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GUN MOUNT AMMUNITION UTILIZATION FEASIBILITY STUDY (U)

15 MAY 1963

NOL
UNITED STATES NAVAL ORDNANCE LABORATORY, WHITE OAK, MARYLAND

GUN MOUNT AMMUNITION UTILIZATION FEASIBILITY STUDY (U)

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ABSTRACT: This report is a compilation of current U. S. Army ammunition which could be utilized as a basis for development for new Naval Gun Mounts. Current standard and developmental Army ammunition for guns, howitzers, mortars and recoilless rifles of caliber 75mm through 280mm is included. Army projectiles including fuze interchangeability and environmental considerations for Naval usage are tabulated. Conclusions are offered regarding the applicability of the ammunition to future Naval Gun Mount usage. Certain rounds requiring special security clearance are omitted from this compilation.

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This report covers a Naval Ordnance Laboratory, White Oak study into Army ammunition having potential Naval application. This study was performed for the Bureau of Naval Weapons under WEPTASK RREN-ST-038/212/5/0000-00-000. Information for this report was obtained from several Army sources and the authors wish to acknowledge the assistance of personnel at Army Materiel Command Headquarters, Picatinny Arsenal, Aberdeen Proving Ground, and the University of Pittsburgh Ordnance Research Staff.

A preliminary copy of this report was forwarded to the Bureau of Naval Weapons as an enclosure to NOL letter KS:EHS:gs Ser 0587 of 29 March 1963. Known differences and revisions from the preliminary report of the Type Classification status of ammunition are reflected in Table I of this NOLTR.

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CONFIDENTIAL

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TABLES

GUN MOUNT AMMUNITION UTILIZATION FEASIBILITY STUDY

INTRODUCTION

1. The U. S. Naval Ordnance Laboratory, White Oak, was requested (by WEPTASK RREN-ST-038/212/5/0000-00-000) to "provide BUWEPS with a compilation of current U. S. Army ammunition which could be utilized as a basis for development for new Naval Gun Mounts." The WEPTASK specified that the study include 75-millimeter to 5-inch calibers but as the study progressed it became apparent that the additional effort to expand the study to 280 millimeters would be relatively minor. Therefore, for completeness, this compilation includes all current Army ammunition from 75 millimeter to 280 millimeter for guns, howitzers, mortars and recoilless rifles.

2. Sources of information for this study were primarily Army Technical Manuals (TM's) and Army Materiel Command (formerly Office Chief of Ordnance) Technical Information Reports (TIR's). In addition, conferences were held with personnel of Army Materiel Command Headquarters, Aberdeen Proving Ground, and Picatinny Arsenal. A bibliography of applicable TM's and TIR's is given in Appendix A.

Current Army Ammunition Status

3. Present day Army weapons are classified according to the following basic types:

a. Gun - A term generally applied to all fire arms but as a type of artillery it is a cannon with a relatively long barrel, low angle of fire, and high muzzle velocity. Present calibers are 75, 76, 90, 105, 120, 155, 165, 175 and 280 millimeter. In a special category is the 152-millimeter gun-launcher cannon (shillelagh system).

b. Howitzer - A cannon with a medium length barrel operating at a relatively high angle of fire and medium muzzle velocity. Present calibers are 105 and 155 millimeter and 8 inch.

c. Mortar - A cannon with a short barrel having a shorter range and a higher angle of fire than a Howitzer. Present calibers are 81 millimeter and 4.2 inch.

d. Recoilless Rifles - A type of gun designed to eliminate the rearward recoil force of firing. These weapons are light weight and primarily used as anti-tank weapons. Present calibers are 90, 106 and 120 millimeter.

In addition, some rocket launchers are capable of firing conventional projectiles but these weapons are unique and not considered a type of gun. Only the XM70E1, 115-millimeter weapon falls in this category and is included in this study.

4. Ammunition for the above weapons is classified into one of the following functionally descriptive categories:

HE - High explosive
HEP - High explosive plastic
HEAT - High explosive anti-tank (shaped charge)
WP - White phosphorus (smoke)
AP - Armor piercing (solid shot)
APC - Armor piercing capped (with heat-treated steel caps, some rounds contain small HE-filled cavities)
CAN - Canister
HVAP - High velocity, armor piercing
HVAP-DS - High velocity, armor piercing, discarding sabot
ILL - Illuminating
APDS - Armor piercing, discarding sabot
GB or VX - Nerve gas
HD or H - Mustard gas
LEAFLET - Propaganda
BEEHIVE - Anti-personnel
HEAT Multipurpose - HEAT, HE and WP
ATOMIC - Nuclear

In addition to the service ammunition listed above there are also several types of non-tactical ammunition. These include target practice ammunition, dummy ammunition, training ammunition, blank cartridges, etc. Only service-type ammunition has been included in this study.

5. For the purpose of recording the status of items of materiel from the standpoint of development and suitability for service use, items are type classified by appropriate ordnance technical committee action. Type classification provides a basis upon which to broadly judge the current qualitative adequacy of Army materiel and to plan and carry out its procurement, issue, maintenance and disposal. Items are authorized status in one of the following types:

a. Development category - materiel currently under development.

b. Limited-production type - (LP) - an item under development considered to be promising enough operationally to warrant initiating procurement and production prior to completion of development and adoption as a standard item.

c. Standard types - the standard types designate the items that have been adopted as suitable for U. S. Army use (or other agencies when the Army is the supply agency) which are acceptable as assets to meet operational requirements; are authorized for inclusion in equipment authorization documents; and are described in published adopted items lists. There may be more than one standard type or more than one item of any specific standard type to fulfill the same requirement. Standard types are

subdivided as follows:

(1) Standard A - the most advanced and satisfactory items currently available to fill operational requirements.

(2) Standard B (substitute standard) - items which have limited acceptability to fill operational requirements. These items are normally used and issued as substitutes for Standard A items.

(3) Standard C (limited standard) - items which have only marginal acceptability for operating requirements and are being forced out of the system as stocks of more adequate items become adequate to meet requirements.

d. Obsolete category - items which are no longer acceptable for U. S. Army use.

Normally, following a program of evaluation and acceptance, ammunition will go from the development status to Standard A status; as newer ammunition is developed and becomes Standard A, the older Standard A ammunition reverts to Standard B, then to Standard C, and finally obsolete.

6. To prevent any ammunition compilation from becoming unwieldy and because it would be of no interest for future Navy planning, all ammunition for weapons which are currently obsolete, of marginal acceptability by Army standards (Standard C), or for which development has been terminated without standardization has been omitted from subsequent tables. Weapons systems thereby removed from further consideration in this report are listed below so the reason for their omission will be understood.

a. All 75 mm Howitzers (Standard C or obsolete)

b. All 75 mm Recoilless Rifles (Standard C)

c. 75 mm Gun M3 (Standard C)

d. All 110 and 156 mm Howitzers (program terminated)

e. 105 mm Mortar (program terminated)

f. Also the development of the following specific weapons has been terminated: T-185E11 76 mm gun, T132E3 90 mm gun (shallow rifling), T-178 90 mm gun, T-140 105 mm gun, T-179 120 mm gun, T-180 155 mm gun, T-208 90 mm gun (smooth bore), T-210 105 mm gun (smooth bore).

Compilation of Current Army Ammunition

7. Current Standard A, B, and developmental ammunition is listed in Table I. The table is arranged according to weapon caliber and nomenclature for the applicable family of compatible ammunition. Since the weapons are

usually one component of a weapon system (i.e. 76 mm M32 gun used on M41 tank), the weapon system application is given for information. Ammunition is categorized as fixed, semi-fixed, or separate loading; and as Standard A, B, or developmental. Where available the ammunition weight, length, muzzle velocity and range are given for Standard A items. For fixed and semi-fixed ammunition the dimensions and weight of the projectile and complete cartridge are given, whereas for separate loading ammunition the projectile and charge are dimensioned separately. Nomenclature for fixed and semi-fixed ammunition is for the complete cartridge, whereas nomenclature for separate loading ammunition is for the projectile only. The 90 mm anti-aircraft guns M1 and M2 and the 120 mm anti-aircraft gun M1 are now Standard B. Since the ammunition is compatible with similar caliber weapons, these weapons are excluded from Table I and the ammunition is listed as Standard B for the appropriate similar weapons.

8. Table I is intended to be only a summary of current Army ammunition. The many characteristics and minor variables between various types and modifications of ammunition are quite extensive and such detail would detract from the overall conciseness and clarity of this report. Army ammunition is described in excellent detail in the TM's and TIR's referred to in Appendix A. No purpose is served by copying Army documents so only the current nomenclature and major characteristics are extracted, and the reader is referred to the appropriate Army literature for detailed information. Except in certain instances, only the family of ammunition (i.e. M313) is tabulated and current modifications (i.e. M313 A1, M313 B2 etc.) are not indicated. It is believed that to refer to specific mods as the latest may be misleading since changes are in continuous process and most mods are of a minor nature.

Fuze Interchangeability

9. Tables II A and II B are projectile-fuze interchangeability charts, cross referenced against Table I. Current fuzes for use with Standard A projectiles listed in Table I are listed. No Standard B or developmental fuzes are included on this chart. Fuzes shown on this chart are only those which are completely authorized for the projectiles shown and do not include any combat emergency-only type fuzes. As with projectiles, fuzes are covered completely in the TM's and TIR's referred to in Appendix A. This chart is only a summary of current applicable artillery and mortar fuzes.

Environmental Considerations

10. Personnel at Army Materiel Command, Aberdeen Proving Ground and Picatinny Arsenal were consulted to determine the environmental qualifications of the projectiles and fuzes listed in Tables I and II. There was a general lack of readily available environmental information for the specific projectiles and fuzes under consideration. Comments, with references to the appropriate TIR's, on the environmental qualifications of projectiles and fuzes as determined from the available data are listed in

Appendix B. Of course the Army ammunition is evaluated with the expected Army environmental conditions in view; however, it is believed that any Army ammunition that is Standard A would meet the majority of the Navy environmental qualifications. Before a projectile or fuze is adopted as Standard A, several hundred items are tested and the ability of the item to meet the Military Standard and JAN test specifications such as standard shocks, vibrations, temperatures, humidities, etc., is well demonstrated. It is therefore recommended that any projectile or fuze tentatively considered for Navy use be studied in more detail on a per case basis. If considered necessary for Navy certification, a small sample lot should be procured and subjected to certain specific tests to substantiate that any unique Navy environment which may possibly differ from Army environment is satisfied.

Conclusions

11. The following conclusions are offered for this study:

a. Complete data pertaining to Navy usage of Army ammunition are not available, making a definite "accept or reject" conclusion difficult. However, one logical conclusion is that only Standard A material should be considered for Navy application. If tentatively selected for consideration as Navy ammunition, any item must be studied in more detail for the purpose of substantiating qualifications within the Navy environment. An evaluation program should be conducted where necessary.

b. System compatibility of ammunition in a Navy weapon system must be demonstrated by tests. Caution must be exercised in converting ammunition from a single-loading Army weapon to a rapid-loading automatic Navy weapon.

c. Repackaging of ammunition will normally be required for the Navy stockpile-to-target sequence. This is a relatively minor consideration and should not affect the tactical aspects of Navy utilization of Army ammunition.

d. This report summarizes information currently available on Army projectiles, cartridges, and fuzes. Much specific and detailed information is available in the TM's, TIR's, and other publications referred to in Appendix A. These documents are continually being revised and updated, giving the latest current information on all ammunition under development and being standardized by the Army. Since 1954 a TIR has been prepared and maintained in a constant state of updating on all projectiles, cartridges, and fuzes under Army development. The Navy could best keep abreast of current Army ammunition developments by means of the appropriate TIR's as they are published since the information contained in this report will rapidly become obsolete as Army developments progress.

e. With judgment guided by anticipated Navy requirements, the following items are not recommended:

(1) All 75 mm ammunition. This is Standard B or lower and is rapidly being phased out of Army planning.

(2) All other Standard B or lower projectiles, cartridges or fuzes which are compatible with current Standard A weapon systems.

(3) Fuze M 520 A1. May not arm when used with a 155 mm Howitzer at the lowest charge in a worn tube. The fuze is sensitive to shock and friction. A pull wire provides safety during shipment and rough handling.

(4) Fuze M 514 A1. Will result in 50% failure of proximity functioning under the following circumstances: 155 mm gun and Howitzer at 55° elevation; 8-inch Howitzer at 50° elevation; 240 mm gun at 45° elevation.

(5) M 328 Smoke Shell for 4.2-inch Mortar. There is excessive pillaring and dissipation of the smoke with inadequate duration of screening. It is unsuitable in the extreme heat of the desert. It is unsuitable for aerial delivery because it is unsafe in case of a malfunctioning parachute.

12. Current Army ammunition developmental trends are as follows:

a. Projectiles - At the present time the principal effort is being exerted on the improvement of HE, HEAT, chemical and anti-personnel rounds.

b. Fillers for Projectiles - The current trends in the development of fillers for projectiles are to provide explosives with a higher rate of detonation and better stability at high temperatures than those used in World War II, and to improve all other fillers.

c. Combustible Cartridge Cases - Such cases have been developed for the 40 mm gun. Under developemnt are a fully combustible cartridge case and primer system for the T-384 105 mm HEAT round. Sufficient knowledge has been acquired to permit the design of a combustible cartridge case for any set of ballistic requirements. None have been standardized to date.

d. Fuzes - Numerous improvements in the design of fuzes have been made since World War II as the result of demands for better performance and because of the introduction of new rounds, particularly those with fin-stabilized projectiles. Fuzes have been made more sensitive, accurate, and versatile by application of new materials, new techniques and new mechanisms. Safety and environmental insensitivity have been improved. Standardization of contour, thread, ruggedness, etc., has been done where possible to make a single fuze applicable to an increased number of projectiles.

CALIBER	WEAPON	USE	APPLICATION	FIXED SEMI-F OR SEP LOADING	AMMUNITION (SEE NOTE 10) STANDARD A	STANDARD B	DEVELOPMENTAL	FOR STANDARD A AMMUNITION PROJECTILE LENGTH (IN.)	PROJECTILE WEIGHT (LBS)	CARTRIDGE (SEE NOTE 1) LENGTH (IN.)	CARTRIDGE WEIGHT (LBS.)	FOR STD. A AMMUNITION MUZZLE VELOCITY (FPS)	FOR STD. A AMMUNITION MAX RANGE (YDS)	REFERENCE
75 MM	M 35 GUN	ANTI-AIRCRAFT & TERRESTRIAL	SKY SWEEPER M51 AA GUN	F		M334 HE								TM9-1300-203 TIR CD-1 TIR CD-9
76 MM	M32(T91E3) M48 GUN	ANTI TANK	M41 TANK	F	M339 AP				14.56	32.89	27.32	3,200	16,080	
					M363 CANISTER			10.65	15.00	32.00	27.18		170 MAX LETHAL R	
					M352 HE (T64)			14.49	15.00	34.05	25.83	2,400	15,680	TM9-1300-203 TIR CD-5 TIR CD-7
					~~M319 HVAP~~ (X)			10.59	7.13	32.60	19.33	4,135	10,810	
					M331 HVAP-DS			8.95	8.22	30.88	20.72	4,125	23,630	
					M361 WP (T140)		T180 HEAT	14.46	15.71	34.05	25.82	2,400	16,070	
81 MM	M1, M29, & XM93 MORTAR (SEE NOTE 2)	TERRESTRIAL	INFANTRY	SF	M362A1 HE (T376)			20.798	7.20	20.798	9.42	800	3,897	
			T257E1 SELF PROPELLED MORTAR		~~M301 ILL~~	M301 ILL	(X)	22.48		22.48	10.71		2,300	
					M370 WP (T30E9)			20.767		20.767	9.34	870	4,500	
						M362 HE (T28E6) M43 HE								
						~~M56 HE~~	(X) XM374 HE							TM9-1300-205 TIR CD-6 TIR CD-7 TIR CD-9
							T214E2 ILL							
							XM375 WP							
							* UNDESIGNATED UNCONVENTIONAL ROUND							
90 MM	M36, M41, & M54 GUN (SEE NOTE 3)	ANTI TANK	M56 SELF PROPELLED GUN M47 TANK M48A2 TANK	F	M318 AP (T33)			14.18	24.18	37.11	44.97	2,800	21,400	
					M431 HEAT (T300E5A1)					33.74			NOTE 9	
					M71A1 HE			16.79	23.57	37.45	39.54	2,800	21,400	
					M377 CANISTER (T22)			11.05	23.24	33.74	41.61		200 MAX LETHAL R.	
					M313 WP				23.64	37.46	42.52	2,800	21,400	TM9-1300-203 TIR CD-5
						M82 APC								
						M336 CANISTER								
						~~M332 HVAP~~	(X)							
						M71 HE								
							T142 HEP							
90MM	M67 RECOILLESS RIFLE	ANTI TANK	INFANTRY	F	M371 HEAT (T249)		XM376 HEP	27.5	6.8	27.78	9.25	700	500	TB9-1300-204/1 TIR CD-5 TIR CD-7 TIR CD-9
105 MM	M68 GUN	ANTI TANK	M60 TANK	F	M392A1 APDS			12.75	33.0	41.0		4,850	NOTE 9	
					M393A1 HEP			24.8	37.0	45.0			" "	
					M456 HEAT (T384)								" "	TB9-1300-203/2 TB9-1300-234-10 TIR CD-5 TIR CD-9
						M392 APDS								
						M393 HEP								
							XM416 WP							

NOTES.
1. CARTRIDGE DIMENSIONS ARE FOR COMPLETE ROUND FOR FIXED AND SEMI FIXED AMMO, FOR CHARGE ONLY FOR SEPARATE LOADING AMMO.
2. FOR 81 MM MORTAR, RANGE VARIES WITH CHARGE. MAX RANGE IS FOR LARGEST CHARGE.
3. 90 MM GUNS M1, M2, M3 (AA) STD. B. MOST AMMUNITION USEABLE IN M41 AND M54 EXCEPT M71 HE WITH CERTAIN FUZES.
4. FOR 105 MM HOWITZER, RANGE VARIES WITH CHARGE. MAX RANGE IS FOR LARGEST CHARGE.
5. FOR 107 MM MORTAR, RANGE VARIES WITH CHARGE. MAX RANGE IS FOR LARGEST CHARGE.
6. ROTATING BAND NARROW FOR 155 MM HOWITZER, AMMO. CAN BE USED IN GUN WITH BASE CHARGE ONLY. ROTATING BAND WIDE FOR 155 MM GUN, AMMO. CANNOT BE USED IN HOWITZER.
7. FOR 155 MM & LARGER, PROPELLING CHARGE IS IN CLOTH BAGS, NO METAL CASE. RANGE VARIES WITH CHARGE, MAX RANGE IS FOR LARGEST CHARGE.
8. CERTAIN ROUNDS REQUIRING SPECIAL SECURITY CLEARANCE ARE OMITTED FROM THIS TABLE.
9. MAX. RANGE NOT APPLICABLE FOR MOST ANTI-TANK ROUNDS. MAX. EFF. R. AGAINST ARMY TARGETS IS APPROX. 2,000 YDS.
(NOTES CONTINUED ON SHEET 2)

TABLE I COMPILATION OF ARMY AMMUNITION

CALIBER	WEAPON	USE	APPLICATION	AMMUNITION TYPE CLASSIFICATION (SEE NOTE 10) FIXED SEMI-F. OR SEP. LOADING	STANDARD A	STANDARD B	DEVELOPMENTAL	FOR STANDARD A AMMUNITION PROJECTILE LENGTH (IN.)	PROJECTILE WEIGHT (LBS.)	CARTRIDGE SEE NOTE 1 LENGTH (IN.)	CARTRIDGE WEIGHT (LBS.)	FOR STD. A AMMUNITION MUZZLE VELOCITY (FPS)	FOR STD A AMMUNITION MAX RANGE (YDS)	REFERENCE
105 MM	M2, M4, M49 AND XM103E3* HOWITZER *FOR XM103E3 HOWITZER ONLY UNLESS CHARGE IS REDUCED (SEE NOTE 4)	ARTILLERY	M52A1 SELF PROPELLED HOWITZER	SF	*M442 HE (T388)	- - -	- - -	-	-	-	-	2,225	16,100	
			T195 SP HOWITZER		M360 GB	- - -	- - -	- - -	35.59	31.48	43.86	1,550	12,330	
			XM104 SP HOWITZER		M60 GAS	- - -	- - -	19.51	33.94	31.10	42.92	1,550	12,330	
			M101A1 TOWED HOWITZER		M84 SMOKE	- - -	- - -	18.84	32.86	30.49	41.93	1,550	12,330	
			XM102 TOWED HOWITZER		M60 SMOKE	- - -	- - -	19.51	34.83	31.10	43.81	1,550	12,330	
					M84 LEAFLET	- - -	- - -	18.84	32.86	30.19	41.93	1,550	12,330	
				F	M327 HEP	- - -	- - -	- - -	23.38	- -	—	1,550	12,330	
					M314 (ILL)	M1 HE ~~M314A2 (ILL)~~ M67 HEAT	(*) *XM380 (BEE HIVE) T151 SERIES (HEAT) *XM427 WP *XM461 HEAT *XM482 HE *XM447 ILL *XM448 WP	- - -	36.55	- -	- -	1,550	12,330	TM9-1300-203 TIR CD-6 TIR CD-9
106MM	M40 RECOILLESS RIFLE	ANTI TANK	M50 SELF PROPELLED MULTIPLE RIFLE	F	M346 HEP	- - -	- - -	- - -	17.55	39.31	37.93	1635	NOTE 9	
					M344 HEAT (T119)	~~M344 HEAT (T119)~~ M345 HEP (T139) M341 HEAT (T184E13)	(*)		17.55	39.31	36.2	1650	"	TM9-1300-204 TIR CD-5 TIR CD-9
107 MM (4.2 IN.)	M30 AND XM95* MORTAR (SEE NOTE 5) *FOR XM95 MORTAR ONLY UNLESS CHARGE IS REDUCED	TERRESTRIAL	M84 SELF PROPELLED MORTAR	SF	M329 HE	- - -	- - -	25.77		25.77	27.07	960	5931	
			XM106 SELF PROPELLED MORTAR		M328WP	- - -	- - -	25.77		25.77	28.66	960	5931	
			INFANTRY		M335 ILL	- - -	- - -	25.7		25.7	26.0	931	5272	
						M2A1 GAS M328A1 WP M3 HE M2 WP	*UNDESIGNATED UNCONVENTIONAL HE AND GAS							TM9-1300-205 TIR CD-6 TIR CD-7 TIR CD-9
115 MM	XM70E1 TOWED ROCKET LAUNCHER	ARTILLERY	MARINES				XM54 HE BOOSTED ROCKET XM378 HE PROJECTILE							TIR CD-6
120MM	XM 105 RECOILLESS RIFLE	ANTI TANK		F			XM 419 HEAT							TIR CD-5 TIR CD-7

NOTES (CON'D)

10. KNOWN DIFFERENCES FROM PRELIMINARY REPORT OF TYPE CLASSIFICATION ARE SHOWN BY CORRECTION (*)

M319 HVAP NO LONGER STANDARD
M301 ILL NOW STD. B
M 54 HE NOW STD. C
M332 HVAP NOW STD. C
M314 ILL NOW STD. A
M344 HEAT NOW STD. A

TABLE I COMPILATION OF ARMY AMMUNITION

CONFIDENTIAL					AMMUNITION			FOR STANDARD A AMMUNITION				FOR STD. A AMMUNITION	FOR STD. A AMMUNITION	
					TYPE CLASSIFICATION (SEE NOTE 10)			PROJECTILE		CARTRIDGE SEE NOTE 1				
CALIBER	WEAPON	USE	APPLICATION	FIXED SEMI-F OR SEP LOADING	STANDARD A	STANDARD B	DEVELOPMENTAL	LENGTH (IN.)	WEIGHT (LBS)	LENGTH (IN.)	WEIGHT (LBS.)	MUZZLE VELOCITY (FPS)	MAX RANGE (YDS)	REFERENCE
120MM	M58 GUN *STANDARD AMMUNITION FOR M1AA GUN BUT CAN ALSO BE FIRED FROM M58 GUN	ANTI TANK	M103 TANK	SEP	M356 HE (T15E3)	------	------	29.02	50.41	34.75	38.74	2,500	19,910	
					M357 WP (T16E4)	------	------	29.02	50.41	34.75	38.74	2,500	19,910	TM9-1300-203 TIR CD-5 TIR CD-9
					M358 AP (T116)	------	------	17.82	50.85	34.69	56.46	3,500	25,290	
					M469 HEAT (T153)	------	------	------	------	------	------	------	NOTE 9	
						*M73 HE								
152 MM	XM 81 GUN-LAUNCHER CANNON		SHILLELAGH				XM13 GUIDED MISSLE							TIR CD-3 TIR CD-5
							XM409 HEAT MULTIPURPOSE							
							XM410 WP							
155 MM	M1, M45, *T255 AND *T258 HOWITZER (SEE NOTE 6) *FOR T255 AND T258 ONLY UNLESS CHARGE IS REDUCED	ARTILLERY	M44, XM62 AND T196 SELF PROPELLED HOWITZERS M114 TOWED HOWITZER	SEP (SEE NOTE 7)	M107 HE	------	------	27.57	95.75	21.0	13.65	1,850	16,355	
					M110 GAS	------	------	27.57	98.49	21.0	13.65	1,850	16,355	
					M110 SMOKE	------	------	27.57	97.50	21.0	13.65	1,850	16,355	
					M121A1 GB&VX	------	------	27.57	99.70	21.0	13.65	1,850	16,355	
					*M470 HE (T387)	------	------	33.0	----	----	----	----	19,700	TM9-1300-203 TIR CD-6 TIR CD-9
						M116 SMOKE								
						M118A2 ILL								
						M121 GB								
							*XM396 BEE HIVE							
							T72E2 ILL							
155 MM	M2 AND M46 GUN (SEE NOTE 6)	ARTILLERY	M53 AND T245 SELF PROPELLED GUNS M59 TOWED GUN	SEP (SEE NOTE 7)		M101 HE								
						M122 GB								
						M104 GAS								
						M116 SMOKE								TM9-1300-203 TIR CD-6 TIR CD-9
						M118A2 BI ILL								
						M104 WP								
165 MM	M57 (T15G) GUN	DEMOLITION	M102 COMBAT ENGINEER VEHICLE	SEP (SEE NOTE 7)	M123 HEP	------	------	------	------	------	------	------	1,000	TM9-1300-203 TIR CD-2
175 MM	M113 (T25G) GUN	ARTILLERY	M107 (T235) SELF PROPELLED GUN	SEP (SEE NOTE 7)	M437 HE (T203E9)	------	------	37.5	147.	49.50	55.0	3,000	36,500	TM9-1300-203 TIR CD-6 TIR CD-9
							T204 WP							
8 INCH	M2 AND M47 HOWITZER	ARTILLERY	M55 AND M110 (T236) SELF PROPELLED HOWITZERS M115 TOWED HOWITZER	SEP (SEE NOTE 7)	M106 HE	------	------	34.35	200.	24.0	28.3	1,950	18,510	
					M426 GB OR VX (T174E2)	------	------	34.35	200	24.0	28.3	1,950	18,510	TM9-1300-203 TIR CD-6 TIR CD-9
					M422 ATOMIC									
280MM	M65 GUN	ARTILLERY	M65 MOTORIZED GUN	SEP (SEE NOTE 7)	M129 HE	------	------	52.93	600	75.0	158.	2,500	31,400	TM9-1300-203 TIR CD-6 TIR CD-9
					M366 ATOMIC									

TABLE I COMPILATION OF ARMY AMMUNITION

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TABLE II A

ARTILLERY AUTHORIZED FUZES

Weapon	Cartridge or Projectile	PD	PD-CP	VT	MT	TSQ	MTSQ	BD	PIBD	Reference*
76 MM Gun	M352	M48 M51 M535	M78	-	M67	-	M500 M520 -	-	-	
	M361	M48 M57	-	-	-	-	-	-	-	
90 MM Gun	M71A1 M313	M51 M48 M57 -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	
	M431	-	-	-	-	-	-	-	M509 M530	TIR CD-9
90 MM Rifle	M371								M530	TB9-1300-204/1
105 MM Gun	M393 M456	-	-	-	-	-	-	M534	M509 M530	TIR CD-9
105 MM How	M360 M60	M508 M51 M508 M535 M57								
	M84 M327	-	-	-	-	M54 -	M501 -	M62 M91		
	M1	M51 M535	M78 -	M513 -	M67 -	M55 -	M500 M520			
	M314 M442	M507 M535		M513		M54	M501 M520			TIR CD-9
106 MM Rifle	M346 M344							M91	M509	TM 9-1300-204 TM 9-1300-204
120 MM Gun	M356	M51 M535	M78			M55	M500 M520			
	M357	M48 M51 M508 M535								
	M469	- -	- -	- -	- -	- -	- -	- -	M509 M530	TIR CD-9
155 MM How	M107	M51 M535	M78	M514	M67	M55	M500 M520			
	M110	M51 M508 M535 M57			M67					
	M121A1 M470	M508 M507 M535		M514			M520			TIR CD-9
165 MM Gun	M123							M62 M91		
175 MM Gun	M437	M535 M51	M78	M514	M67	M55	M520 M500			
8 In. How	M106	M51 M535	M78	M514	M67	M55	M520 M500			
	M426	M508								
280 MM Gun	M124	M535	M78	M514	M67	M55	M520			

* Reference - TM9-1300-203 unless noted
PD-Point Detonating
PD-CP Point Detonating - concrete piercing
VT-Variable time (proximity)
MT-Mechanical Time
TSQ-Time and super quick
MTSQ-Mechanical Time and super quick
BD-Base detonating
PIBD-Point initiating base detonating

TABLE IIB

FUZE INTERCHANGEABILITY CHART - MORTAR AMMUNITION

X - Authorized Fuzes		Mechanical Time and Superquick			Point Detonating					Proximity	
Cannon	Cartridge	M500 Series	M501 Series	M520	M51A5	M521	M524 Series	M526	M535	M513 Series	M517 Series
81mm Mortar M1, M29 and XM93	HE M362 Series						X	X			X
	Smoke WP M370						X	X			X
4.2-inch Mortar M30 and XM95	HE M329	X		X	X				X	X	
	Illuminating M335		X								
	Smoke M328					X					

Bibliography

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2. Department of the Army Technical Manual TM9-1300-203; Ammunition for Anti-aircraft, Tank, Anti-tank, and Field Artillery Weapons

3. Department of the Army Technical Bulletin TB9-1300-203/1; Assembly of Explosive Components; GB and VX Projectiles

4. TB 9-1300-203/2; Cartridge, 105mm: HEP, M393 and M393A1

5. TB 9-1300-234-10; Cartridge, 105mm: APDS, M392 and M392A1

6. TM 9-1300-204; Ammunition for Recoilless Rifles

7. TB 9-1300-204/1; Cartridge, 90mm: HEAT, M371

8. TM 9-1300-205; Ammunition for Mortars

9. TM 9-1900; Ammunition, General

10. TM 9-3305-1; Principles of Artillery Weapons

11. TM 9-500; Ordnance Corp Equipment Data Sheets

12. TB 9-AMM 2 Ammunition: Restricted or Suspended

13. (CONF) Army Materiel Command Technical Information Report B(14); List of Technical Information Reports (U)

14. TIR A (2); Classification System for Technical Information Reports

15. (SECRET) TIR CD-1 and CD-1 Supplement 1; Air Defense Weapons (U)

16. (SECRET) TIR CD-2 and CD-2 Supplement 1; Combat Vehicles (U)

17. (SECRET) TIR CD-5 and CD-5 Supplement 1; Anti-tank Weapons (U)

18. (SECRET) TIR CD-6; Conventional Artillery Weapons (U)

19. (SECRET) TIR CD-7 and CD-7 Supplement 1; Infantry Weapons (U)

20. (SECRET) TIR CD-9 and CD-9 Supplement 1; Conventional Artillery Ammunition (U)

21. (CONF) TIR S (24); Developmental items Classified Standard, Substitute Standard, or Limited Standard Since April 1954 (U)

Appendix A

22. (CONF) TIR X (24); Developmental Items Terminated Since April 1954 (U)

23. (CONF) TIR Z (7); Subject Index of Published Technical Information Reports (U)

24. TIR-6 series; Artillery Ammunition (approximately 49 reports)

25. TIR-8 series; Fuzing Devices (approximately 41 reports)

26. Department of the Army Supply Bulletin SB9-122; Ordnance Corp, Adopted Items of Materiel

27. (CONF) SB9-176; Ordnance Corp, Type Classified Materiel (U)

28. Ammunition Complete Round Chart, Department of the Army; prepared by Picatinny Arsenal, Dover, New Jersey

29. Department of the Army, Army Regulations AR 700-20; Logistics (general), Type Classification of Materiel

30. Ordnance Proof Manual ORD-M608-PM, Vol 1 - Arms and Ammunition Testing, Vol 2 - Automotive Testing, Vol 3 - Small Arms Testing, Vol 4 - Ordnance Instrumentation; Distributed by Development and Proof Services, Aberdeen Proving Ground; request must be approved by Army Materiel Command.

31. Department of the Army Phamplet No. 310-3; Military Publications, Index of Training Publications (includes Field Manuals, Firing Tables, and Trajectory Charts)

Appendix B

Comments on Environmental Qualifications of Fuzes and Projectiles

1. Fuzes

Item - Fuze M 530 (T278E7)

TIR - 8-1-5A5(3)(C)

Pertinent information - Operability satisfactory against armor. Operable on graze impact with T-300 cartridge. Functioned with other cartridges after ricochet impact. Safe and operable after parachute delivery. Safe with malfunctioning parachute. Passed jolt, jumble, drop, transportation vibration, and temperature and humidity tests. Operable at temperatures from -40°F to +125°F. Bore safe.

Item - Fuze M 508A1 PD

TIR - 8-1-3A8(2)(U)

Pertinent information - Functioned on ground impact when tested in 4.2-inch mortar. Functioned against 0.02-inch aluminum when tested in 155 mm gun. Bore safe. Operable hot, cold and ambient. Area of concern: Do not use in rain or falling snow.

Item - Fuze M 535 (T177E3) PD

TIR - 8-1-3A1(2)

Pertinent information - Replaces M 51A5. Minimum arming delay 40-100 feet, except for antiaircraft rounds. Area of concern: Arming delay is 25-50 feet with antiaircraft 75 and 90 mm ammunition. Not Standard A with antiaircraft ammunition.

Item - Fuze M 513A2 (T226E3)

TIR - 8-1-7A4 (3)(C)

Pertinent information: VT with PD backup. Operable -40°F to +160°F Area of concern: Susceptible to jamming.

Item - Fuze M 514A1 (T227E3)

TIR - 8-1-7A5(2)(C)

Pertinent information - VT with impact firing backup. Operable at 0°F to +120°F. Area of concern: Will result in 50% failure of proximity functioning under the following circumstances; 155 mm howitzer and gun at 55° elevation, 8-inch howitzer at 50° elevation, 240 mm gun at 45° elevation.

Item - Fuze M 520A1 (T288E1) MTSQ

TIR - 8-1-1B8(2)(U)

Pertinent information - Contains booster M125A1 (an auxiliary detonating fuze). Areas of concern: Spin of 2000 rpm necessary for arming may not be obtained in a 155 mm howitzer at lowest charge in a worn tube. A pull wire provides safety during shipment and rough handling. The fuze is sensitive to shock and friction and must be properly packaged.

Item - Fuze M 534A1 (M534E3) BD

TIR - 8-1-4A5(1)(C)

Pertinent information - Has graze functioning feature. Fuze functioning at low angles satisfactory. Should it not function at a low angle, it may function on a subsequent impact.

Item - Fuze M 521 (T247) PD

TIR - 8-1-3A11(2)(U)

Pertinent information - Mortar fuze. Superquick or 0.05-second delay. To be used with 4.2-inch chemical shell M 328. Satisfactory cold and ambient. Areas of concern: Not satisfactory hot. Cannot be dropped safely by parachute. High percent duds when fired with 75 mm T 262 chemical shell.

Item - Fuze M 524 (T186E11) PD

TIR - 8-1-3A24(2)(U)

Pertinent information - Mortar fuze. Superquick or delay. Safe for parachute delivery. Temperature limits -40°F to +160°F. Passed jolt and jumble tests. Areas of concern: Pull wire for safety in storage and transportation. Not moisture-proof.

Item - Fuze M 535 (T177E3) PD

TIR - 8-1-3A1(2)(U)

Pertinent information - Mortar fuze. Superquick or with 0.05-second delay. Waterproof. Has graze impact capability.

2. Cartridges or Projectiles

Item - M 352A1 HE-T

TIR - 6-6-7A1(2)

Appendix B

Pertinent information - 76 mm gun. Passed accuracy tests at ambient temperature.

Item - M 361A1, Smoke, WP

TIR - 6-6-8A1(6)

Pertinent information - 76 mm gun. Accuracy satisfactory at ambient and -40°F from new and worn tube. Reliability satisfactory. Dispersion satisfactory. Satisfactory after rough handling and cross-country hauling.

Item - M 360, Gas, GB

TIR - 6-9-8A2

Pertinent information - 105 mm Howitzer. Report dated November 1954. User tests show satisfactory results.

Item - M 393 HEP-T

TIR - 6-9-6A5(1)(S)

Pertinent information - 105 mm gun. No test results given. M 393 is standard B. M 393A1 is Standard A.

Item - M 356 HE-T (T15E3)

TIR - 6-12-7A1(2)(U)

Pertinent information - 120 mm gun. Separated ammunition. Used with M 45 propelling charge. User tests satisfactory.

Item - M 121, Gas, GB

TIR - 6-14-8A2(2)(C)

Pertinent information - 155 mm howitzer. M 121A1 is Standard A. Can be parachute delivered. Works well in temperate zone and arctic.

Item - M 124 HE

TIR - 6-19-7A1(1)(C)

Pertinent information - 280 mm gun. Separate loading with M 43 bagged propelling charge. Area of concern: Neither the M 124 (forged) nor the M 124A1 (cast) will defeat a 6-foot concrete wall.

Appendix B

Item - M 370, Smoke, WP

TIR - 6-7-8A1(1)(C)

Pertinent information - 81 mm mortar. No test results.

Item - M 329 HE (E85R7)

TIR - 6-10-7A1(1)(C)

Pertinent information - 4.2-inch mortar. Recommended use of comp B as the filler instead of TNT.

Item - M 328 (E84R7) Smoke

TIR - 6-10-8A1(1)(U)

Pertinent information - 4.2-inch mortar. Areas of concern: Excessive pillaring and dissipation of the smoke with inadequate duration of screening; unsuitability under extreme heat of desert; unsuitable for aerial delivery because unsafe in case of a malfunctioning parachute.

Item - M 371 (T289E6) HEAT

TIR - 6-8-5A3(3)(C)

Pertinent information - 90 mm recoilless rifle. Area of concern: Did not meet requirement of defeating six-inch armor at 64° obliquity 90% of the time.

Item - M 392A1 APDS

TIR - 6-9-1A3(2)(S)

Pertinent information - 105 mm gun. Service tests satisfactory.

Item - M 456 (T384E4) HEAT

TIR - 6-9-5A7(3)(C)

Pertinent information - 105 mm gun. Target operability satisfactory. Standard A in temperate climates. Summer and winter environmental tests to be conducted.

Item - M 442 (T388) HE

TIR - 6-9-7A12(1)(C)

Pertinent information - 105 mm Howitzer. No test results.

Appendix B

Item - M 358 (T116E7) AP

TIR - 6-12-1A1(3)(C)

Pertinent information - 120 mm gun. Ballistic acceptance tests satisfactory.

Notes

1. Fuze M 535 PD replaces Fuze M 51A5, except for 75 and 90 mm AA ammo (TIR 8-1-3A1(2)).

2. M 525 Fuze standard C - TIR 8-1-3A21(3)(U)

3. M 526 Fuze standard B - TIR 8-1-3A21(2)

4. M 527 Fuze standard C - TIR 8-1-3A21(2)

5. 81 mm mortar smoke shell M 57 - standard C - TIR 6-7-8A1(1)(C)

6. Fuze M77 - standard C - TIR 6-7-8A1(1)(C)

7. 4.2 inch mortar chemical shell M2 - standard B - TIR 6-10-8A1(1)(U)

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SUBJECT ANALYSIS OF REPORT

DESCRIPTORS	CODES	DESCRIPTORS	CODES	DESCRIPTORS	CODES
Guns	GUNS	Fuze	FUZE		
Mount	MOUT	Compatibility	CMPB		
Ammunition	AMMU	Environment	ENVI		
Utilization	USAG				
Feasibility	FEAS				
Army	ARMY				
Navy	NAVA				
Howitzers	HOWI				
Mortars	MORT				
Recoilless	RCOL				
Rifles	RIFL				
Projectiles	PROJ				

Naval Ordnance Laboratory, White Oak, Md.
(NOL technical report 63-115)
GUN MOUNT AMMUNITION UTILIZATION FEASIBILITY STUDY (U), by P. W. Naylor and L. J. Shkolnik. 15 May 1963. 6p. tables. BuWeps task RREN-ST-038/212/5/0000-00-000. CONFIDENTIAL

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3. Ammunition - Small arms
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III. Shkolnik, Leon J., jt. author
IV. Project

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