 471/1, Artillery Section, The Theater General Board.
67. Extract from Headquarters Ninth Army, "FA and TD Information Summary Number 85", dated 26 March 1945, file 471/1, Artillery Section, The Theater General Board.

THE GENERAL BOARD  
UNITED STATES FORCES, EUROPEAN THEATER  
APO 408

PART TWO

COMMAND CONTROL OF AMMUNITION

CHAPTER 1

SCOPE OF STUDY

57. The Purpose of this part of the artillery ammunition study is to examine the ammunition rationing methods used in the past campaign in order to determine those methods which should be used in any similar future campaign.

58. Method of Presentation. The study embraces an examination of ammunition rationing as applied at all echelons from Headquarters European Theater of Operations to the battery. In general the discussion proceeds in order, from highest echelon to lowest echelon. An exception is made in the case of the army group. Because 12th Army Group's experience chronologically includes the worst methods and the best methods of higher echelon ammunition rationing, the initial discussion centers on 12th Army Group.

CHAPTER 2

AMMUNITION RATIONING. ARMY GROUP LEVEL

SECTION 1

RATIONING APPLIED AT THE GUN MUZZLE

59. Limitation of Discussion. Throughout this chapter the discussion is limited to 12th Army Group. It is believed 12th Army Group's methods give wider coverage than 6th Army Group, since the former's methods ranged from those giving practically no control to those giving almost absolute control of ammunition. Furthermore, rationing as applied by 6th Army Group was limited in that it applied to only two armies and was complicated by the fact that the armies were of different nationality. It is felt 12th Army Group's experience illustrates a more general case: rationing applied to four armies of a single nationality.

60. Ammunition Control 6 June - 31 July 1944. In order to understand why 12th Army Group adopted its initial methods of ammunition control, it is necessary to review ammunition control as practiced by First Army prior to 1 August 1944. On the surface First Army's method of ammunition rationing was a model of simplicity: at recurring intervals the army prescribed to each corps how many rounds of each type of ammunition the corps could fire in the ensuing period (usually four days). The visible evidences of rationing were the periodic letters to corps of which the following is an example:<sup>1</sup>



"HEADQUARTERS  
FIRST UNITED STATES ARMY  
APO 230

17 July 1944

"SUBJECT: Ammunition Allocation.

TO : Commanding General, VIII Corps, APO 308, U. S. Army.

"1. You are authorized to expend ammunition not in excess of the rates shown on the attached table for the period 180600B to 0600B of D plus 1 Day for Operation COBRA.

"2. Authorized expenditure rates for succeeding periods will be furnished you 24 hours in advance of the effective period.

"3. These expenditure authorizations are not cumulative.

O. N. BRADLEY,  
Lieutenant General, U.S.A.  
Commanding"

In actual fact First Army's control of ammunition was far more complete than that ordinarily enjoyed by any army in combat; up until 1 August First Army controlled all supply installations on the continent. This gave the army (within the limits of transportation) absolute control over the distribution of ammunition and over the build-up, make-up, and location of all reserves. First Army's system had two weaknesses: first, it was impossible for a corps to plan ammunition expenditures further in the future than to the end of the ammunition rationing period (four to six days); secondly, there was no incentive to save since at the end of the rationing period ammunition saved reverted to army.

61. Expenditure Limitations were the first method of rationing tried by 12th Army Group. On the surface the system was exactly that in vogue in First Army. The Army Group prescribed to each army each eight days the amount of ammunition of critical types which that army could expend. A sample cable (one sent 15 August 1944 to First Army) follows:<sup>2</sup>

"Expenditure of the following quantities of ammunition is authorized during the period 180600 to 260600:

	*	*	*	*	*	
Shell; HE; 105-mm How,	M2,	M4	&	M7	150,000	
Shell; HE; 155-mm How					36,400	
Shell; HE; 155-mm Gun; M1					10,000	
Shell; HE; 155-mm Gun, M12					4,100	
Shell; HE; 4.5-in Gun					7,300	
Shell; HE; 8-in How					5,700	
Shell; HE; 8-in Gun					720	
Shell; HE, 240-mm How					1,440	

\* \* \* \* \*

"In addition to the above, Shell, Smoke, White Phosphorus for 105-mm Howitzer M3 and 155-mm Howitzer may be expended in an amount not to exceed 2% of Shell, High Explosive.

"Expenditure of all types of ammunition not specifically mentioned herein will be controlled by the Army Commander."

62. Assessment of the Expenditure Limitation Method. The resemblance of the 12th Army Group expenditure limitation method to that of First Army was entirely superficial. The army was an administrative unit; the army group was not. The army controlled all supply installations; the army group controlled none. The army controlled the physical distribution of ammunition and the physical disposition of reserves; the army group controlled neither. The weaknesses of the system as applied by First Army were greatly increased when the system was applied by 12th Army Group. Let us examine these weaknesses.

a. The system gave little control over the distribution of reserves of the most critical items. True the army group did prescribe maximum supply levels. However, if the maximum supply level was five units of fire and there were only three units of fire available, if one army requisitioned its full five units of fire, the maximum possible reserve level in other armies dropped below three units of fire.

b. The system tended to aggravate shortages. When an item became critical, the first army recognizing the critical situation was liable to requisition maximum quantities of the item, thus filling the supply line to itself and possibly completely disrupting the supply line to other armies.

c. The system gave no assurance that expenditures would be replaced by supply agencies. All ammunition on the continent or expected to be on the continent was considered available when, in actual fact, ammunition in Normandy was not available to armies on the German border.

d. The system was not geared to the tactical situation. If an enemy attack was launched on the sixth day of a rationing period, the army knew what ammunition was available to it for only two days into the future.

e. The system encouraged wasteful shooting. Since savings accumulated by any unit in any period simply reverted to the army group, there was no incentive for any unit to save.

f. The system was an honor system which depended for enforcement on the expenditure reports of lower units. Some units falsified expenditure reports; these units felt they were justified since there was no other way to carry over the right to expend from one period to the next.<sup>3,4</sup>

g. The system made it almost impossible for armies to ration ammunition intelligently. So little information of future supply was furnished armies that long range planning was hopeless.<sup>5</sup>

## SECTION II

### CREDIT SYSTEM

63. Outline of 12th Army Group Credit System. As one of two major steps in overhauling its ammunition supply system, 12th Army Group, 21 October 1944, initiated a credit system. In explanation of the system established, the letter establishing the system is quoted in toto.

"HEADQUARTERS 12TH ARMY GROUP  
APO 655

471 (G-4 Sup)

21 October 1944

"SUBJECT: Supply of Ordnance Ammunition.

TO : Commanding General; First Army; APO 230.  
Commanding General; Third Army; APO 403.  
Commanding General; Ninth Army, APO 339.  
Commanding General, 94th Infantry Division,  
APO 94.  
Commanding General, Special Troops, Hq Twelfth  
Army Group, APO 655.

"1. In order to insure proper distribution of Ordnance ammunition available to this Group, future supplies thereof will be provided on a credit basis. Except to the extent that credits therefore have been authorized, requisitions for ordnance ammunition placed by all commands on and after 14 October 1944 have been cancelled.

"2. Hereafter ordnance Class V supply will be furnished as outlined below:

a. Allocations will be prescribed from time to time by this headquarters.

b. Based on these allocations, the Communications Zone will establish for the commands of this Group, credits in designated Communications Zone depots.

c. Copies of credits will be furnished the command concerned and the regulating station which serves that command.

d. Credits for the several commands will be established in general in the depots of the Advance Section, Communications Zone.

e. Requisitions forwarded by you to the regulating station will show the credit number and the number of Communications Zone depot carrying the obligated stocks. Requisitions will not be in excess of credit authorizations.

f. Unless otherwise provided, credits will expire 30 days from date of issue.

g. Commands will continue to forward to this headquarters and the Communications Zone daily status of ammunition stock reports. As an additional entry on this report, there will be shown, "Quantity Allocated but not Received". The latter will include all quantities allocated to you but not yet received in depots or ammunition supply points under your control.

"3. Reserves of ordnance ammunition previously authorized by this headquarters are hereby rescinded. Authorized ordnance ammunition credits may be expended or held in reserve at the discretion of the commander concerned. Additional supplies to replace quantities which may be expended from basic loads, will be obtained from authorized credits.

"4. Initial allocations under this procedure will be made at an early date, and based thereon credits for ordnance ammunition will be furnished your command.

By command of Lieutenant General BRADLEY:

RAYMOND STONE, JR  
Colonel, AGD  
Asst Adj Gen"

In addition to the information furnished by Armies, Army Group also received from Communications Zone daily reports of the unobligated ammunition stocks in the forward depots of the Communication Zone (O-609 Soissons (S-89), O-610 Liege (K-42), O-611 Verdun (U-26)) and sufficient information on which to base sound estimates of future arrivals of ammunition in the forward depots.

64. Appreciation of the Credit System. The system established was essentially that described in paragraphs 75, 76, and 77 Field Manual 100-10 Field Service Regulations, Administration. The benefits of the credit system are tabulated below:

a. The credit system with its attendant book-keeping gave the Army Group continuous up-to-date information on the status of critical items of ammunition.

b. The credit system gave the Army Group complete and flexible control of the distribution of all the ammunition available to the Army Group.

c. The credit system gave the Armies reasonable assurance that ammunition allocated to them would be available to them.

d. The credit system encouraged prudent shooting. Since ammunition once allocated belonged to the Army, there was an incentive to save ammunition in quiet periods for use in more active periods.

65. Incompleteness of the Credit System. The credit system, itself, was an incomplete answer to proper command control of ammunition. The credit system did not provide Armies with information on future supply. This lack prevented proper long-range ammunition planning by Armies.

## SECTION 3

### AMMUNITION FORECASTS

66. Reasons for Adopting Ammunition Forecasts. After institution of the credit system there was still considerable feeling that 12th Army Group should continue to limit expenditures. The reasons for abandoning the limitations of expenditures and substituting an ammunition forecast are given in the Daily Journal of the Artillery Section, 12th Army Group, 3 November 1944:<sup>6</sup>

"Also discussed with "G-3 12th Army Group" the present system and/or systems of controlling ammunition. I, "(the Munitions and Equipment Officer, Artillery Section)" stated that the Arty Section felt that the limitation on the expenditures themselves was not correct in principle. The analysis \* \* \* presented to "G-3" was approximately as follows:

For anyone to ration expenditures there are four items which must be known or estimated.

- a. The ammunition on hand in the armies.
- b. The amount of ammunition which can be supplied to the armies.
- c. The Army Group reserve.
- d. An evaluation of mission and of the plan of the army.

Of these items army knows best the ammunition in the army. The Army Group must estimate the replacement ammunition; it can well pass this information along to army with no change in the validity of the estimate. Army Group can inform armies that there is no Army Group reserve. With present flexibility of plans, army is in the best place to evaluate their mission. It appears that we ration expenditures on less reliable information than that which could be in possession of armies if we adequately inform them as to resupply and army group reserves. It would be preferable to tell the Army Commander that for such and such a period he could expect resupply at such and such a rate. Allow the Army Commander to use the ammunition given to him as he deems best. Army Group would control the rate of expenditure over the front by the rate of resupply which it stated to any army. "G-3 agreed" that the principle outlined was 100% sound."

67. Method of Forecasting Ammunition Supply. On 6 November 1944 12th Army Group replaced the limitation on expenditures by a forecast of future supply. To forecast ammunition supply 12th Army Group sent each army a letter each ten days telling that army the amounts of critical types of ammunition it could expect to have made available to it in the succeeding 30 days. The content of the forecast can best be judged by an actual example.<sup>7</sup>

"HEADQUARTERS 12TH ARMY GROUP  
APO 655

471 (G-4 Sup)

28 February 1945

"SUBJECT: Ammunition Supply for the Period 010600 March  
to 310600 March 1945.

TO : Commanding General, First Army; APO 230.  
Commanding General, Third Army; APO 403.  
Commanding General, Ninth Army, APO 339.

"1. Forwarded herewith as an inclosure is a table showing the estimated ammunition supply for your command during the period 010600 March to 310600 March 1945.

"2. The amounts of ammunition forecast in the first 10 days of the subject period and those amounts due from previous forecasts prior to 1 March can be considered as a firm commitment to your command. The amounts of ammunition forecast for the last 20 days of the subject period are estimates only, subject to change in composition or mission of your command.

"3. It is anticipated that the requirements of your command for the following items can be supplied from stocks available in forward depots of the Communications Zone; therefore, these items have been omitted from the attached forecast, and all quantities of these items still due your command from previous forecasts have been cancelled: 60mm Mortar, High Explosive; 75mm Howitzer, High Explosive, White Phosphorus; 75mm Gun, High Explosive; 76mm Gun, High Explosive normal charge, and 90mm Gun, High Explosive with fuze M48. In the event the aforementioned items become critical in the future due to abnormal demands, they will be placed on subsequent tables showing estimated ammunition supply for your command.

"4. This headquarters, based on your ammunition situation reports, will initiate action to establish credits for the items of ammunition included in the forecast as well as all other Ordnance ammunition items.

By command of Lieutenant General BRADLEY;

RAYMOND STONE, JR  
Colonel, AGD  
Asst Adj Gen."

1 Incl: Estimated Resupply (Dup)  
An extract from the inclosure  
follows:

\* \* \* \* \*

"The ammunition listed hereon is an estimate of the amount of ammunition the army may expect to receive for the period 010600 March to 010600 April 1945. Quantities shown are in addition to stocks on hand as of 010600 March and in addition to credits in forward area depots if such credits resulted from credit requests prior to and including credit request number 112.

Type	Still Due Previous Estimate to 010600 March	Estimated Available at Forward Depots by 110600 March	Estimated Additional Available at Forward Area Depots by 210600 March	Estimated Additional Available at Forward Area Depots by 010600 April
155mm Gun HE M101	0	18,650	18,650	18,650
WP M104	0	190	190	190"

\* \* \* \* \*

The inclosure also covered critical types of ammunition for all other artillery weapons.

68. Preparation of the Forecast. The mechanics of preparing the forecast were as follows: G-3 informed the Artillery Officer that the G-3 estimate of the activity of the armies the following thirty days was in a certain ratio. (e.g. First Army 50%, Third Army 40%, Ninth Army 10%). The Artillery Officer then recommended to G-3 a distribution for all incoming ammunition based primarily on the G-3 activity factors but also considering the reserves available to each army (especially unearned reserves accrued, for example, by a sudden reduction in the Army troop strength) and also any major uneven distribution of weapons across the front (for example, two battalions of 8-inch Guns in First Army, one each in Third and Ninth). A sample recommendation by the Artillery Officer is shown below:<sup>8</sup>

\* \* \* \* \*

"To	From	Date	Ammunition Estimate - 20 January - 20 February 1945
G-3	Arty	16 Jan 1945	"1. It is recommended that all ammunition available for resupply to the Army Group for the period 200600 January to 200600 February be divided as shown below:

a. All calibers except the 75mm howitzer, the 8-inch howitzer, the 8-inch gun, and the 240mm howitzer:

First Army	50%
Third Army	40%
Ninth Army	10%

b. Ammunition for the 75mm howitzer:

	Weapons in Army
First Army	47% 215
Third Army	47% 200
Ninth Army	6% 39

c. Ammunition for the 8-inch howitzer:

	<u>Operational Bns in Army</u>
First Army 45%	3
Third Army 35%	3 <sup>f</sup>
Ninth Army 20%	2

d. Ammunition for the 8-inch gun:

	<u>Operational Bns in Army</u>
First Army 50%	2
Third Army 30%	1
Ninth Army 20%	1

e. Ammunition for the 240mm howitzer:

	<u>Operational Bns in Army</u>
First Army 50%	4
Third Army 30%	2
Ninth Army 20%	2

"2. As in previous estimates, it is believed Ninth Army should receive a greater share of the heavier calibers than of the light calibers.

"3. Proposed distribution of 75mm howitzer ammunition takes cognizance of two facts:

a. Ninth Army now has a relatively high per weapon reserve (approximate reserves are First 400, Third 270, Ninth 600 rounds per weapon).

b. The heaviest firing is done by airborne weapons, none of which are in Ninth Army.

T B H"

\* \* \* \* \*

This recommendation when approved by G-3 was forwarded through G-4 to Ordnance who prepared the actual forecast. The forecast was dispatched as a G-4 action.

69. Appreciation of the Forecast. The value of the forecast can be judged by the following statement of the Ordnance Ammunition Officer, First Army:<sup>9</sup>

\* \* \* \* \*



"During November, 12th Army Group for the first time provided information to the Army Commander of what quantities of High Explosive items could be expected to be available during the next 30 days. This information was provided with corrections each 10 days and served as a sound basis for future planning."

\* \* \* \* \*

The credit system gave the Army Group control of ammunition; the forecast made it possible for armies to control ammunition. The credit system and the forecast combined gave complete command control of ammunition.

CHAPTER 3  
AMMUNITION ALLOCATION BY THE  
EUROPEAN THEATER OF OPERATIONS

70. Necessity for Allocation. In November and December 1944, it became obvious that the Zone of the Interior would be unable to meet theater requirements in most types of artillery ammunition. It was, therefore, necessary for Headquarters European Theater of Operations to allocate available ammunition supplies between 6th Army Group and 12th Army Group and also to keep the two army groups informed as to their future supply.

71. Method of Allocation. Initially the allocation of ammunition between army groups was accomplished by stating to the army groups an average rate in rounds per weapon per day at which they could expect to be supplied. In addition the army groups were furnished from time to time information as to the future rate of supply to the theater. This system worked reasonably well, the chief deficiency being that it did not accurately reflect the ups and downs of ammunition arrival in the theater; for example, if 50,000 rounds of 4.5 inch gun ammunition were scheduled to arrive the 15th of February, the whole month's rates might be higher than was actually justified by stocks on hand at the beginning of the month. The system the theater soon adopted was outlined in a letter, extracts of which are given below:

"HEADQUARTERS  
EUROPEAN THEATER OF OPERATIONS  
UNITED STATES ARMY

APO 887  
14 March 1945

AG 471 OpGD

"SUBJECT: Allocation of Ground Force Ammunition to Major Commands.

TO : Commanding General.

\* \* \* \* \*

Each Army Group

\* \* \* \* \*

"1. With the consolidation of the lines of communication into one Communications Zone, it is necessary to allocate the available supply of ground force ammunition to the major commands of this theater.

"2. Effective with the ten day period beginning 21 March 1945, all ground force ammunition in this theater will be allocated to the various major commands by the Commanding General, Communications Zone, in this manner:

a. Allocations for the 6th and 12th Army Groups will be made for the ten day periods, 1st to 10th, 11th to 20th, and 21st to last day of each month. These allocations will be published so as to reach the army groups by the 27th, 7th, and 17th of each month. The Supreme Headquarters, Allied Expeditionary Force, maintenance day of supply rate for critical items will be regarded as a minimum target for forward availability.

b. \* \* \* \* \*

c. Allocations published by Headquarters, Communications Zone, will include this information:

- (1) Credit balance remaining unallocated to subordinate units of major commands from previous allocations.
- (2) Allocation for the period covered.
- (3) Estimate of amounts to be allocated for the succeeding periods to 90 days in the future, for planning purposes. For army groups, estimated allocation will be furnished covering two subsequent ten-day periods and in addition two thirty-day periods. For other major commands, estimated allocations will be furnished covering two subsequent thirty-day periods.

d. All ground force ammunition will be divided between the various major commands on a weapons strength basis, first consideration being given to the requirements of army groups for ammunition in short supply. Weapons basis for army groups will be computed by Headquarters, Communications Zone, and will include the weapons of units assigned or attached or to be attached for operational control during the period covered by the allocation. \* \* \* \* \*

\* \* \* \* \*

e. \* \* \* \* \*. Ammunition accruing to units attached or assigned to Fifteenth US Army while staging will accrue to Supreme Headquarters, Allied Expeditionary Force, reserve until that reserve reaches nine days of supply for all weapons in the theater. When a unit in Fifteenth US Army staging area is released to either army group for operation, Headquarters, Communications Zone, will release from Supreme Headquarters, Allied Expeditionary Force, reserve twenty days' maintenance of ammunition for such

units to establish the army reserve for those units. This reserve will be available to furnish twenty days' maintenance reserve for divisions of major units transferred between army groups.

f. The weapons of divisions placed in Supreme Headquarters, Allied Expeditionary Force reserve will be included in the weapons strength of the army group to which attached and their weapons strength will be included in the weapons strength of that army group.

g. For the initial period, the ammunition to be allocated will be for all unobligated amounts in stock and all Communications Zone depots east of a north and south line through Paris (S04) and north of an east and west line through Arles (S85), plus all amounts "in transit" from Channel and Mediterranean ports, and base sections on the day the computations are made. Thereafter, the amounts to be allocated each period will be the amounts that become available from ship discharge since the preceding computation plus planned movements from rear areas.

h. Of the amounts allocated each period to the major commands plus remaining balance from previous allocations, each major command will advise the Commanding General, Communications Zone, the amounts to be credited to each army or other major subordinate unit. Upon receipt of this information, the Commanding General, Communications Zone, will set up a credit in appropriate depots for the unit, advising the unit, the major command, and the depot of the amounts by type credited. For the purposes of placing these credits for units of the 6th Army Group, Continental Advance Section may be considered a depot.

i. Upon receipt of the credits by armies or major subordinate units of the other commands, the armies may place requisitions on the designated depots of section with copies to the regulating stations of the amount desired shipped, stating the period during which shipment is to be made.

"3. The Commanding General, Communications Zone, will maintain the Supreme Headquarters, Allied Expeditionary Force reserve. The amounts held in reserve will not be included in the amounts to be divided for allocation, and will be issued only on authority of the Supreme Commander.

"4. \* \* \* \* \*

BY COMMAND OF GENERAL EISENHOWER:

R. B. LOVETT  
Brigadier General, USA  
Adjutant General"

In effect Headquarters European Theater of Operations simply extended the credit forecast system back to include the theater. The successful application of the system to 6th Army Group was hindered by lateness of receipt of allocations and by difficulties in perfecting channels for

establishing credits and for insuring ammunition movement. It is believed, had the campaign continued, these difficulties would have proved purely mechanical. As applied to 12th Army Group the theater credit forecast system worked well.

CHAPTER 4

AMMUNITION ALLOCATIONS BY

ARMIES AND SUBORDINATE UNITS<sup>4</sup>

SECTION 1

AMMUNITION ALLOCATIONS BY ARMIES TO CORPS

72. Methods Employed. The first example in the European Theater of Operations of ammunition allocations by armies to corps occurred on 15 June 1944 when First Army rationed ammunition by placing restrictions of so many rounds per gun per day on the expenditures permitted its corps. Such restrictions were imposed because ammunition stocks were far below target levels. This method was discontinued on 2 July but during the period 4 to 15 July a degree of control aimed at preventing unrestricted firing was in effect; First Army Commander required that units generally conform on a corps-wide basis to one unit of fire for attack, one-half unit of fire for each subsequent day of attack, and one-third unit of fire for a normal day of firing. This method imposed very little restriction on firing and depot stocks became insufficient to sustain the rate at which ammunition was being expended. Consequently on 16 July a strict rationing program was initiated in order to re-build the army reserves. This program returned to the method of limiting the number of rounds per gun per day which each corps could fire. The ration was on a day to day basis with no accumulation from one day to the next permitted.<sup>10</sup> On 1 August, 12th Army Group imposed rationing on its armies. At this time, however, the attitude of the armies is expressed in the following extract from Third Army After Action Report:<sup>11</sup>

\* \* \* \* \*

"Artillery ammunition was rationed to the Army by 12th Army Group. The Army, however, did not consider it necessary or desirable to impose rationing upon the several corps because of the light expenditures in the mobile situation and because it was desirable to assist the rapid advance by unrestricted ammunition expenditure when support was needed."

\* \* \* \* \*

As German resistance stiffened, firing increased and allocations by armies to corps became necessary; except for very brief periods ammunition restrictions were imposed throughout all subsequent operations. Such restrictions followed the familiar pattern of prescribing to each corps how many rounds of each critical type of ammunition the corps could fire in the ensuing period. The periods ranged

from one to fifteen days; they varied between armies and were changed within armies from time to time. In most cases no accumulations from one period to the next were permitted the corps.

73. Weaknesses in Controlling Ammunition by Limitation of Expenditures. This method of control as employed by armies in the European Theater had two major weaknesses: First, it was impossible for a corps to plan ammunition expenditures further in the future than to the end of the ammunition rationing period. (The shorter the period the more handicapping this deficiency became); second; since no accumulations beyond the period were permitted, there was no incentive for corps to save ammunition from one period to the next. It was generally felt that any ammunition remaining at the end of the period was lost to the corps; therefore, efforts were made to see that the full ration was fired. In some cases units drew the full allocation regardless of expenditures and built up reserves in unit dumps. In such cases expenditure records showed expenditure of the full allocation. Exceptions to the policy of firing or stocking all allotted ammunition occurred, but for the most part only when mutual trust between the army and its corps and between the corps within the army led commanders to feel that all army savings were readily available to any unit in case of emergency. Another result of permitting no accumulations beyond the period was the reduction of the amount of ammunition available for firing below the figures specified by the allocation. This condition existed because all echelons subordinate to army were forced to maintain a suitable reserve against an unpredictable emergency late in the ration period. Building up this reserve necessitated reduced firing at the beginning and middle of the period. The percentage of the ration available for firing varied with three factors: the length of the period, the amount of the allocation, and the availability of army reserves in case of emergencies. Reducing any of these factors reduced the percentage of the allocation available for firing.

74. The Advantages of Controlling Ammunition by Limitations of Expenditure are simplicity and speed of execution. Issuing agencies are relieved of the involved bookkeeping required by a system based upon credits.

75. Evaluation of the System of Controlling Ammunition by Limitations of Expenditures.

a. The disadvantages of this system can be reduced greatly by instituting the following:

- (1) Allow units to accumulate savings beyond the ration period.
- (2) Make the ration period as long a period as knowledge of the ammunition situation and the tactical situation will permit.
- (3) Build up trust in the ration system. This can be done by limiting expenditures only when such limitations are

necessary, by making the restrictions sufficiently flexible to permit units to draw extra ammunition for unpredictable emergencies, and by schooling artillery and staff personnel in the reasons for rationing and the methods used.

b. A credit forecast system has been shown to have advantages over a limitation of expenditure system for control of ammunition by army groups and higher echelons (Chapters 2 and 3, Part Two). The advantages to be gained at these levels by use of a credit system are primarily those which give the higher echelons control over the physical disposition of reserves. Since an army controls its own supply agencies it controls the disposition of army reserves. Therefore, these advantages of the credit system are not as important at the army level as they are at higher levels.

c. The simplicity of a system whereby armies control ammunition by limitations of expenditures gives such a system an advantage over the credit system that far outweighs its disadvantages.

## SECTION 2

### AMMUNITION CONTROL BY CORPS

4

#### AND SUBORDINATE UNITS

76. Methods of Control Employed and Their Weaknesses. Most corps controlled ammunition by limiting expenditures, although a few exercised control by credits on issues. At the corps level both methods appear to have achieved the same degree of control. Divisions and most field artillery groups employed limitations on expenditures. Some groups and most battalions controlled expenditures at their fire direction centers through which all fire missions cleared. In a few cases, usually when batteries and their battalions were separated, the battalion controlled expenditures by setting a limit on the number of rounds that the batteries could fire. The allocation period set by each headquarters usually corresponded to the period prescribed by the headquarters above it; depending upon the army, this period varied from one to ten days. No accumulation of savings beyond the ration period was permitted. Of course the amount of ammunition allocated each period varied with the supply and tactical situations but it is interesting to note that whether limitations on expenditures or credits were used for control, each headquarters held out part of its allocation as a reserve. In most cases this reserve was held until near the end of the period in order to have ammunition available to meet unpredictable emergencies or to use on lucrative targets appearing late in the period. Considerable ammunition thus saved was fired on harassing and interdiction missions during the last minutes of the period when the need for a reserve had diminished. Units from corps to field artillery battalions are unanimous in stating that the weaknesses of the systems used in the European Theater are as follows:

a. It was impossible for a commander to plan ammunition expenditures beyond the end of the ration period. Even field artillery battalion commanders, especially those of direct support battalions, need some information on the future availability of ammunition.

b. The practice of having all ammunition savings revert to higher headquarters at the end of the ration period led to arbitrary firing of the entire ration or to stocking of unfired portions of the allotment in unreported unit dumps.

77. Evaluation of the Systems Used for Controlling Ammunition. The major weaknesses of the limitations of expenditure method of ammunition control are the same for all units from the army to the battalion. The same measures which correct these weaknesses at the army level will correct them for all subordinate units. The advantages of simplicity and speed of execution which the limitations of expenditures system has over the credit system increase at the lower command levels. These advantages recommend its use by corps and subordinate units down to the field artillery battalion. Of course, battalion control of ammunition through fire direction centers is normal and entirely satisfactory.

## CHAPTER 5

### AMMUNITION RESERVES

78. Basis of Discussion. One feature of command control of artillery ammunition not heretofore discussed is the control of reserves. The size of reserves and the unit of measure of reserves have a direct bearing on artillery capabilities. The discussion below differentiates between tactical reserves and administrative reserves.

79. Tactical Reserves are those accumulated to increase the sudden striking force of the artillery available to a commander. Typical examples are the reserves accumulated by Ninth Army for the Roer and Rhine River crossings. No maximum limitation should be placed on the size of such reserves accumulated from the resources available to a unit except such limitations as are placed by the unit itself. For a higher echelon to limit the tactical reserves of a lower echelon is equivalent to the higher echelon stating it understands the plans and capabilities of the lower echelon better than the lower echelon does itself. Had 12th Army Group, for example, limited the ammunition reserves of Ninth Army prior to the Rhine crossing, 12th Army Group would have prevented Ninth Army from reaping the full benefit of its artillery fire power. (See Paragraphs 49 and 50 this report) Maximum limitations on the accumulation of tactical reserves should not be imposed by a higher headquarters, since they deny a commander full exploitation of his artillery.

80. Administrative Reserves simply represent ammunition which is in transit between supply installations, in progress through supply installations, or in pools in

supply installations; that is, the ammunition necessary to maintain a continuous forward flow. The proper size of the administrative reserve is dependent largely on the amount of ammunition handled per day, that is to say, it is dependent upon the number of weapons and upon the expenditure rate. The administrative reserve can be made to vary with the number of weapons simply by expressing the reserve in terms of rounds per weapon per day (doubling the number of weapons, doubles the reserve). The administrative reserve can be made to vary with the expenditure rate if the reserve is expressed in terms of the actual maintenance rate, since, unless you are over-building or destroying your administrative reserve, over a long period of time the input to the supply system must equal the output. Headquarters, European Theater of Operations, recognized this principle when it prescribed theater, army group, and army reserves in terms of the actual theater maintenance supply rate. (See Paragraph 71, this report) In summary, experience indicated that to assure adequate but not excessive administrative reserves the unit of measure should be the actual maintenance rate. It should be noted carefully that the actual maintenance rate did not supplant the tactical unit of measure, the unit of fire, defined by the War Department as "a balanced expenditure by the various weapons committed to battle under conditions of normal action."<sup>12</sup> The unit of fire reflects tactical employment; the actual maintenance rate reflects supply capabilities. The unit of fire was retained to compute tactical requirements by armies, corps and divisions. The actual maintenance rate was adopted for supply planning by armies and, particularly, by higher echelons.



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## PART THREE

### PHYSICAL MEANS OF SUPPLY

#### CHAPTER 1

##### SCOPE OF STUDY

81. The Purpose of Part Three is to discuss the physical means and methods of artillery ammunition supply. Equipment, organization, and procedures which were successful and which were orthodox are not discussed in detail. The emphasis is on deficiencies and recommendations for the correction of these deficiencies.

82. The Basis of Part Three is the consolidated opinion of officers familiar with war-time ammunition supply. The justification is "combat experience".

#### CHAPTER 2

##### AMMUNITION HAULING VEHICLES

###### SECTION 1

1

###### AMMUNITION RESUPPLY VEHICLES

83. The Combat Test of Ammunition Supply Vehicles was comprehensive. It included operation when supply runs were short and operation when supply runs were extremely long. It included operation over hard-surfaced, well-maintained, wide highways and operation over narrow muddy, icy, practically impassible roads. Of the trailers tested, the ammunition trailer M10 was used in quantity during the entire campaign; the ammunition trailers M21 and M23 were used on a much more limited scale from December 1944 to May 1945.

84. Trailers for Ammunition Resupply had many deficiencies in common. These included:

- a. Reduction in the maneuverability of the towing vehicle;
- b. Reduction in the speed of the towing vehicle;
- c. Poor flotation;
- d. Difficulty of manhandling.

In addition to these deficiencies the ammunition trailer M10 was charged with having limited ammunition capacity, with being too short for heavy calibre charges, and with mechanical defects (notably a weak drawbar and lunette assembly and the lack of a positive lock for the landing wheel). The ammunition trailer M23 had one deficiency not equally chargeable to the rest: its width (103.5 inches) made it a constant threat to temporary bridges on supply routes.

35. Use of Tractors for Ammunition Resupply in combination with trailers added to the deficiencies inherent in the trailers themselves. Additional deficiencies noted were:

- a. Excessive gasoline consumption;
- b. Magnification of traffic problems due to extremely reduced speed;
- c. Magnification of road maintenance problems;
- d. Actual inability on icy roads;
- e. Excessive tractor maintenance problems.

36. Cargo Carriers for Ammunition Resupply for self-propelled artillery can be charged (to a somewhat smaller extent) with all the deficiencies charged to tractors in paragraph 35, above.

37. Ammunition Frames were discarded by lost units after short periods of use. In addition to making a vehicle a special purpose vehicle, use of the frames gave little added protection to the ammunition at the cost of increased weight, reduced cargo space, and increased difficulty of loading and unloading.

38. Summary. The tractor-trailer combination was completely unsatisfactory both from the standpoint of the towed and the towing vehicle. Trailer deficiencies themselves made the truck-trailer combination undesirable. The most satisfactory solution (and one used extensively) was resupply entirely by truck, preferably the 2½-ton cargo truck. Ammunition frames were unnecessary and undesirable.

## SECTION 2

### TRANSPORTATION FOR BASIC LOADS<sup>1</sup>

39. Trailers as Transportation for Basic Loads have one great advantage: they present a ready means of increasing the ammunition capacity of the firing battery by use of already present motive power, fifth section\* trucks or tractors. Furthermore, the disadvantages of the trailer are greatly diminished when its use is limited to basic load haulage. It is no longer continually on the move. This reduces to a great degree the traffic jams, the broken bridges, the torn-up road, the clogged ammunition supply points, and the excessive gasoline consumption which accompany trailer ammunition resupply.

90. The Trailer Ammunition MLO, despite the increased advantages listed in Paragraph 39, is unsatisfactory even for transportation of basic loads. The one-ton cargo trailer, also an item of issue to field artillery units, has better riding characteristics, is lighter and yet has greater cargo space. Some artillery units used it to haul ammunition. It outperformed the ammunition trailer MLO

\* For 3-inch gun batteries and 240mm howitzer batteries, third section rather than fifth section.

under similar conditions of weather and terrain. The one-ton cargo trailer should be satisfactory for transportation of basic loads.

91. Transportation of Basic Loads for Self-Propelled Artillery was attempted by half-track car, by trailers, and by the cargo carrier M30. Desirable characteristics for vehicles for this purpose are armor protection and mobility equal to the self-propelled artillery it accompanies. The half-track which lacked both characteristics was unsatisfactory. The use of trailers behind the Howitzer Motor Carriage M7 reduced the mobility of the towing vehicle too greatly. The cargo carrier M30 as a carrier of basic loads was satisfactory.

92. Summation. For towed artillery, trailers were satisfactory vehicles for transportation of basic loads (assuming the substitution of the one-ton cargo trailer for the unsatisfactory ammunition trailer M10). For self-propelled artillery, the only satisfactory vehicle was the cargo carrier M30.

### CHAPTER 3

#### FIELD ARTILLERY AMMUNITION

#### SUPPLY ORGANIZATION AND OPERATION

##### SECTION 1

##### ORGANIZATION<sup>2</sup>

93. The Ammunition Supply Organization Employed by field artillery units in the European Theater of Operations closely approximated that prescribed in present Tables of Organization and Equipment: light and medium battalions had battalion ammunition trains and firing battery fifth sections; heavy artillery had only firing battery fifth sections.\* The use of substitute equipment (notably trucks for tractors and trailers) introduced variations in organization, especially in that of heavy artillery.

94. The Supply Organization in Light and Medium Battalions, proved satisfactory. Most, but not all, battalions used ammunition train and fifth section vehicles interchangeably. The organization was flexible and efficient. There was no standard difference, and, apparently, no need for a difference, in the organization employed by divisional and non-divisional battalions.

95. The Supply Organization in Heavy Battalions was greatly influenced by the substitute equipment issued. Two different methods of organization were tried by battalions fortunate enough to have trucks substituted for tractors and trailers. One method was the present prescribed method: subdivision of ammunition hauling facilities between firing batteries; the second method was organization of a battalion ammunition train capable of subdivision into sections for attachment to firing batteries.

\* For 3-inch gun battalions and 240MM battalions third sections rather than fifth sections.

The second method had all the advantages of the first and, in addition, made possible central control when central control was feasible and desirable.

## SECTION 2

### OPERATION<sup>2</sup>

96. The Methods of Operation employed in field artillery ammunition supply were, with few exceptions, those prescribed in current War Department Field Manuals. The methods were the same for divisional and non-divisional units. Major variations to standard procedure and major weaknesses in standard procedure are described below.

97. Information on Ammunition Supply Point Stocks was frequently available only at the ammunition supply point itself. To save ammunition trains useless trips, most battalions were forced to employ one officer or non-commissioned officer as a roving reporter on the status of stocks in the nearest supply installations. Heavy battalions, not authorized an ammunition officer by Tables of Organization, were given an extra officer to meet this need. Those instances when the information was furnished by a higher echelon indicate that, every artillery headquarters from corps artillery down should, as standing operating procedure, provide the next lower echelon with up-to-date supply point stockage information.<sup>3</sup>

98. Information on Heavy Firing Programs was frequently late in arrival at the firing battery. The result, particularly at night, was a severe strain on ammunition handling facilities. Artillery headquarters should, but often did not, emphasize the necessity for providing firing batteries with an early estimate of the number and type of rounds to be fired.

99. Ammunition Records and Reports. Many battalions found it necessary to keep an ammunition train non-commissioned officer at the fire direction center. This non-commissioned officer was responsible for ammunition records and reports, for the determination of ammunition hauling requirements, and for the transmission of these requirements to the ammunition train commander. The system relieved the battalion commander and the fire direction personnel of all ammunition details and insured continuity of ammunition records and reports.

100. Use of Vehicles Other Than Ammunition Vehicles for ammunition resupply was limited to occasional use of the firing battery executive's truck. Use of prime movers and kitchen trucks was definitely avoided. These latter vehicles were not included in ammunition resupply plans.

101. Basic Loads were prescribed by individual armies. A theater basic load would have been more convenient in initial equipment of units. The basic load actually carried was all the ammunition a unit could transport, an amount which generally exceeded the prescribed basic load and an amount which ordinarily definitely exceeded vehicle rated tonnage capacity. The amounts varied with the weather, terrain, vehicle maintenance, and

operations. The percentages by type varied principally with operations. For separate loading ammunition extra fuzes, primers, and charges were necessary.

102. Ammunition Supply Points.<sup>3</sup> Round trip distances to ammunition supply points exceeded those expected. Normal round trip distances ranged from 50 to 125 miles, but in some cases stretched to 300 miles. Round trip time, a better gauge, averaged roughly eight hours. This was despite every effort by ordnance personnel to keep ammunition supplies close to the front. Artillery ammunition supply planning was forced to anticipate long hauls.

103. Packaging of Ammunition<sup>4</sup> was satisfactory. Preferred methods of packaging were: for fixed and semi-fixed rounds, two round in fiber containers packed in a wooden box; for separate loading projectiles, the metal rotating band cover; for separate loading powder charges, the metal container. The difficulty of removing frozen mud from separate loading projectiles made a covering for the entire projectile desirable. The markings on ammunition containers and on components not shipped in containers were indistinct and involved.

#### CHAPTER 4

#### AMMUNITION LOT SEGREGATION<sup>5</sup>

104. The Problem. Modern field artillery gunnery is largely based on the premise that, by observation of the place of fall of a few rounds, the artilleryman is able to predict the place of fall of many rounds. This premise is wholly accurate only so long as all rounds fired have the same ballistic characteristics. Unfortunately, the necessity of mass production prevents the close manufacturing tolerances which would guarantee to all ammunition (even of a single type) the same ballistic characteristics. Consequently, artillery ammunition is sub-divided into ammunition lots, each lot consisting of rounds with very similar firing qualities. In order to exploit to the fullest the capabilities of our field artillery gunnery, it is a necessity that the number of ammunition lots delivered to a single field artillery battalion be small and that the number of rounds per lot be large.

105. History. The problem of ammunition lot segregation was recognized by the European Theater of Operations and as shown in Paragraph 18 above, a pre-invasion solution was attempted. This solution failed. Thereafter, until November 1944 cross-beach unloading, the emphasis on moving ammunition tonnage forward, and frequently the small mixed lots received from the Zone of the Interior prevented any concerted effort to maintain ammunition lot integrity. The following tabulation is typical of the situation throughout this period. It shows the lots drawn at one ammunition supply point (Number 121, Depot 3) from 27 through 30 September.

Chart on following page.

<u>Field Artillery Battalion</u>	<u>Total Rounds drawn</u>	<u>Number of lots drawn</u>	<u>Average number of rounds per lot</u>
26 FA Bn	594	29	20.5
26 FA Bn	792	45	18.0
26 FA Bn	742	57	14.5
84 FA Bn	262	32	8.2
60 FA Bn	1076	36	29.9

In evaluating this tabulation contrast it with the stated 1st US Army Group requirement: delivery of 500 rounds of a single lot to a single battalion.

106. The Solution. The lot segregation problem starts in a factory in the Zone of the Interior and ends in a battery position at the front. A successful solution is possible only if every agency which helps move ammunition exerts continued, well directed efforts to maintain ammunition lot integrity. In November and December 1944, with the cooperation of the Zone of the Interior, the European Theater of Operations developed procedures to furnish field artillery ammunition by lot number and in sizable lots. The time lag from factory to gun and the previously mixed stocks prevented real results at battalion level before the end of the war. The system attempted is outlined below:

- a. Incoming ships contained segregated ammunition lots, with a maximum number of rounds per lot and a minimum number of lots per ship.
- b. An ordnance company (or detachment) supervised unloading operations to insure correct sorting by lots.
- c. All ammunition from a single ship was sent to a single depot.
- d. Communication Zone forward depots issued 105mm howitzer ammunition by lot number, separate loading ammunition charges by lot number, separate loading ammunition projectiles by weight zone.
- e. Armies attempted to send single lots received to a single ammunition supply point.

This intense, well planned campaign produced some improvement. However, the war ended before there was sufficient time for a thorough test of the system's ability to deliver ammunition by lot number to the guns.

107. Summation. Ammunition supply for field artillery must contemplate delivery to the field artillery battalion of ammunition in large lots segregated by lot number. Until the closing months of the war, the European Theater of Operations was unable to maintain ammunition lot integrity. The system finally adopted, the one outlined above, promised success but was never completely combat-proven.

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PART FOUR

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 1

CONCLUSIONS

108. Artillery Ammunition Supply and Requirements.

a. That most major items of artillery ammunition were in short supply on the continent from June 1944 to April 1945.

b. That artillery ammunition shortages were caused by:

- (1) Limited beach and port discharge, June to October 1944.
- (2) Over-extended, incompletely developed supply lines, September and October 1944.
- (3) Insufficient production in the Zone of the Interior, November 1944 to April 1945.

c. That artillery ammunition shortages contributed materially to lengthening the war.

d. That artillery ammunition shortages delayed and jeopardized minor operations.

e. That artillery ammunition shortages resulted in increased casualties.

f. That the best summary of opinion of the using arms and of the supplying services as to ammunition requirements for such a campaign is the European Theater of Operations Recommended Day of Supply, 3 March 1945. (See Paragraph 53, this study).

109. Command Control of Ammunition.

a. That, in a major campaign, every echelon must ration (or allocate\*) artillery ammunition.

b. That, initially, throughout all echelons, most personnel understood neither the necessity for ammunition rationing nor the basic principles of ammunition rationing.

\* Herein the words ration and allocate have been used interchangeably. The effect at the guns is similar.

- c. That rationing by restriction of expenditures at the army group level was not satisfactory.
- d. That rationing by restriction of expenditures was not attempted above the army group level.
- e. That rationing by a credit-forecast system proved effective at the army group level and above.
- f. That rationing through limitation of expenditures was satisfactory at army level and below.
- g. That, at any echelon, failure to forecast future supply prevented proper planning by the next lower echelon.
- h. That, at every echelon, any system of rationing which did not assure lower echelons the benefit of savings resulted in mutual distrust, in false expenditure reports, in illegal hoarding, in paper ammunition shortages, and above all, in wasteful use of available ammunition.
- i. That limitations on tactical ammunition reserves would have lessened artillery capabilities.
- j. That the proper unit of measure of administrative ammunition reserves was the maintenance day of supply.
- k. That the proper unit of measure for tactical planning was the unit of fire.

#### 110. Ammunition Hauling Vehicles.

- a. That trailers, tractors, and cargo carriers were definitely unsatisfactory for ammunition resupply.
- b. That trucks (particularly 2½-ton cargo trucks) were satisfactory for ammunition resupply.
- c. That trailers (to include one-ton cargo trailers substituted for ammunition trailers M10) were satisfactory transportation for a portion of the basic load of towed battalions.
- d. That the cargo carrier M30 was the only satisfactory ammunition vehicle for transportation of basic loads for self-propelled artillery.
- e. That ammunition frames were unnecessary and undesirable.

#### 111. Field Artillery Ammunition Supply Organization.

- a. That the most desirable ammunition resupply organization for all field artillery battalions was a battalion ammunition train divisible into battery sections and equipped with 2½-ton cargo trucks towing one-ton cargo trailers.

b. That the most desirable fifth section\* for towed battalions was one equipped with trucks large enough to function as emergency prime movers, and was one which included a spare standard prime mover towing an ammunition carrying trailer.

#### 112. Field Artillery Ammunition Supply Operation.

a. That every field artillery battalion needed a battalion ammunition officer.

b. That it was desirable to have, at fire direction center, an ammunition train sergeant charged with all ammunition supply matters.

c. That supply point stockage information was not properly disseminated to field artillery battalions.

d. That firing battery ammunition handling personnel were unnecessarily burdened by late receipt of heavy firing programs.

e. That the basic load actually carried in combat was above vehicle rated capacity and was usually determined by the battalion commander concerned.

f. That, from firing battery to ammunition supply point, the round trip distance was generally between 50 to 125 miles.

g. That the markings on ammunition containers and on components not shipped in containers were not sufficiently distinct and were not sufficiently simple.

h. That, for separate loading projectiles, an anti-mud covering would have been desirable.

#### 113. Ammunition Lot Segregation.

a. That artillery ammunition was usually issued in small lots and often in mixed lots.

b. That the ammunition lot integrity system adopted in the closing days of the war would, probably, have succeeded.

### CHAPTER 2

#### RECOMMENDATIONS

#### 114. Artillery Ammunition Supply and Requirements.

a. That the European Theater of Operations Recommended Day of Supply, 3 March 1945, be accepted as the best available estimate of the artillery ammunition requirements of a large-scale force engaged in a major campaign in Western or Central Europe. (See Paragraph 53, this study).

\* For 8-inch gun and 240mm howitzer battalions, third rather than fifth section.

b. That future logistical planning for any similar campaign be based on delivering from the factory to the gun sufficient ammunition to meet the requirement stated in subparagraph a, above.

115. Command Control of Ammunition.

a. That the necessity for command control of artillery ammunition by every echelon be accepted as inevitable in any major campaign.

b. That the basic principles of command control of ammunition and satisfactory methods of exercising that control be described in detail in pertinent War Department publications and in the courses of instruction of service schools and of the Command and General Staff School.

c. That the credit system of control be prescribed for army groups and higher echelons.

d. That control through limitation of expenditures be accepted as satisfactory for armies and lower echelons.

e. That the forecasting of future supply be emphasized as a necessary part of any system of artillery ammunition control.

f. That the right to accumulate savings be incorporated in any prescribed system of ammunition control.

g. That it be accepted doctrine that, within the limits of availability, a unit should not prescribe maximum limitations for the tactical ammunition reserves of its subordinate units.

h. That the unit of measure used in stating the administrative reserves of theaters, army groups, and armies be the daily maintenance supply rate.

i. That the unit of fire be retained as a unit of measure for tactical planning of armies, corps, and divisions.

116. Ammunition Supply Organization and Equipment.

a. That every field artillery battalion be authorized an ammunition train divisible into battery sections and equipped with 2½-ton cargo trucks towing one-ton cargo trailers.

b. That, for towed battalions, fifth sections\* be equipped with trucks large enough to act as emergency prime movers and include a standard prime mover towing an ammunition carrying trailer.

c. That the use of ammunition trailers be limited to transport of basic loads and that the one-ton cargo trailer replace the ammunition trailer M10.

\* For 8-inch gun and 240mm howitzer battalions, third rather than fifth section.

d. That, for self-propelled artillery, the fifth section be equipped with cargo carriers mounted on the same chassis as the gun or howitzer concerned.

e. That the use of ammunition frames be abandoned.

117. Field Artillery Ammunition Supply Operation.

a. That pertinent War Department publications and the course of instruction of the Ordnance and of the Field Artillery School emphasize the necessity for prompt dissemination of ammunition supply point information down to include field artillery battalions.

b. That the course of instruction of the Field Artillery School emphasize the necessity of providing firing batteries early estimates of expected heavy expenditures.

c. That it be accepted as doctrine that a basic load should be prescribed by a theater of operations but that authority to exceed this basic load as the operation dictates should be delegated to corps and division commanders.

d. That future artillery ammunition supply planning be based on the presumption that the round trip distance to an ammunition supply point will be from 50 to 125 miles.

e. That an anti-mud covering be developed for the protection of separate loading projectiles.

f. That there be developed and adopted a simplified, more distinct method of marking ammunition containers and ammunition components not shipped in containers.

118. Ammunition Lot Segregation. That the necessity for maintaining ammunition lot integrity and the methods of maintaining ammunition lot integrity be incorporated in pertinent War Department publications and in the course of instruction of the Ordnance and of the Field Artillery Schools.