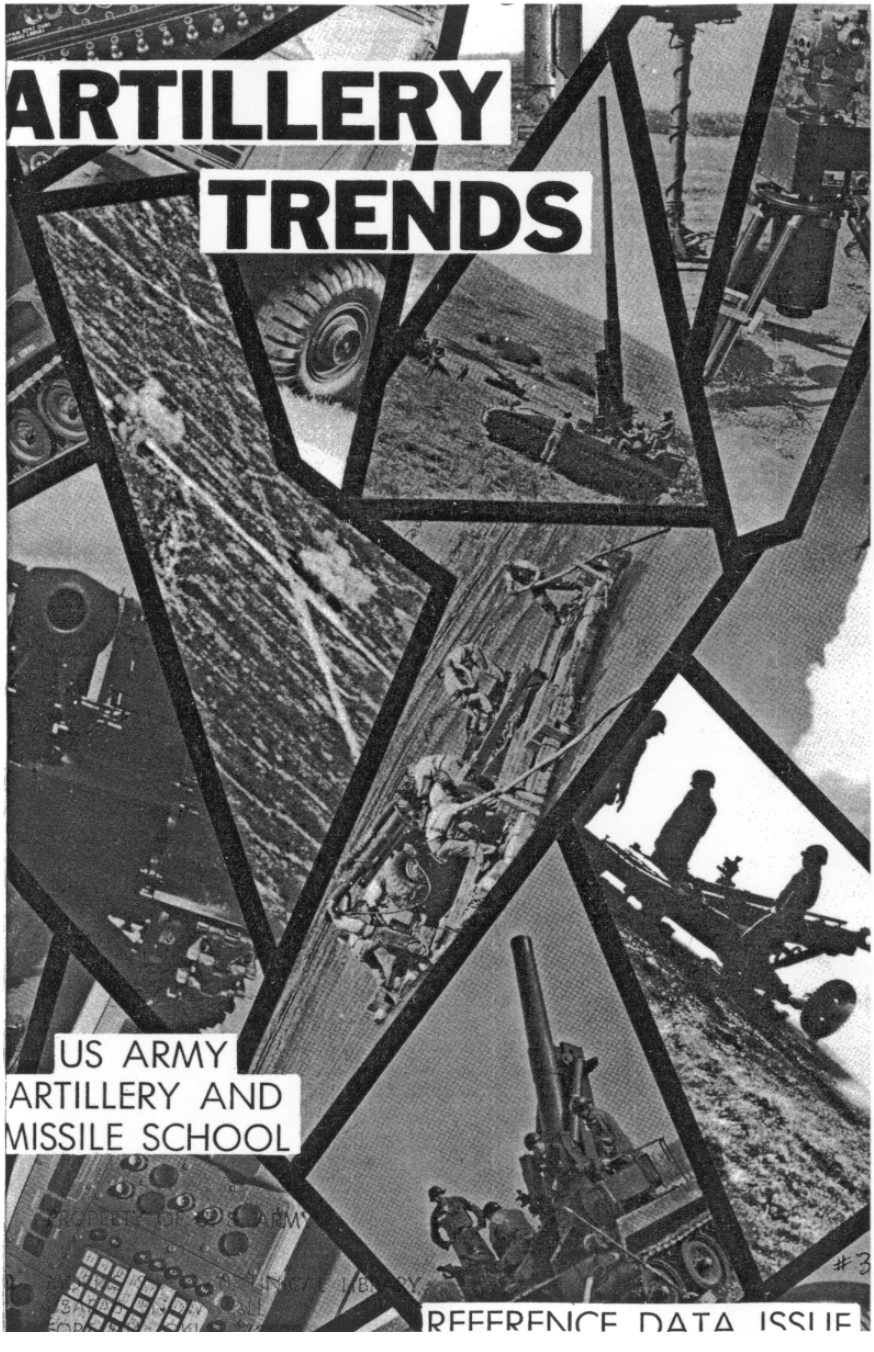
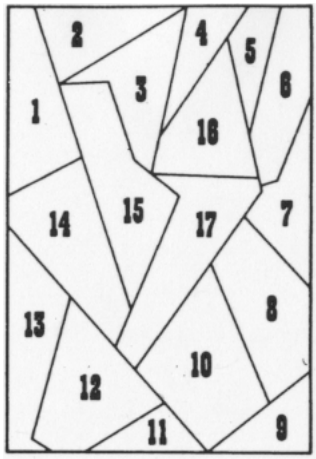

ARTILLERY
TRENDS
US ARMY
ARTILLERY AND
MISSILE SCHOOL
REFERENCE DATA ISSUE



1. AN/TRC-80 radio-transmitter
2. SB-22/PT switchboards, stacked
3. XM656 5-ton cargo truck
4. Infinity aiming reference collimator M1
5. AN/TPS-25A radar set
6. ABLE azimuth gyro
7. Pershing missile
8. M102 105-mm howitzer
9. Bore of M114A1 155-mm howitzer
10. M110 8-in SP howitzer
11. Laser rangefinder
12. FADAC computer
13. UH-1B helicopters
14. M109 155-mm SP howitzer
15. Bracket on crossroads
16. M107 175-mm SP gun
17. M101A1 105-mm howitzer on a raft

TABLE OF CONTENTS

INTRODUCTION

This issue of ARTILLERY TRENDS is special in nature, consisting of a ready reference consolidation of frequently-used field artillery data. It is not intended in this consolidation to replace other, more detailed reference books such as "Notes for the Battery Executive." Instead, we have extracted from such references and from pertinent field manuals that information which we feel is most useful in the broad analysis of the present day field artillery weapon systems. Where research requires the detailed investigation of any particular component of the weapon system, or of any particular phase of its organization or operations, it is recommended that all applicable publications be consulted.

The material contained represents the best information available at the time of publication. All readers and users of this handbook are invited to forward information concerning changes or suggestions for improvement of content and format to:

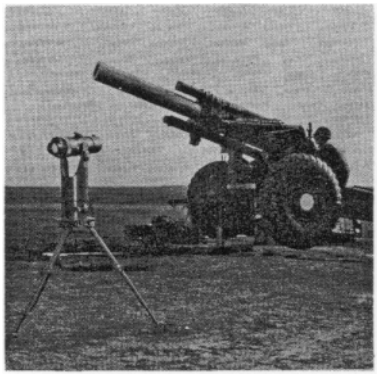
Commandant

U. S. Army Artillery and Missile School

ATTN: AKPSIAS-PL-AT

Fort Sill, Oklahoma 73503

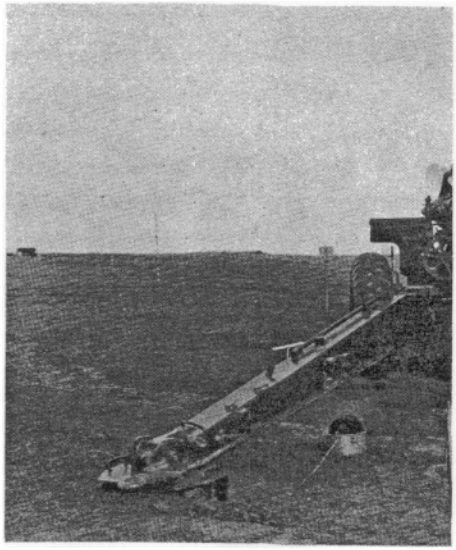
COLLIMATOR, INFINITY AIMING REFERENCE: M1



The new aiming reference for indirect laying of artillery weapons is the Infinity Aiming Reference Collimator M1. No longer does accuracy require that a cannoneer charge across the landscape to thrust his red and white striped Bengal Lances into the ground at intervals of 50 meters. Under the new procedure using the collimator, it is necessary only to position the instrument 12 to 48 feet from the weapon and align the illuminated reticle of the collimator with that of the panoramic telescope mounted on the weapon.

SECTION I
FIELD ARTILLERY EQUIPMENT

We're not saying outright that the Infinity Aiming Reference Collimator is scheduled to replace aiming posts. Nevertheless, it may be well to get acquainted with this useful device, as issue is presently being made to U.S. Army Artillery cannon and rocket units.



WEAPONS

TABLE IA. CANNON

Weapon	M116 75-mm Pack How	M101A1 105-mm How (Towed)	M102 105-mm How (Towed)	M52A1 105-mm How (SP)	M108 105-mm How (SP)
Maximum Range (meters)	8, 796	11, 000	11, 500	11, 000	11, 500
Traveling Weight (pounds)	1, 440	4, 980	3, 140	53, 000	46, 221
Air Transportability	Phase I	Phase I	Phase I	Phase III	Phase III
Traverse Limits (mils)	53 right and left of center	409 right and 400 left of center	6, 400	1066 right and left of center	6, 400
Elevation Limits (mils)	-89 to +800	-89 to +1156	-89 to +1333	-178 to +1156	-106 to +1333
Sustained Rate of Fire (rd per min)	2. 5	3	3	3	3
Water Crossing Capability	Floatable	Floatable	Floatable	Fordable (48 inches)	Amphibious (with kit)
Time to Emplace (minutes) (1)	7	3	4	1	1
Prime Mover	1/4-ton truck; Helicopter; Packs	2 1/2-ton truck; Helicopter; 3/4-ton truck (Abn Div)	3/4-ton truck; Helicopter	SP	SP
Using TOE	NA	6-155E 6-185E 6-405E 6-705T	6-215F 6-705T	6-345E 6-385E 6-465E	6-345E 6-385E 6-465E
Reference Manuals	FM 6-78 TM 9-319 FT 75-I-4 FT 75-I-4 (Abr)	FM 6-75 TM 9-3007 TM 9-325 FT 105-H-6 FT 105 ADD-B-1 FT 105 ADD-D-0	FM 6-70 TM 9-1015-234-12 FT 105-AS-2 FT 105 ADD-B-1	FM 6-77 TM 9-7204 FT 105-H-6 FT 105 ADD-B-1 FT 105 ADD-D-0	FM 6-79 TM 9-2350-217-10 FT 105-AS-2 FT 105 ADD-B-

(1) Time to emplace is that time required to emplace and lay single registering piece.

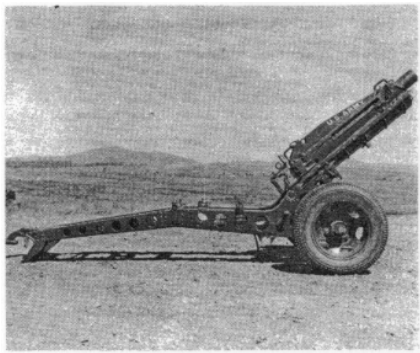


Figure 1. 75-mm How M116

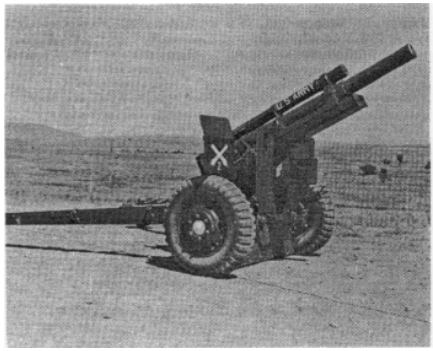


Figure 2. 105-mm How M101A1

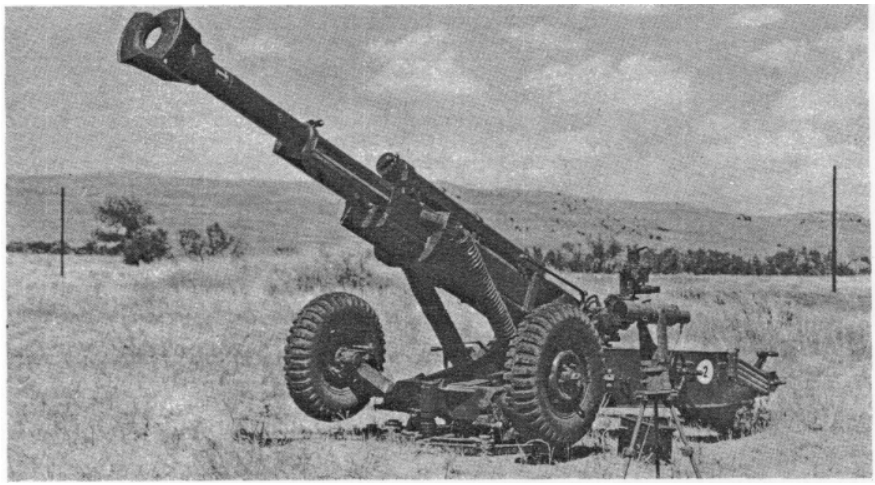


Figure 3. 105-mm How M102

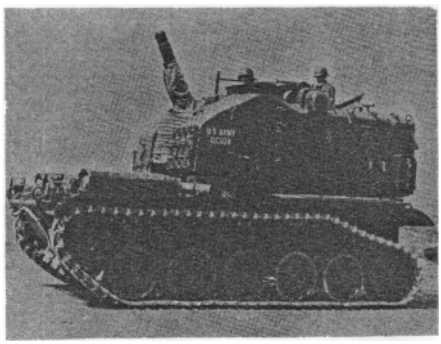


Figure 4. 105-mm How M52A1

Figure 5. 105-mm How M108

WEAPONS

TABLE IA. (Cont)

Weapon	M114A1 155-mm How (Towed)	M123A1 155-mm How (Aux SP)	M44A1 155-mm How (SP)	M109 155-mm How (SP)	M115 8-inch How (Towed)
Maximum Range (meters)	14,600	14,600	14,600	14,600 (18,000 with ext rg ammo)	16,800
Traveling Weight (pounds)	12,950	13,540	64,000	52,461	29,700
Air Transportability	Phase I	Phase I	Phase III	Phase III	Phase III
Traverse Limits (mils)	448 right and 418 left of center	448 right and 418 left of center	533 right and left of center	6400	533 right and left of center
Elevation Limits (mils)	0 to +1156	0 to +1156	-89 to +1040	-53 to +1333	-36 to +1156
Sustained Rate of Fire (rd per min)	1	1	1	1	0.5
Water Crossing Capability	Fordable (30 inches)	Fordable (30 inches)	Fordable (42 inches)	Amphibious (with kit)	Fordable (60 inches)
Time to Emplace (minutes) (1)	5	5	1	1	20
Prime Mover	5-ton truck	5-ton truck; Auxiliary	SP	SP	10-ton truck
Using TOE	6-165E 6-425E		6-355E 6-455E	6-37E 6-355E 6-365E 6-455E	6-165E 6-415E
Reference Manuals	FM 6-81 TM 9-1025-200-12 FT 155-Q-3 FT 155-AJ-1 FT 155 ADD-A-1	FM 6-81 TM 9-1025-200-12 FT 155-Q-3 FT 155-AJ-1 FT 155 ADD-A-1	FM 6-92 TM 9-7004 FT 155-Q-3 FT 155 ADD-A-1	FM 6-88 TM 9-2350-217-10 FT 155-AH-2 FT 155-AJ-1 FT 155 ADD-A-1	FM 6-90 TM 9-3004 FT 8-J-3 FT 8-O-3 FT 8 ADD-A-0

(1) Time to emplace is that time required to emplace and lay single registering piece.

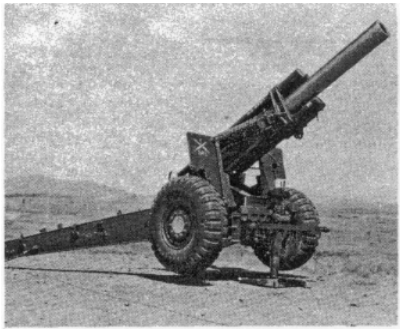


Figure 6. 155-mm How M114A1

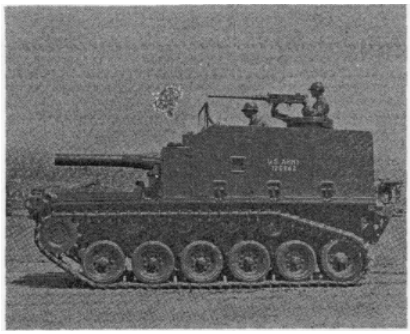


Figure 7. 155-mm How M44A1

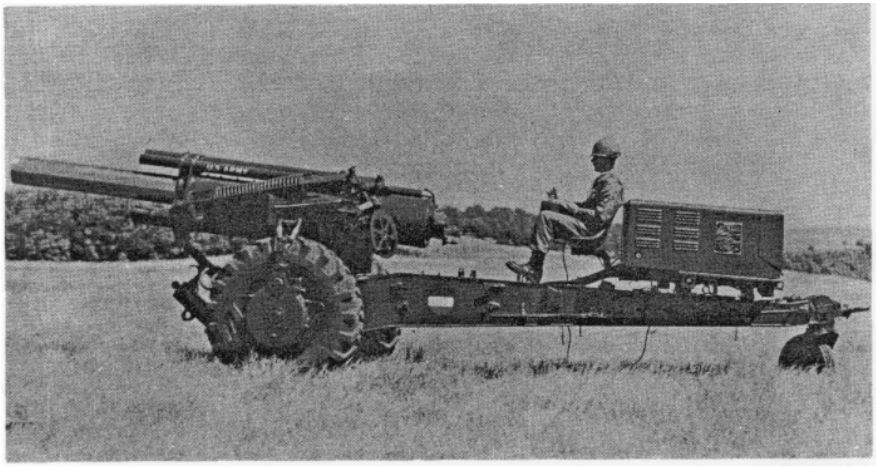


Figure 8. 155-mm How M123A1

Figure 9. 155-mm How M109

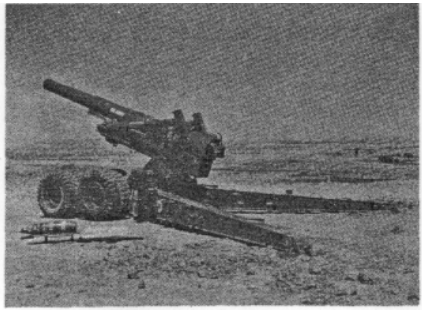


Figure 10. 8-in How M115

WEAPONS

TABLE IA. (Cont)

Weapon	M55 8-in How (SP)	M110 8-in How (SP)	M107 175-mm Gun (SP)	M3 Armament Subsystem, Helicopter (2.75-in rkt)	M91 115-mm Multiple Rkt Launcher
Maximum Range (meters)	16,800	16,800	32,700	3,000	10,600
Traveling Weight (pounds)	98,000	58,500	62,100	NA	1,200
Air Transportability	Phase III	Phase III	Phase III	Phase I	Phase I
Traverse Limits (mils)	533 right and left of center	533 right and left of center	533 right and left of center	6400	178 right and left of center
Elevation Limits (mils)	-89 to +1156	+35 to +1156	+35 to +1156	NA	+14 to +1067
Sustained Rate of Fire (rd per min)	0.5	0.5	0.5	4 second ripple of 48 rds	15 second ripple of 45 rds
Water Crossing Capability	Fordable (48 inches)	Fordable (42 inches)	Fordable (42 inches)	NA	Fordable (30 inches)
Time to Emplace (minutes) (1)	1	2	3	NA	30 (Includes loading 45 rds)
Prime Mover	SP	SP	SP	UH-1B Helicopter	2 1/2-ton truck
Using TOE	6-355E 6-445E	6-355E 6-445E	6-435D	6-725T	DS Bn TOE all Div Artys and sep Bde Artys except abn
Reference Manuals	FM 6-93 TM 9-7220 FT 8-J-3 FT 8-O-3 FT 8 ADD-A-0	FM 6-94 TM 9-2300-216-10 FT 8-J-3 FT 8-O-3 FT 8 ADD-A-0	FM 6-94 TM 9-2300-216-10 FT 175-A-0 (Rev II)	TM 9-1950	FM 6-54 TM 9-1055-215-12 FTR 115-C-1

(1) Time to emplace is that time required to emplace and lay single registering piece.

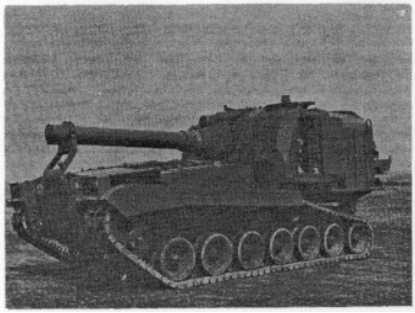


Figure 11. 8-in How M55

Figure 12. 8-in How M110

Figure 13. 175-mm Gun M107

Figure 14. 2.75-in Folding Fin Aerial Rocket System M3

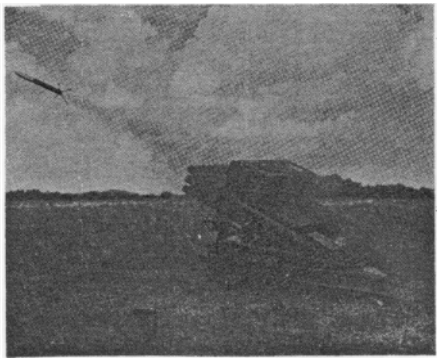


Figure 15. 115-mm Multiple Rocket Launcher M91

WEAPONS

TABLE 1B. ROCKETS AND MISSILES

Weapon	MGR-3A Little John	MGR-1B Honest John	XMGM-29A Sergeant	XMGM-31A Pershing	XMGM-52A Lance
Min and Max Range (approx)	3000 m to 20,400 m (max rg)	5000 m to 38,000 m (max rg)	46 km to 140 km	185 km to 740 km (1)	Max rg greater than that of HJ (1)
Water Fording Capability (inches)	21	30 (w/o kit) 60 (w/kit)	30	42	Amphibious
Guidance	Free Flight	Free Flight	Inertial	Inertial	DC-Autornet
Propulsion	Solid Propellant	Solid Propellant	Solid Propellant	Solid Propellant	Storable Prepackaged Liquids
Mobility	Air-Phase I Veh-100%	Air-Phase II Veh-100%	Air-Phase II Veh-100%	Air-Phase II Veh-100% Helicopter	Air-Phase I Veh-100%
Prime Mover	3/4-ton truck; Helicopter	M139 5-ton truck chassis M386	5-ton tractor M52	XM474E2 tracked vehicle	XM667 tracked vehicle
Field of Fire (mils)	267 right and left of center	267 right and left of center	6329	6400	400 right and left of center
Launch Elevation (mils)	0 to +978	72 to +1066	+1333	+1600	0-1066
Length of Rkt or Msl (meters)	4.36	7.58	10.52	10.55	6.10
Diameter (millimeters)	318	762	787	1016	559
Rkt or Msl Weight (pounds)	778.6	4,325	10,000	10,225	3,000
Using TOE	6-565T	6-175E 6-525E	6-555T	6-615T	6-195T 6-595T
Reference Manuals	TM 9-1055-212-12 FM 6-57 FTR 318-A-1 FTR 318 ADD-A-1 FTR 318 ADD-B-1	TM 9-1055-205-10 FM 6-59 FTR 762-G-1 FTR 762-H-1 FTR 762 ADD-C-1 FTR 762 ADD-D-1 FTR 762 ADD-E-0	TM 9-1410-302 -20 TM 9-1440-301 -12 TM 9-4935-303 -12	TM 9-1400-375- Series	POMM 9-1400-485-12

(1) Change from past published instruction.

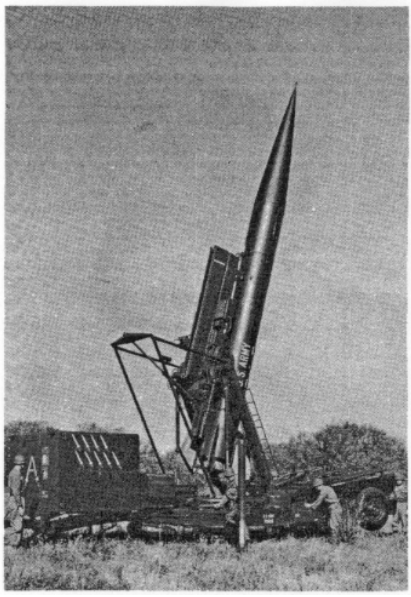


Figure 16. Sergeant Missile XMGM-29A

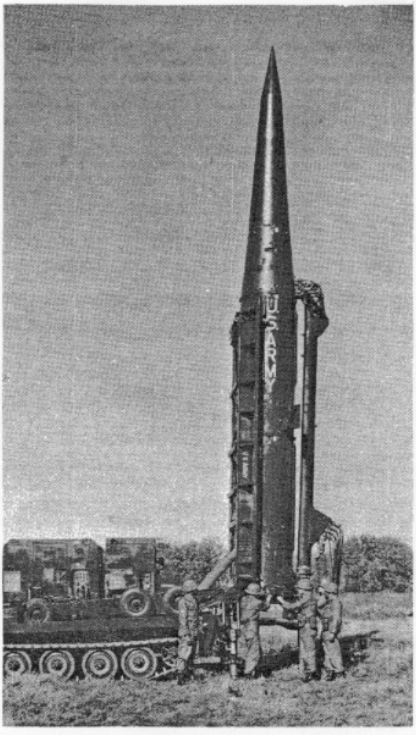


Figure 17. Pershing Missile XMGM-31A

Figure 18. Little John Rkt MGR-3A

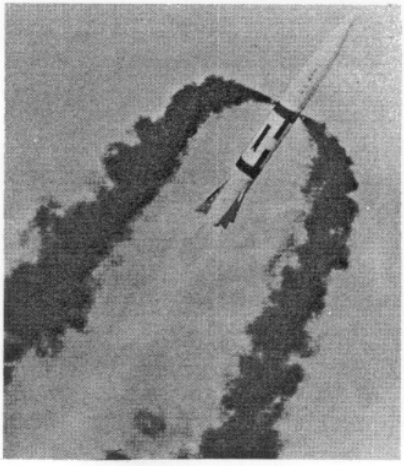


Figure 20. Lance Missile XMGM-52A

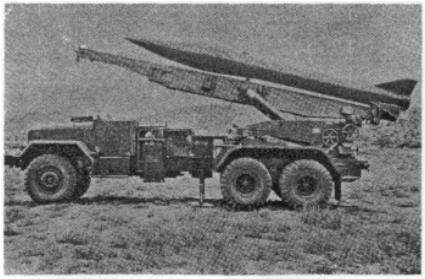


Figure 19. Honest John Rkt MGR-1B

AMMUNITION

TABLE II. AMMUNITION

Weapon	Type Ammo	Item Description	Wt of Fuzed Proj	Wt of Complete Round (Max Chg)	How Shipped	Fuze (1)		
						Impact	Time	VT
75-mm Pack How M116	HE	Cartridge, HE, M48	14.70	18.24	Fuzed or unfuzed	M557 M78A1 (CP)	M520A1	M513 Series
105-mm How M52A1 M101A1 M102 M108	HE	Cartridge, HE, M1	33.00	42.00	Fuzed or Unfuzed	M557 M78A1 (CP)	M520A1 M564	M513 Series
	HE, Antitank	Cartridge, HEAT, M67	29.29	37.06	Fuzed	M62A1 M91A1 (tracer)		
		Cartridge, HEP-T, M327	23.38	33.35				
	Gas	Cartridge, Gas. Persistent, M60 H or HD	33.94	42.94	Fuzed	M557		
		Cartridge, Gas, Nonpersistent, GB, M360	35.40	44.40	Fuzed	M508 M557		
	Smoke	Cartridge, Smoke, HC, BE, M84 Series	32.86	41.86	Fuzed		M501A1	
		Cartridge, Smoke, WP, M60	34.80	43.80	Fuzed	M557		
	Colored Smoke	Cartridge, Smoke, BE, M84 Series	Green 31.13	Green 39.13	Fuzed		M501A1	
			Red 30.68	Red 39.68				
			Yellow 30.30	Yellow 39.30				
	Leaflet	Cartridge, Leaflet, BE, M84 Series			Fuzed		M501A1	
		Cartridge, Leaflet, BE, M488	33.00	42.00				
	Illuminating	Cartridge, Illuminating, M314 Series	34.90	43.90	Fuzed		M501A1	
	Target Practice	Cartridge, TP-T, M67	28.20	37.06	Complete			
	Blank	Cartridge, Blank, M395		6.24				
	Dummy	Cartridge, Dummy, M14	33.06	42.06	Complete	M59 inert	M54 inert	
M101A1 only	Anti-personnel	Cartridge, Anti-personnel, XM546	28.50	38.25	Fuzed		XM563E1 MTMA (2)	

(1) Fuzes listed are appropriate for peace time use. Other fuzes also authorized are listed in TM 9-1300-203 and the appropriate firing table.
(2) Fuze can be set for mechanical time or muzzle action.

Figure 21. Comparison of U.S. Army Artillery projectiles

TABLE II. AMMUNITION (Cont)

Weapon	Type Ammo	Item Description	Wt of Fuzed Proj	Wt of Complete Round (Max Chg)	How Shipped	Fuze (1)		
						Impact	Time	VT
155-mm How M44A1 M114A1 M123A1 M109	HE	Projectile, HE, M107	95.00	100.75 GB 108.65 WB	Unfuzed	M557 M78A1 (CP)	M520A1 M564	M514 Series
	Gas	Projectile, Gas, Nonpersistent, GB, or Persistent, VX, M121A1	101.80	107.55 GB 115.45 WB	Unfuzed	M508 M557		M514 Series (VX only)
		Projectile, Gas, Persistent, H or HD, M110	98.49	104.24 GB 112.14 WB	Unfuzed	M508 M557		
	Smoke	Projectile, Smoke, WP, M110	97.50	103.25 GB 115.15 WB	Unfuzed	M557		
		Projectile, Smoke, HC, BE, M116 Series	94.35	100.10 GB 108.00 WB	Unfuzed		M501A1	
	Colored Smoke	Projectile, Smoke (Red, Yellow, Green), BE M116 Series	86.40	92.15 GB 100.05 WB	Unfuzed		M501A1	
	Illuminating	Projectile, Illuminating, M118 Series	100.00	105.75 GB 113.65 WB	Unfuzed		M501A1	
	Nuclear	Projectile, Atomic, XM454	120.45					
	Dummy	Projectile, Dummy, M7	95.00	102.37 M2	Complete			
8-Inch How M55 M110 M115	HE	Projectile, HE, M106	200.00	213.30 GB 228.30 WB	Unfuzed	M557 M78A1	M520A1 M564	M514 Series
	Gas	Projectile, Gas, Nonpersistent, GB, or Persistent, VX, M426	200.00	213.30 GB 228.30 WB	Unfuzed	M508 M557		M514 Series (VX only)
	HE Spotting	Projectile, HES, M424	242.00	272.00M80	Unfuzed		M543	
	Nuclear	Projectile, Atomic, M422	242.00	272.00M80	Unfuzed		M542	
	Dummy	Projectile, Dummy, M14	200.00	228.75 M4	Complete			
175-mm Gun M107	HE	Projectile, HE, M437	147.00	202.00M86E1	Unfuzed	M572		M514 Series
	Dummy	Projectile, Dummy, M458	147.00	202.00M98	Unfuzed	M73		
Armament Subsystem, Helicopter M3, M16 (2.75 in. Rocket) and Rocket Motor, 2.75 in., MK40 Mod 0	HE	Whd, HE, MK1	6.47	19.17	Unfuzed	MK178 MK176		
		Whd, HE, XM151	9.60	22.30	Unfuzed	M423		
	Smoke	Whd, Smoke WP, E12	7.00	19.70	Unfuzed	M423		
		Whd, Smoke WP, M152	10.00	22.70	Unfuzed	M423		
	Colored Smoke	Whd, Colormarker, Red, XM152	6.90	19.50	Unfuzed	M423		
		Whd, Colormarker, Yellow, XM153	6.90	19.50	Unfuzed	M423		
	Practice	Whd, Inert, MK1	6.47	19.17	Unfuzed	Inert		
		Whd, Inert, MK5	6.47	19.17	Unfuzed	Inert		
	AT	Whd, HE, AT, M1	6.47	19.17	Unfuzed	P1M406 MK181		
		Whd, AT, MK5 Mod 0	6.47	19.17	Unfuzed	MK181		
	Dummy	Whd, Inert, MK1	6.47	18.10	Unfuzed	Inert		
115-mm Rkt Lr	Mltp Chemical Rocket, Chemical, M55 M91		58.00 (2) 74.00	58.00 (2) 74.00	Complete	M417		

(1) Fuzes are appropriate for peace time use. Other fuzes also authorized are listed in TM 9-1300-203 and the appropriate firing table.

(2) With shipping and firing container.

TRANSPORTATION

TRANSPORTABILITY

a. Artillery weapons are classified according to their method of transport.

(1) Towed—Cannons and launchers which are mounted on a carriage to be moved as a trailed (transported) load by a prime mover. A towed carriage contains no power source.

(2) Self-propelled (SP)—Cannons and launchers which are permanently installed on vehicles which provide automotive power for the vehicle and the weapon.

b. Artillery weapons are also classified according to methods of transportation which can be used to deliver the weapon to a combat area. All artillery weapons can be transported by road, rail, or ship. Classification according to methods of aerial transportation are as follows:

(1) Helicopter transportable—Weapons which can be carried rotary wing aircraft and landed in sufficient assembly to permit immediate employment.

(2) Air transportable, see paragraph 3, AR 705-35.

(a) **Phase I (parachute and assault landing).** Assault landing aircraft must be capable of land on unprepared surfaces and minimum criteria airstrip in territory not held by friendly forces. All artillery must be capable of **immediate** effective employment.

(b) **Phase II (initial air landing).** Artillery normally moved in this phase are the followup elements of those units participating in phase I. These artillery must be air transportable in aircraft capable of landing on minimum criteria airlanding facilities held by friendly forces. All artillery should be capable of effective employment within **1 hour** after delivery.

(c) **Phase III (heavy air landing).** Artillery normally moved in this phase are followup elements of those units participating in phases I and II. These artillery must be air transportable in aircraft capable of landing on prepared air landing facilities held by friendly forces. It is desirable that all artillery be capable of effective employment within **6 hours** after delivery.

IIIA. WHEELED VEHICLES

Vehicle	Purpose	Curb Weight fully equipped less payload & crew (lbs) (1)	Payload (HWY) (lb)	Pay load (cross country lbs)	Max allowable speed (MPH)	Cruise Range (miles)	Fuel Cap (gal)	Fording depth (inches) w/kit	Fording depth (inches) w/o kit	Air Trans Phase; Craft		Ref Tech Manual
Truck 1/4-ton M38A1	Utility	2,665	1,200	800	55	280	17 gasoline	70	37.5	I	C-130	TM 9-8014
M151A1	Utility	2,273	1,200	800	66	300	17.7 gasoline	60	21	I	C-130	TM 9-2320-218-10
M170	Ambulance	2,963	3 litter or 5 seated patients		60	268	20 gasoline	70	36	I	C-130	TM 9-8014
3/4-ton M37B1	Cargo	5,950	2,000	1,500	55	225	24 gas	84	42	I	C-130	TM 9-8030
M43	Ambulance	7,150	4 litter or 8 seated patients		55	225	24 gas	84	42	I	C-130	TM 9-8030
1/2-ton M274	Carrier Lt WPN's	925	1,000	1,000	25	100	8 gas	NA	18	I	C-130	TM 9-2320-213
2 1/2-ton M34	Cargo	12,186	10,000	5,000	62	300	50 gas	72	30	I	C-130	TM 9-8022
M35	Cargo	12,880	10,000	5,000	58	300	50 gas	72	30	I	C-130	TM 9-8022
M35A1	Cargo	13,443	10,000	5,000	58	500	50 diesel	NA	30	I	C-130	TM 9-2320-235-10
M36	Cargo	14,640	10,000	5,000	58	300	50 gas	72	30	I	C-130	TM 9-2320-235-10
M135	Cargo	12,500	10,000	5,000	58	350	56 gas	78	30	I	C-130	TM 9-8024
M211	Cargo	13,580	10,000	5,000	58	300	50 gas	72	30	I	C-130	TM 9-8024
M49C	Fuel tanker	13,895	7,500	5,000	58	300	50 gas	72	30	I	C-130	TM 9-8022
M217C	Fuel tanker	14,340	8,000	5,000	55	300	56 gas	80	30	I	C-130	TM 9-8024
M50	Water tanker	15,184	8,300	5,000	58	300	50 gas	72	40	I	C-130	TM 9-8022
M222	Water tanker	15,693	8,500	3,500	55	300	56 gas	80	30	I	C-130	TM 9-8024
M221	Truck tractor	12,105	12,000	7,000	55	300	56 gas	72	30	I	C-130	TM 9-1819 AA
M275	Truck tractor	11,590	12,000	7,000	58	350	50 gas	72	30	I	C-130	TM 9-8022
M109	Shop van	15,231	7,500	5,000	58	300	50 gas	72	30	III	C-130	TM 9-8023-1
M220	Shop van	15,085	7,500	5,000	55	300	56 gas	80	30	III	C-124A	TM 9-8024
M60	Light wrecker	23,960	3,500	1,500	58	300	50 gas	72	40	I	C-130	TM 9-8022
M108	Wrecker Crane	19,785	3,500	600	58	350	50 gas	72	40	I	C-130	TM 9-8022
M135	Set, searchlight	12,330	6,695	5,000	58	350	56 gas	78	30	I	C-130	
M292	Van, expansible	20,609	5,000	5,000	58	300	50 gas	72	40	III	C-124A	SNL G-742
5-ton M41	Cargo	19,835	15,000	10,000	59	280	78 gas	78	30	I	C-130	TM 9-2320-211-10
M54	Cargo	19,945	15,000	10,000	52	214	78 gas	78	30	I	C-130	TM 9-2320-211-10
M54A1	Cargo	20,523	20,000	10,000	54	400	78 diesel	78	30	I	C-130	TM 9-2320-211-10
M55	Cargo	24,064	20,000	10,000	52	221	78 gas	78	30	I	C-130	TM 9-2320-211-10
M52	Truck Tractor	18,813	25,000	10,000	50	300	110 gas	78	30	III	C-124A	TM 9-2320-211-10
M246	Truck Tractor Wrecker	32,830	16,000	12,000	50	230	78 gas	78	30	III	C-124A	TM 9-2320-211-10
M62	Wrecker	33,675	12,000	7,000	52	214	78 gas	78	30	III	C-124A	TM 9-2320-211-10
M543	Wrecker	34,400	12,000	7,000	52	217	78 gas	78	30	III	C-124A	TM 9-2320-211-10
10-ton M125	Cargo	30,000	35,000	20,000	43	30	220 gas	78	30	III	C-124A	TM 9-2320-206-12
M123	Tractor	32,250	35,000	21,000	42	300	166 gas	78	30	III	C-124A	TM 9-2320-206-12
M249	Gunlifting	37,950		53,675	40	165	140 gas	NA	60	III	C-133A	TM 9-8006
M250	Gunlifting	35,910		45,330	40	165	140 gas	NA	60	III	C-133A	TM 9-8006

IIIB. TRACK LAYING RECOVERY VEHICLES

			Lift capac 50,000	Tow capac 90,000								
M74	Recovery	89,000			21	100	168 gas	72	36	III	C-133A	TM 9-7402
M88	Recovery	108,000	50,000	82,500	31	222	425 gas	NA	64		NA	TM 9-2320-222-10
M578	Recovery	54,000	30,000	60,000	34	450	320 diesel	72	42	III	C-133A	TM 9-2320-238-10

IIIC. ARMORED PERSONNEL, CARGO, AND EQUIPMENT CARRIERS

M59	APC	39,504	NA	3,096	32	120	136 gas	Amphib		III	C-133A	TM 9-2300-203-12
M113	APC	20,000	NA	3,860	40	200	80 gas	Amphib		I	C-130	TM 9-2300-224-10
M113A1	APC	19,755	NA	2,260	40	300	95 diesel	Amphib		I	C-130	TM 9-2300-224-10
M114	APC-RECON	12,900	NA	1,849	34	300	110 gas	Amphib		I	C-130	TM 9-2320-224-10
M116	Cargo	7,800	NA	3,000	37	300	65 gas	Amphib		I	C-130	TM 9-2320-223-10
M577	CP-FDC	22,800	NA	1,100	35	200	120 gas	Amphib		III	C-124A	TM 9-2300-224-10
M577A1	CP-FDC	23,060	NA	1,200	42.5	400	123 diesel	Amphib		III	C-124A	TM 9-2300-224-10

IIID. SELF-PROPELLED WEAPONS

M44A1	155mm How	64,000	NA	NA	35	76	150 gas	42		III	C-133A	TM 9-2350-203-10
M52A1	105mm How	53,000	NA	NA	42	100	179 gas	48		III	C-133A	TM 9-7204
M107	175mm Gun	62,100	NA	NA	34	450	300 diesel	42		III	C-133A	TM 9-2300-216-10
M108	105mm How	46,221	NA	NA	35	220	135 diesel	Amphib w/kit		III	C-133A	TM 9-2350-217-10
M109	155mm How	52,461	NA	NA	35	220	135 diesel	Amphib w/kit		III	C-133A	TM 9-2350-217-10
M110	8-in How	58,500	NA	NA	34	450	300 diesel	42		III	C-133A	TM 9-2300-216-10

(1) Weight of self-propelled weapons is with full combat load.

TABLE IIIE. VEHICLES PECULIAR TO ROCKET AND MISSILE UNITS

Vehicle	Purpose	Curb Weight (pounds)	Payload (pounds)	Max Allow Speed (mph)	Cruise Range (miles)	Fuel Capacity (gal) and type	Water Crossing Cap.		Air Transportability Phase. Craft	
							With Kit	Without Kit		
XM474E2	Msl Equip carrier, PSG	11,900	12,000	38	200	85 gas	NA	42	II	C-115B
Launching Sta XM504	Launcher, Sergeant	16,800	NA	52	NA	NA	NA	30	II	C-130
OMTS or FMTS	Test Sta, Sergeant	15,000	NA	58	NA	NA	NA	30	II	C-130
Motor Guidance Transport Trailer	Missile Section Transporter, Sergeant	4,900	11,000	58	NA	NA	NA	30	II	C-130
XM667	SP Launcher, Lt, Lance	13,500	10,500	40	280	85 diesel	Amphibious		I	C-130
M572 2 1/2-ton M36	Rkt Hdlg Unit, LJ Rkt	15,155	10,000	58	300	50 gas	72	30	I	C-130
M289, 5-ton Chassis M139D	Launcher HJ Rkt	41,800	5,913	29	220	70 gas	60	30	III	C-133A
M386, 5-ton Chassis M139	Launcher HJ Rkt	34,250	5,913	59	224	70 gas	60	30	III	C-130A
M46, 5-ton Chassis M55	Heating & tie-down unit, HJ Rkt	24,264	20,000	52.6	214	78 gas	78	30	II	C-130

TABLE IIIF. DEVELOPMENTAL SURFACE VEHICLES

XM561	Cargo, Personnel and weapon carrier	6,200	2,900 w/crew	50	Average 440	40 diesel	Amphibious	I	C-130
XM656 5-ton	Cargo truck	15,600	10,000	50	Highway 300	78 multi-fuel	Amphibious	Unk	Unk
XM520E1 8-ton GOER	Cargo	24,368	16,000	30	400	106 diesel	Amphibious	II	C-133A
XM559E1 8-ton GOER	Tanker	28,190	2,500 gal	31	400	106 diesel	Amphibious	II	C-133A
XM553 10-ton GOER	Wrecker	38,844	Tow 20,000 Boom Cap. 20,000	30.5	333	106 diesel	Amphibious	III	C-133A
XM548 6-ton Tracked	Cargo/Ammunition	14,450	12,000	38	300	105 diesel	Amphibious	II	C-130

NOTES:

Developmental vehicles considered for use in field artillery organizations.

Weight and performance data are approximated and subject to change during development.

Figure 22. XM561

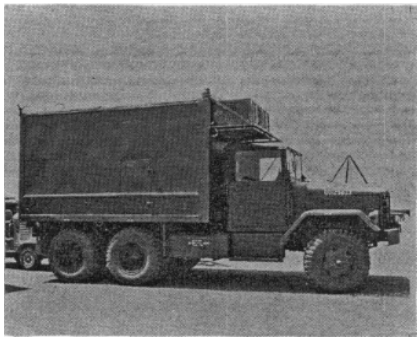


Figure 23. M109 2½-ton Shop Van

Figure 24. XM656

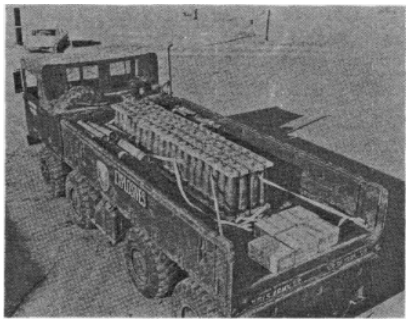


Figure 25. XM656 showing 155-mm ammunition load

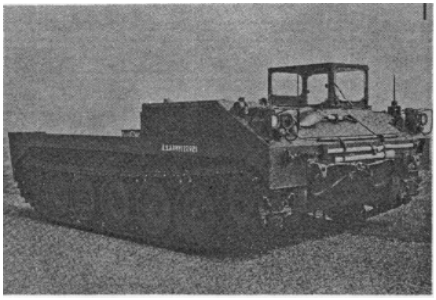


Figure 26. XM474E2

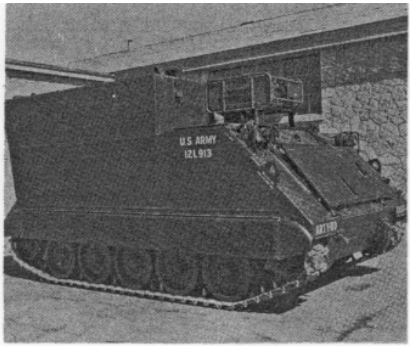


Figure 27. XM577

TRANSPORTATION

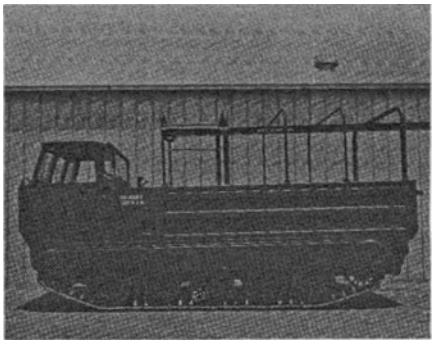


Figure 28. XM548

Figure 29. Pershing missile unit —XM474E2 tracked vehicles

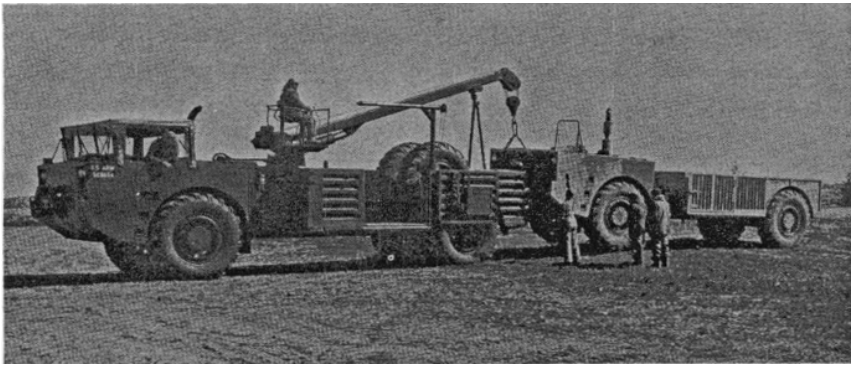


Figure 30. XM553

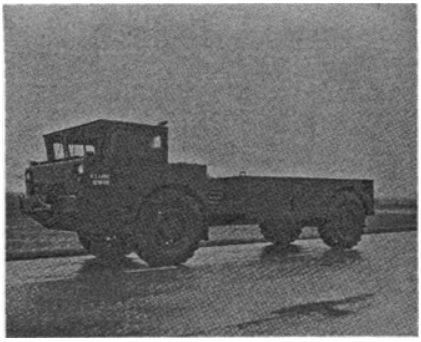


Figure 31. XM520E1

Figure 32. M109 How with flotation kit

TABLE IVA. FIXED-WING AIRCRAFT

Aircraft	O-1A, E Bird Dog	U-6A Beaver	U-1A Otter	CV-2B Caribou	OV-1A Mohawk	OV-1B Mohawk	OV-1C Mohawk	U-8F Seminole
Purpose	Recon; Observation; Trainer; Radio Relay; Radiological survey; Wire Laying; Message drop	Personnel Cargo transport; Recon photo duties; Resupply; Medical evacuation; Wire laying	Personnel; Cargo; Transport; Battlefield Illumination	Transport of specialized teams; Medical evacuation, Resupply	Close combat surveillance	Close combat surveillance	Close combat surveillance	Command Liaison Transportation
Max allowable gross weight (1)	2,400	5,100	8,000	28,500	14,722	15,795	14,823	7,700
Crew	1 (plus AOBSR)	1 (2 for IFC)	1 (2 for IFC)	3	1 (plus AOBSR)	1 (plus Rad Op)	1 (plus IR Op)	1 (2 for IFC)
Payload w/full fuel (pounds)	382	992	1,600	6,860	NA	NA	NA	590
Max fuel cap gal	42	95	216	828	Int: 297 Ext: 300	Int: 297 Ext: 300	Int: 297 Ext: 300	230
Cruise speed (kts)	87	109	105	157	200	200	200	150
Endurance at cruise speed not incl 30 min res (hrs/min)	3/30	5/45	6/50	7/30	2/08	1/51	2/01	6/15
Max cargo sp (cubic ft)	NA	125	293	1,150	NA	NA	NA	158
Special equipment available	Camera still picture - KA-39A	Camera still picture - KA-39A; 2 litters	Camera, still picture - KA-39A; 6 litters	20 litters	Camera still picture - KA-30A	Camera still picture - KA-30A; AN/APS-94 SLAR	Camera still picture - KA-30A; Infrared detector AN/UAS-4	NA
Troop seats	1 (AOBSR)	5	10	32	0	0	0	5

(1) Weight includes aircraft, crew, equipment, fuel, and oil.

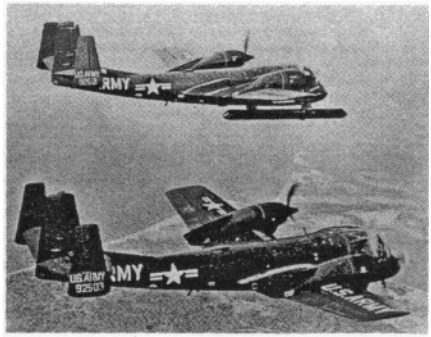


Figure 33. Mohawk

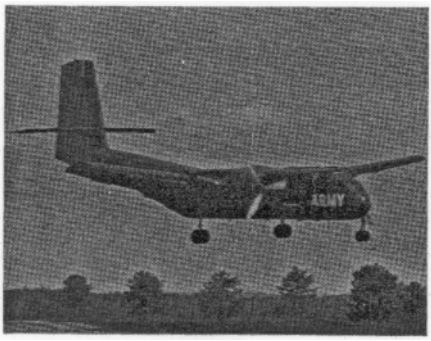


Figure 34. Caribou

TABLE IVB. ROTARY WING AIRCRAFT

Aircraft	OH-13S Sioux	OH-23G Raven	CH-47A Chinook	CH-37B Mojave	UH-1D Iroquois	UH-1B Iroquois	CH-54 Skycrane
Purpose	Observation; Recon; Radiological survey; Wire laying	Recon; Observation; Radiological survey; Wire laying	Cargo and personnel transport	Cargo and personnel transport	Utility/tactical; Weapons aircraft; Transport cargo and personnel		Heavy lift
Max allowable gross weight	2,850	2,800	33,000	31,000	9,500	8,500	38,000
Crew	1	1	3	3	2	2	2
Payload w/full fuel load (lb)	400	400	10,924	6,197	2,102	2,540	14,470
Max recm ext load (pounds)	NA	NA	13,700	7,500	4,000	4,000	20,000
Max int fuel cap (gal)	43	46	630	406	220	165	892
Cruise speed (kts)	75	78	130	85	92-110	92-110	100 w/pod
Endurance at cruise speed not incl 30 min res (hr/min)	3/12	2/25	1/45	1/15	3/00	2/30	1/30
Max cargo sp (cubic ft)	NA	NA	1,462	1,252	220	140	2,680
Special equipment available	M2 dual machinegun system; 2 litters	M2 dual machinegun system; 2 litters	24 litters	24 litters	XM3, 2.75″ Rocket System; M5 Grenade Lchr, M6 Quad Machinegun (7.62mm); XM16, 7.62mm Quad Machinegun and 2.75 Inch Rocket System (7 rockets ea Pod); SS-11 Antitank Missile System; AN/UVS-1, VATL System; 3-6 litters		48 litters
Troop seats	1	2	33	23	11	7	68

Figure 35. Iroquois

Figure 36. Chinook

TABLE VA. OLD FM RADIOS

Radio Set	Receiver/ Transmitter	Frequency (mc)	Operation Modes	Range (km)	Ch T1	Ch Pres	Power Req	Ref Manual	Remarks
AN/GRC-3 -5 -7	R-108/RT-66/RT-70 R-109/RT-67/RT-70 R-110/RT-68/RT-70	20.0-27.9 27.0-38.9 38.0-54.9	Voice	16-24	80 120 170	2 2 2	12/24v DC	TM 11-284	3 pres chls on aux rcvr; set utilizes AM-65 AF amplifier
AN/GRC-4 -6 -8	RT-66/RT-70 RT-67/RT-70 RT-68/RT-70	20.0-27.9 27.0-38.9 38.0-54.9	Voice	16-24	80 120 170	2 2 2	12/24v DC	TM 11-284	Set utilizes AM-65 AF amplifier
AN/VRC-8 -9 -10	RT-66 RT-67 RT-68	20.0-27.9 27.0-38.9 38.0-54.9	Voice	16-24	80 120 170	2 2 2	12/24v DC	TM 11-286	
AN/VRC-13 -14 -15	RT-66 RT-67 RT-68	20.0-27.9 27.0-38.9 38.0-54.9	Voice	16-24	80 120 170	2 2 2	12/24v DC	TM 11-291	Set utilizes AM-65 AF amplifier
AN/VRC-16 -17 -18	R-108/RT-66 R-109/RT-67 R-110/RT-68	20.0-27.9 27.0-38.9 38.0-54.9	Voice	16-24	80 120 170	2 2 2	12/24v DC	TM 11-611	3 preset channels on aux receiver
AN/VRC-20 -21 -22	R-108/RT-66 R-109/RT-67 R-110/RT-68	20.0-27.9 27.0-38.9 38.0-54.9	Voice	16-24	80 120 170	2 2 2	12/24v DC	TM 11-642	3 preset on aux rcvr; set utilizes AM-65 AF amplifier
AN/VRQ-1 -2 -3	2 RT-66 2 RT-67 2 RT-68	20.0-27.9 27.0-38.9 38.0-54.9	Voice	16-24	80 120 170	2 2 2	12/24v DC	TM 11-287	Provide automatic retransmission capability
AN/VRC-7	RT-70	47.0-58.4	Voice	1.6	115	2	6/12/24v DC and 6v PP-448/GR	TM 11-285	Set utilizes AM-65 AF amplifier
AN/PRC-6	RT-196/PRC-6	47.0-55.4	Voice	1.6	43	1	BA-270	TM 11-296	
AN/PRC-8 -9 -10	RT-174/PRC-8 RT-175/PRC-9 RT-176/PRC-10	20.0-27.9 27.0-38.9 38.0-54.9	Voice	5-8	80 120 170	Continuous tuning	BA-279 or 24v DC w/ AM-598/U	TM 11-4065	AM 598/U is an amplifier, power supply
AN/TRC-20	RT-111/TRC-20	27.0-38.9	Voice	8	120	2	24v DC PP-1067/GR	TM 11-615	Special purpose, SR Equip in TA Bn

TABLE VB. NEW FM RADIOS

AN/PRC-25	RT-505/PRC-25	30.00-75.95	Voice	8	920	2	Dry btry BA 386/U	TM 11-5820-398-10	Replaces AN/ PRC-8, -9, -10 for man pack only
AN/GRC-125	RT-505/PRC-25	30.00-75.95	Voice	8	920	2	BA 386/U or 24v DC Amp power supply	TM 11-5820-498-10	Replaces AN/ PRC-8, -9, -10 for man pack or vehicular operations
AN/VRC-53	RT-505/PRC-25	30.00-75.95	Voice	8	920	2	24v DC Amp power supply	TM 11-5820-498-10	Replaces AN/ PRC-8, -9, -10 for vehicular operations only
AN/VRC-12	RT-246/VRC R-442/VRC	30.00-75.95	Voice	24-32	920	10	24v DC	TM 11-5820-401-10	Replaces AN/ VRC-16, -17, -18
AN/VRC-43	RT-246/VRC	30.00-75.95	Voice	24-32	920	10	24v DC	TM 11-5820-401-10	Replaces AN/ VRC-8, -9, -10
AN/VRC-44	RT-246/VRC 2 R-442/VRC	30.00-75.95	Voice	24-32	920	10	24v DC	TM 11-5820-401-10	No previous configuration w/ capability
AN/VRC-45	2 RT-246/VRC	30.00-75.95	Voice	24-32	920	10	24v DC	TM 11-5820-401-10	Replaces AN/ VRQ-1, -2, -3
AN/VRC-46	RT-524/VRC	30.00-75.95	Voice	24-32	920	0	24v DC	TM 11-5820-401-10	Replaces AN/ VRC-8, -9, -10
AN/VRC-47	RT-524/VRC R-442/VRC	30.00-75.95	Voice	24-32	920	0	24v DC	TM 11-5820-401-10	Replaces AN/ VRC-16, -17, -18
AN/VRC-48	RT-524/VRC 2 R-442/VRC	30.00-75.95	Voice	24-32	920	0	24v DC	TM 11-5820-401-10	No previous similar configuration
AN/VRC-49	2 RT-524/VRC	30.00-75.95	Voice	24-32	920	0	24v DC	TM 11-5820-401-10	Replaces AN/ VRQ-1, -2, -3
Transmitter, AN/PRT-4	AN/PRT-4 (Squad radio)	47.0-57.0	Voice or Tone	LP: 0.5 HP: 1.6	200	2	12 volt dry battery	Not published	May replace AN/ PRC-6 transmitter only
Receiver AN/PRR-9	AN/PRR-9 (Squad radio)	47.0-57.0	Voice	NA	200	1	6 volt dry battery	Not published	May replace AN/ PRC-6 receiver only

COMMUNICATIONS

TABLE VC. AM RADIOS

Radio Set	Receiver/ Transmitter	Frequency (mc)	Operation Modes	Range (km)	Channels	Power Req	Ref Manual	Remarks
AN/ARC-27	RT-178/ARC-27	225. 0-399. 9	VHF/UHF Voice	Line of sight	1750; 18 preset	27. 5v DC 16 amps	TM 11-5821-225-10	Being replaced by AN/VRC-24
AN/GRC-19	R-392/URR T-195/GRC-19	0. 5-32. 0 1. 5-20. 0	Voice CW	80	7 preset (xmtr)	28. 5v DC 44 amps	TM 11-5820-295-10	To be replaced by AN/GRC-106; part of AN/GRC-46, AN/VRC-29, AN/VSC-1
AN/GRC-26 (A, B, C) D	2 R-388/URR 2 BC-610 (A, B, C) 2 R-390/URR 2 T-368/URT	0. 5-30. 5 2. 0-18. 0 0. 5-32. 0 1. 5-20. 0	Voice CW, FSK, simult vc & FSK	160 voice 400 CW & FSK	Continuous manual control	115v AC 50-60 cps 100 watts	TM 11-5820-202-10	On-line security capability for full duplex operation
AN/GRC-46	R-392/URR T-195/GRC-19	0. 5-32. 0 1. 5-20. 0	voice CW, FSK simult vc & FSK	80	7 (xmtr) preset	27. 5v DC 100 amps	TM 11-5815-204-10	Mtd in electronic shelter S-144/G. On-line security capability
AN/GRR-5	R-174/URR (receiver only)	1. 5-18. 0	Voice CW, MCW	NA	10 preset	6/12/24v DC w/PP-308, 115v AC or dry battery	TM 11-295 & TM 11-5820-284 series	Uses 2 BA-419 and 1 BA 403
AN/URC-4	RT-159/URC-4	120. 0-130. 0 240. 0-260. 0	Voice MCW Tone	16, 32, 64 w/aircraft at 1, 000, 5, 000 & 10, 000 feet	2 fixed 1 preset	BA-1264/ U	TM 11-510	Emergency aviator's radio for rescue situations; dropped in survival kit or carried in a vest.
AN/URC-10	RT-278/URC-10	238. 0-263. 0	Voice & tone	56 line of sight	1 fixed	14v dry battery	Not yet published	Replaces URC-4. Lw submin VHF personnel rescue radio set
AN/VRC-24	RT-323/VRC-24	225. 0-399. 9	Voice	48 at 1, 000 ft 160 at 10, 000 ft	1750; 19 preset	24v DC	TM 11-5820-222 series	Ground-to-air comm in conjunction with ARC-27, ARC-55, or ARC-51
AN/VRC-29								AN/GRC-46 less shelter, for trucks & APC's
AN/VRC-34	RT-77/GRC-9	2. 0-12. 0	Voice CW, MCW	Voice 16-24 CW 24-48	Continuous or 6 crystal freq	6/12v DC w/DY-88/ GRC-9; 24v DC w/ DY 105/ GRC-9	TM 11-263	Vehicular version of AN/GRC-9; GRC-87 when not mtd; uses DC gen GN-43 or GN-58 & battery BA-317/U
AN/VSC-1	R-392/URR T-195/GRC-19	0. 5-32. 0 1. 5-20. 0	Voice CW, FSK	80	7 (xmtr) preset	27. 5v DC 100 amps	TM 11-5815-204 series	AN/GRC-46 mtd in 1/4-ton, but less shelter, reperforator tw, & on-line security equip; air-droppable

TABLE VD. SINGLE SIDEBAND RADIOS

Radio Set	Receiver/ Transmitter	Frequency (mc)	Operation Mode	Range (km)	Channels	Power Req	Reference Manual	Remarks
AN/GRC-106	RT-662/GRC	2. 0-29. 999	Voice CW	80	28, 000	28v DC veh battery	TM 11-5820-520 series	Replaces AN/GRC-19; may be mounted on 1/4-ton vehicle
AN/GRC-142	RT-662/GRC and Modem MD-522	2. 0-29. 999	Voice; CW FSK; voice & FSK simult	80 ground wave 2400 sky wave	28, 000	27. 5v DC 100 amp high cap generator	TM 11-5820-520 series	Replaces AN/GRC-46; on-line sec capa capability, half-duplex operation 3/4-ton veh mtd
AN/GRC-122	2 RT-662/GRC and Modem MD-522	2. 0-29. 999	Voice; CW FSK; voice & FSK simult	80 ground wave 2400 sky wave	28, 000	27. 5v DC 100 amp high cap generator	TM 11-5820-520 series	AN/GRC-142 plus additional RT for full duplex
AN/GRC-108 (1)	2 RT-662/GRC w/ amplifier RF AM-3399/GRC-108 and Modem MD-522	2. 0-29. 999	Voice; CW FSK; voice & FSK simult	160 ground wave 2400 sky wave	28, 000	115v; 230v, Trailer mtd 10 kw power unit		Replaces AN/GRC-26, 3/4-ton vehicle mtd full duplex on-line security
AN/VSC-2	RT-662/GRC and Modem MD-522	2. 0-29. 999	Voice; CW FSK; voice & FSK simult	80 ground wave 2400 sky wave	28, 000	28v DC		Replaces AN/VSC-1 same as GRC-142 less reperforator in 1/4-ton vehicle for airborne operations
AN/VSC-3 (1)	Replacement for present AN/VRC-29; tracked vehicular version of AN/GRC-142.							

TABLE VE. ARMY AIRCRAFT RADIOS

AN/ARC-44	RT-294/ARC-44	24. 0-51. 9	FM voice CW for homing	Line of sight (2)	280 preset	27. 5v DC	TM 11-5821-204 series	Air-to-ground comm. 100kc ch spacing repl by AN/ARC-54
AN/ARC-45	RT-295/ARC	225. 0-399. 9	VHF/UHF AM voice	(2)	1750; 12 preset	27. 5v DC	TM 11-5821-299 series	Air-to-air, air-to-ground comm
AN/ARC-51	RT-650/ARC-51	225. 0-399. 9	VHF/UHF AM voice	(2)	1750; 18 preset	27. 5v DC	TM 11-5821-242 series	Replaces ARC-55 for traffic control comm, Op ceiling 70, 000 ft
AN/ARC-54	RT-348/ARC-54 (Built-in retransmission, using 2 ARC-54).	30. 00-69. 95	FM voice visual readout for homing	Line of sight (2)	800; 20 preset	27. 5v DC	TM 11-5821-244 series	Air-to-ground comm, 50kc spacing; replaces ARC-44; compatible w/ VRC-12 series and PRC-25
AN/ARC-55	RT-349B/ARC-55	225. 0-399. 9	VHF/UHF AM voice or tone	(2)	1750; 18 preset	27. 5v DC	TM 11-5821-225 series	Modified ARC-27; Air-to-air, air-to-ground; op at 25,000
AN/ARC-73	T-17L-7A R-51X-2B	T: 116. 0 149. 95 R: 108. 0 151. 95	VHF; AM voice	(2)	T: 680 R: 880	27. 5v DC	TM 11-5821-217 series	General purpose air-to-air and air-to-ground
AN/ARC-95	RT-651/ARC-95	2. 0-15. 0	AM voice	(2)	22	27. 5v DC	TM 11-5821-247 series	Replaces ARC-59; air-to-air and air-to-ground
AN/ARC-98 (1)	Under development	2. 0-29. 999	AM; SSB	240 (2)	28, 000	27. 5v DC	Not published	1kc spacing; Compatible w/GRC-106 & 108; replaces ARC-95 and 102 for low-flying aircraft
AN/ARC-102	RT-698/ARC-102	2. 0-29. 999	AM voice CW; SSB	(2)	28, 000	27. 5v DC	TM 11-5821-248 series	1kc spacing. Compatible w/GRC-106 & 108. Air-to-air; air-to-ground

(1) Developmental item.

(2) Range will vary considerably according to terrain, atmospheric conditions and the altitude of the aircraft.

NOTE: FSK = Frequency shift keying (same as RATT) radio teletype.

TABLE VF. RADIO TERMINAL SETS AND ASSOCIATED EQUIPMENT

Equipment	Purpose and Description	Reference Manual	Remarks
AN/TRC-80	Mobile, air transportable tropospheric scatter RT set. 1 Transmitter: AM Group OA-3832/TRC-80 — Frequency Rg, 4, 400-5000 mc FM, voice and teletype, rg 112 km (160 using dual diversity), 333 channels, 120/208 v AC, 3 phase, 400 cycle 2 receivers: Radio Recvr Group OA-3831/TRC-80	TM 11-5820-469 series	Peculiar to FA bn, Pershing
AN/TSA-15	Mobile switching facility capable of interconnecting 5 half duplex, 2 wire voice frequency TT circuits and 29 telephone circuits. Telegraph-telephone Swbd group consisting of: 1 Shelter S-141 on 2 1/2-ton vehicle — 6 Telegraph Terminals TH-5/TG 3 SB-22 Switchboards (stacked) — 6 Signal Converters TA-182/U 4 Teletypewriters TT-4/TG — 1 Patch Panel 2 Teletypewriters TT-76/GGC — Rack and cabling for 5 sets of on-line security equipment 1 Generator set PU-474M (2 units of 10 kw each)	Not published	Used at Pershing Bn Hq Btry to interconnect all AN/TRC-80 terminal sets and provide circuits into the army area system and to higher headquarters
AN/MGC-17	Mobile TT central office for switching 17 voice frequency tt circuits. Has facilities for mounting 2 units of on-line security equipment. Components: 1 Shelter S-169 — 1 SB-22/PT 3 Telegraph Terminals TH-5/TG 6 Signal Converters TA-182/U 1 Teletypewriter TT-4A/TG 2 Teletypewriters TT-76B/GGC 1 Trailer mtd gas generator PU-322/G (2 PE-75, 2, 5 kw ea)	TM 11-5815-205-15	Used in division area comm system, Msg center of corps arty & in each btry of the Pershing bn to terminate TRC-80
AN/MRC-69 (V)	Mobile radio relay terminal set operating in rg of AN/TRC-24 or AN/GRC-50. Provides 2 12-channel radio relay terminals or 1 12-channel radio relay terminal and one 12-channel land line carrier terminal, FM, line of sight, planning rg 48 km. Components: 1 Shelter, S-141 or S-178/MRC-69 — 26 Sig converters TA-182/U 2 Radio Sets AN/TRC-24 or AN/GRC-50 (V) — 12 Filters F-98/U 2 Telephone Terminals TCC-7 — 1 Gasoline eng generator PU-474/G (2 10kw sets mtd on trailer). Commercial power can be used.	TM 11-5820-204-15	Provides trunking facilities in a division area communication system
AN/MRC-73 (V)	Mobile UHF radio terminal set operating in rg of AN/TRC-24 or AN/GRC-50. Provides 12 channels of carrier telephone or 11 channels of carrier telephone and 4 channels of carrier TT over spiral 4 cable or radio, planning rg 48 km. Components: 1 Shelter, S-181/MRC-73 — 1 Telegraph Terminal TCC-20 1 Radio Set AN/TRC-24 or AN/GRC-50 (V) — 1 Telegraph Terminal TH-5/TG 1 Telephone Terminal TCC-7 — 1 Teletypewriter TT-4A/TG 12 sig converters TA-182/U 1 Gasoline eng generator PU-474/M, (2 units of 10 kw ea.)	TM 11-5895-221-15	Used in corps & army radio relay comm. Used by corps arty for radio relay comm to FA groups and div artys (Furn by sig unit.)
AN/MRC-54 (V)	Mobile UHF radio relay repeater set operating in rg of AN/TRC-24 or AN/GRC-50. Can be used in conjunction with MCC-6 as terminal set. 3 12-channel carrier equipment (one a spare). Planning rg 48 km. Components: 1 Shelter S-177/MRC-54 (V) — 1 Set trailer mtd gasoline eng generator PU-474/G (2 10 kw sets) 3 Radio Sets AN/GRC-50 (V) or AN/TRC-24	TM 11-5820-203-15	Used in div, corps & army area systems. Used by corps arty (Furn by sig unit)
AN/MCC-6	Mobile telegraph terminal; 24 channels of carrier telephone or 22 carrier telephone and 16 carrier telegraph channels. When used in conjunction with AN/MRC-54, radio repeater set becomes a radio terminal set. Components: 1 Shelter S-185/MCC-6 — 2 Telegraph Terminals TCC-4 1 Telephone Terminal TCC-7 — 1 Telegraph Terminal TH-5/GT 1 Telephone Terminal TCC-50 — 1 Teletypewriter TT-4A/TG 8 Filters F-98/U — 28 Sig converters TA-182/U 1 Set trailer mtd gas eng generator PU-474/M (2 units of 10 kw each)	TM 11-5805-285-15	Used in div, corps & army area comm systems. Used by corps arty (Furn by sig unit).
AN/MSC-29	Mobile telegraph terminal for receiving and transmitting messages; capacity of 8 full or 12 half duplex voice frequency teletypewriter circuits. Components: 1 Shelter S-176/MSC-29 — 4 Teletypewriters TT-4A/TG 1 SB-22A/PT — 8 Teletypewriters TT-76B/GGC 8 Sig Converters TA-182/U — 12 Telegraph Terminals TH-5/TG 4 Filters F-98/U — 1 Trailer mtd gas eng generator PU-294 (2 PU-286, 5 kw ea) mounting racks and cabling for on-line security equipment	TM 11-5895-205-15	Used in div, corps and army area comm systems. Also used in FDC of corps arty
AN/TRC-24	Transportable, multichannel, VHF-UHF radio set used at div, corps and army level to provide high quality high capacity tactical comm. Intended to replace wire where quick installation is required. A basic unit in various configurations of terminal and repeater sets in radio relay systems, frequency range divided into 7 separate bands, ranging from 50 to 1875 mc. Planning rg is 48 km.	TM 11-5820-287 series	Major components: 1 R-417/TRC-24 1 T-302/TRC-24
AN/GRC-50 (V)	Mobile UHF radio transmitting and receiving equip for use with multi-channel carrier telephone terminal apparatus such as terminal telephone AN/TCC-7; FM, covers 2 frequency bands: 600 to 1,000 mc and 1,350 to 1,850 mc. Total of 450 operational channels available on each band. Used with 4, 12 or 24 channel frequency-division multiplex (FDM) or 12 or 24 channel time division multiplex (TDM) equipment (pulse code modulation) to provide telephone, teletypewriter, data, or facsimile circuits. Multiplex equip available will determine the number of channels. Consists of: Transmitter T-893(P)/GRC — Power Supply PP-2054/GRC Receiver R-1148(P)/GRC — Voltage Regulator CN/514/GRC Power Unit PU-294 (2 PU-286 5 kw each)	TM 11-5820-461 series	Replaces AN/TRC-24 radio set in many applications

COMMUNICATIONS

TABLE VG. ANTENNA EQUIPMENT

Equipment	Purpose and Description	Reference Manual	Remarks
AN/GRA-12	Portable half wave antenna (center fed Hertz) assembly designed for transmission and reception of radio signals between 1.5 and 18 mc. It may be used with sets having a power output of less than 500 watts and a characteristic impedance of 52 ohms.	TM 11-2651	Approximate wt: 229 lbs
AN/GRA-50	Lightweight doublet antenna kit for transmitters and receivers with a frequency range of 1.5 to 20 mc not exceeding 100 watts. Uses existing terrain features for supports.	TM 11-5820-467 series	Approximate wt: 12 lbs
AN/GRA-4	Portable half-wave antenna assembly designed for transmission and reception of radio signals between 1.5 and 18 mc. For sets with transmitter output of less than 100 watts. Characteristic impedance of 72 or 500 ohms. Includes two mast assemblies of 16 mast sections each.	TM 11-2651	Approximate wt: 170 lbs
RC-292	Elevated wide band modified ground plane antenna designed to operate with and extend range of FM radios operating in frequency range of 20-70 mc.	TM 11-5820-348 series	
AT-791, AS-1537 or later development	New elevated omnidirectional half-wave antenna being designed to extend range of new family of FM radios. Although several designations for antenna appear as developmental items on new TOE, nomenclature has not yet been officially designated. When standardized, new antenna will replace RC-292.	Not published	
AT-984/G	Directional long-wire antenna used to extend range of tactical FM radio sets operating between 20 and 76 mc frequency range. Also used to overcome electronic jamming.	Not published	
AS-1729/VRC (formerly AT-912A/VRC)	10 ft center fed whip antenna with automatic matching unit. Component of new family of vehicular mounted FM radios, an improved version of the AT-912/VRC. Matching unit automatically adjusts electric length of antenna to selected operating frequency.	TM 11-5820-402 series	

TABLE VH. REMOTE CONTROL DEVICES

Device	Purpose	Distance Limitation	Power Requirement	Reference Manual
Radio Set Control Group AN/GRA-6	(1) Controlling & operating old FM sets from distance. (2) 2-way telephone comm between remote & local operators. (3) Local control of radio sets.	Approx 3 km with WD-1/TT	4 BA-30 1 BA-414/U	TM 11-5038
Radio Set Control Group AN/GRA-39	(1) Controlling & operating new FM sets from distance. (2) 2-way telephone comm between remote & local operators. (3) Local control of one radio set.	Approx 3 km with WD-1/TT	6 BA-30 for each unit	TM 11-5820-477-12
Radio Set Control Group AN/GSA-7	(1) Provides electronic switching device for use in integrated wire/radio systems. (2) Connects radios with local battery telephone equipment on a push-to-talk basis. (3) Interconnects two push-to-talk radio sets for automatic relay (two sets required). (4) Provides operator facilities for listening, signalling or talking to either or both ends of the circuit. Note: Cable CX-7474/U must be used to make the AN/GSA-7 compatible with the VRC-12 series of radios. This cable interconnects the 10 point and 5 point equipment.	Governed by limitations imposed by wire system & radio net equipment it is integrating. Max planning distance 16 km over WD-1/TT	24v DC 115v or 230v AC self-contained	TM 11-5135-15
Radio Set Control Group OA-1754/GRC	(1) Turns on or off Transmitter of GRC-19 or GRC-46. (2) Provides selection of type of operation. (3) Tunes to desired preset frequency (transmitter only). (4) Indicates when transmitter is ready to transmit.	75 feet imposed by special purpose cable.	Furnished by set to which equipment is connected	TM 11-806 chap 5

TABLE VJ. SWITCHBOARDS

Switchboard	Nr of lines accommodated	Type of operation	Power Requirements	Major Components	Reference Manual	Remarks
SB-993/GT	6	Manual Local Battery	None	1 MT-2156/GT 7 U-184/GCT	TM 11-5805-294-15	Emergency switching center, uses visual signalling
SB-22/PT and SB-22A/PT	12	Manual, local battery with magneto signalling	4 BA-30	1 SB-22/PT 1 MX-230A/PT (3 spare line packs)	TM 11-5805-262-12	SB-22A differs from SB-22 in contents of accessory kit. The kit for SB-22A (MX-2915/PT) contains 2 line packs & 1 trunk pack. By stacking SB-22 switchboards a total of 29 circuits can be controlled.
SB-86/P	30 including 2 civilian trunks	Manual, local battery, or common battery signalling.	4 BA-30 10 BA-200/U	1 SB-248/P 1 TA-207/P 1 PP-990/G	TM 11-2134 & TM 11-4134	Cannot be used directly for radio-wire integration. To change configuration from 30 to 60 drop board, signal assembly switchboard TA-207/P can be added.
SB-223/GR (Swbd signal assembly)	12 microphone lines, 6 record channels, 4 telephone lines	Manual, no ringing on switchboard	BB-53 or other 12v DC source	SB-223/GR		Used by sound ranging platoon of TA Btry. Connects 2 sound bases to Sound Ranging Set GR-8.
Telephone connecting and switching group MX-155/GT	Total of 10 (1 circuit of 2, 1 circuit of 8)	Manual	None	1 Jack panel SB-16/GT, 7 Reel brackets, 7 Jacks U-17/GT, 15 Cords CX-231/GT	TM 11-2546	Provides conference telephone circuits among battery XO, assistant XO, & 6 howitzer or gun sections.

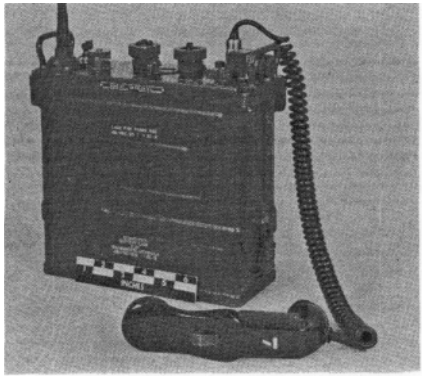


Figure 37. AN/PRC-25

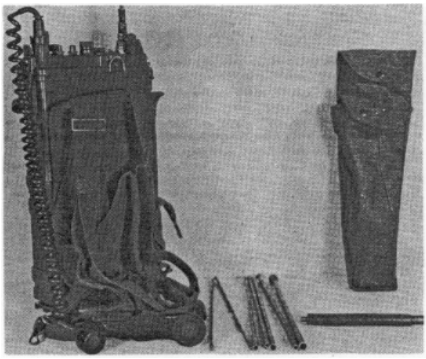


Figure 38. AN/PRC-9

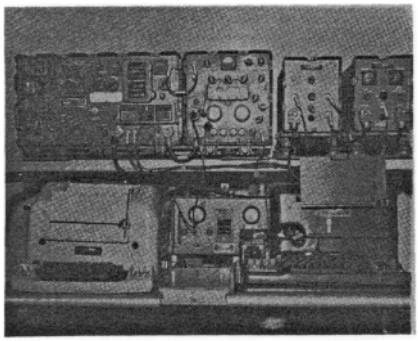


Figure 39. AN/GRC-46

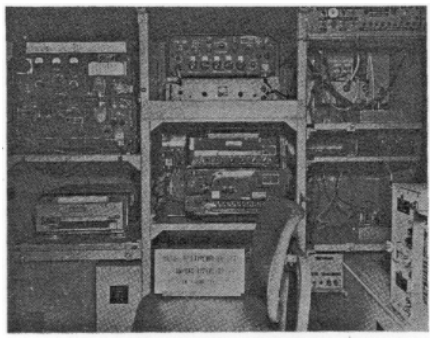


Figure 40. AN/GRC-122

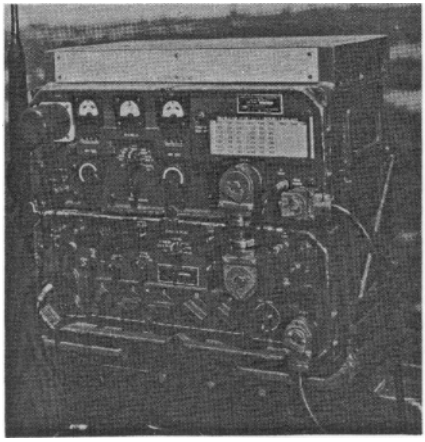


Figure 41. AN/GRC-106

Figure 42. AN/TRC-80

COMMUNICATIONS

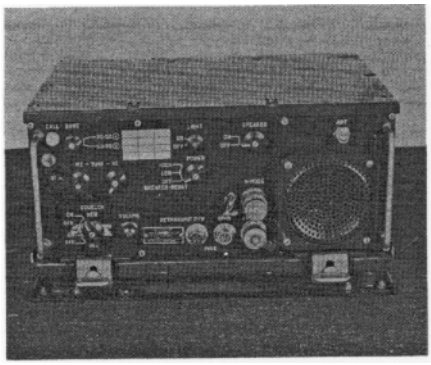


Figure 43. AN/VRC-46

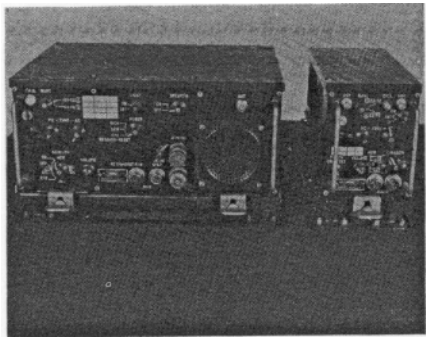


Figure 44. AN/VRC-47

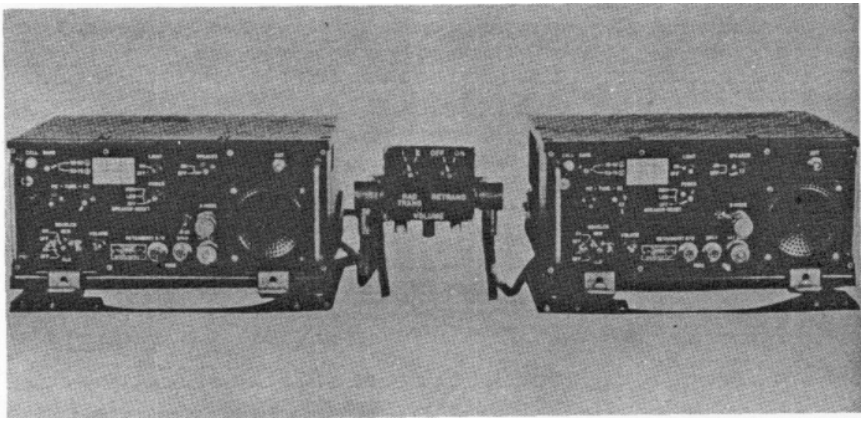


Figure 45. AN/VRC-49

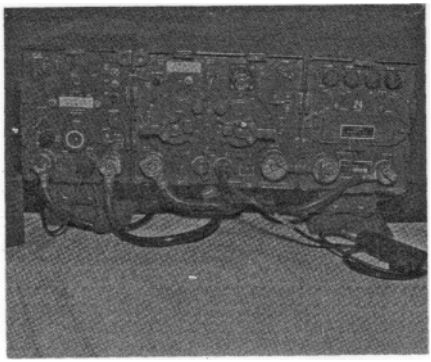


Figure 46. AN/VRC-17

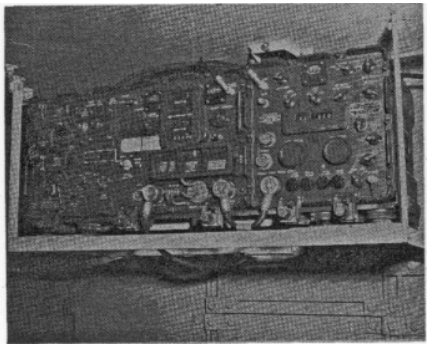


Figure 47. AN/GRC-19

VATLS (Figure 48)

The Visual Airborne Target Locator System (VATLS), AN/UVS-1, provides the artillery with greatly increased target acquisition capability. Initial field tests by the U. S. Army Artillery Board demonstrated the increased effectiveness which will result from the use of this addition to the artillery aerial observer's equipment. The system consists of both ground and airborne components. The ground station components include a shelter-mounted computer, tracker, distance measuring equipment, and power generator. The airborne components, mounted in a UH-1B helicopter, include on aircraft-mounted beacon (for tracking), a stabilized telescope, a gyroscopic reference, a Laser rangefinder, and the airborne portion of the ranging data entry device and data link.

The observer who controls the VATLS operation locates targets by using either the unaided eye, binoculars, or the stabilized, variable magnification telescope. Using the telescope, the target is centered in the concentric circle reticle and a "mark" is made. This "mark," the depression of a contact button, electronically transmits to the ground subsystem the aircraft altitude, telescope azimuth, depression angle to the target, and target classification. The primary mode of operation is a "two-sight" technique providing an aerial base from which the target location is determined.

This technique is similar to target area survey. On each end of the base, the ground tracking radar and distance measuring equipment fix the aircraft location. The fixed output of the system are the UTM coordinates and the altitude of the target, computed by the integral digital computer.

Though the "two-sight" technique using an aerial base is the primary operational mode, the incorporation of a LASER for aircroft-to-target distance measurement in the equipment now being developed will provide a "one-sight" mode.

Figure 48. Visual Airborne Target Locator System.

TARGET ACQUISITION

Radar Set AN/TPS-25A (Figure 49)

The AN/TPS-25A is a transportable ground surveillance radar capable of detecting moving ground targets at ranges between 450 and 18,280 meters. The set utilizes the doppler principle to provide a means of detection, identification and location of moving targets. The frequency of the amplitude variations of the video pulses, which are proportional to the target velocity is amplified and applied to earphones and/or a loudspeaker. The operator utilizes the characteristic sounds to detect and identify moving objects. An "A" scope is also used to display both fixed and moving target echoes to assist the operator in detecting and tracking targets. Target locations are presented in the form of map coordinates and polar coordinates on counters at the operator's panel. The location of the target is also indicated by a bright dot of light shining through a map mounted on the radar mapboard. A seven-man crew can emplace the set in 15 minutes, if the antenna is mounted on the transmitter-receiver unit, and in approximately 45 minutes if mounted on three most sections. The radar control unit and mapboard can be operated within the equipment shelter or it can be remoted up to 225 feet from the antenna.

Radar Set AN/MPQ-10A (Figure 50)

The AN/MPQ-10A is a mobile tracking type radar used in the counterbattery role. It is capable of locating artillery pieces with 0 to 400 meter accuracy at ranges up to 18,000 meters. The set scans a 200 to 800 mil azimuth sector until an artillery projectile is detected. The radar beam then is positioned in range and azimuth to the approximate position in space through which the projectile passed. When a second round is fired by the same weapon, the radar is "locked" on the projectile and tracks it through a portion of its trajectory. From a plot of the projectile height, azimuth, and range, all against time, the operator can determine the origin or location of the weapon that fired the projectile. A twelve-man crew can emplace the set in 45 to 60 minutes.

Sound Ranging Set, GR-8 (Figure 51)

The GR-8 is used to locate hostile artillery by measuring the relative times at which sound waves generated by firings reach accurately located microphone positions on the ground. Targets may be located by sound ranging to accuracies of 0 to 150 meters and to ranges of 20,000 meters, dependent upon the intensities of the sounds they produce, and upon meteorological conditions.

Radar Set AN/MPQ-4A (Figure 52)

The AN/MPQ-4A is a mobile, short-range, dual-beam-intercept, non-tracking radar used by the artillery to locate mortars and other high-angle weapons. The set has the capability of locating mortars with 50-meter accuracy at ranges up to 10,000 meters. When a projectile passes through the dual beam, two separate echoes appear on a scope. The operator then positions azimuth and range strobes over the echoes, and an analog computer computes the coordinates of the weapon that fired. The AN/MPQ-4A can be emplaced in 30 to 45 minutes.

Periscope Battery Command, M43 (Figure 53)

The M43 periscope is used to locate targets by visual observation and intersection from two or more observation posts (flash ranging). Trained observers using the M43 and employing flash ranging techniques can locate hostile artillery and other targets at distances up to 15,000 meters, depending upon visibility limits from individual observation posts. Flash ranging is also used for the collection of battlefield information and for the calibration, adjustment, registration, and location of friendly artillery fires. Flash ranging techniques are accurate to within 50 meters.

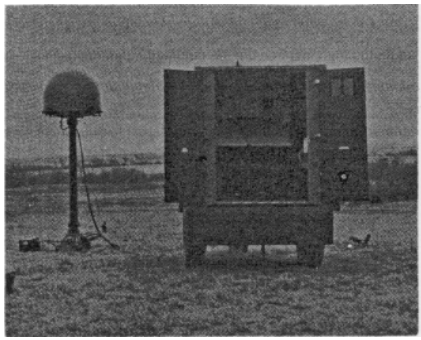


Figure 49. AN/TPS-25A

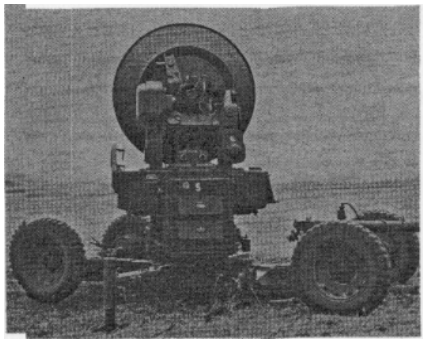


Figure 50. AN/MPQ-10A

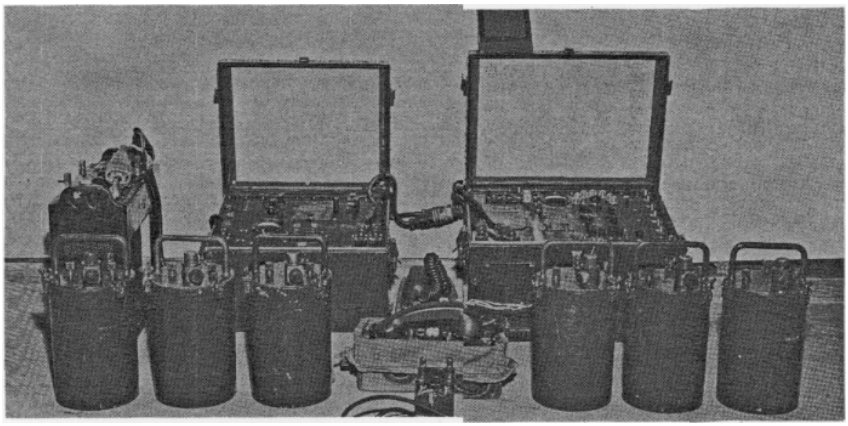


Figure 51. Sound Ranging Set, GR-8

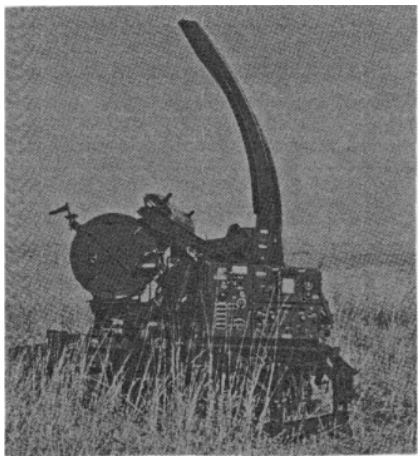


Figure 52. AN/MPQ-4A

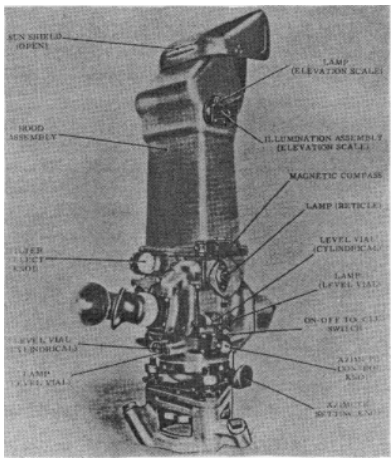


Figure 53. Periscope M43

TARGET ACQUISITION

Laser XM23 (Figure 54)

The XM23 Laser (Light Amplification by Stimulated Emission of Radiation) will provide the forward observer with precise polar plot data in the form of azimuth, vertical angle and distance. The Laser technique involves the determination of range by measuring the transit time of a ray of light beamed to a target and reflected back to the rangefinder, achieving a reading accurate enough to bring to reality the artillery ideal of "first round fire for effect."

Surveying Instrument, Azimuth Gyro, Artillery (ABLE) (Figure 55)

The surveying instrument, azimuth gyro, artillery, is a portable gyrocompass used to establish a true north reference. The instrument consists of a sensing element, control indicator, tripod and cables. The sensing element contains a highly sensitive, single-axis, rate gyroscope. A T2 theodolite, mounted on the sensing element, is used to transfer the established north reference to any desired point. The control indicator provides the controls necessary to operate the gyro. This instrument is used by artillery survey parties at all echelons.

Surveying Instrument, Distance Measuring, Electronic Microwave, Model MC8 (Figure 56)

This instrument is a portable, transistorized, electronic distance measuring device which consists basically of an FM transmitter/receiver, power supply, parabolic-reflector antenna, front-panel control facilities and a battery. These components are all incorporated in a single instrument package which is mounted on a tripod. Two of these instruments, one at each end of the line to be measured, determine by phase comparison, distances ranging from 200 to 50,000 meters, with an accuracy of 1:250,000 ±1.5 centimeters. The instruments are used in artillery survey parties found at division artillery, the target acquisition battalion, and certain cannon and missile units.

Theodolites, T-16 and T-2 (T-16 shown, Figure 57)

The T-16 theodolite is used to obtain angular values in artillery surveys executed to fifth-order (1:1000) accuracy. Its scales are readable directly to 0.2 mil and by interpolation to 0.1 mil. Vertical and horizontal scales may be read simultaneously and may be illumined by either sunlight or self-contained, artificial light. An optical plumb system is provided. The 28-power telescope produces inverted images. The universal field artillery tripod is used to support the instrument. The T-2 theodolite provides greater accuracy than the T-16, permitting execution of fourth-order (1:3000) surveys. Its scales are readable directly to 0.002 mil and by interpolation to 0.001 mil. Vertical and horizontal scales must be individually viewed by means of a selector knob. Its other characteristics are essentially the same as those of the T-16.

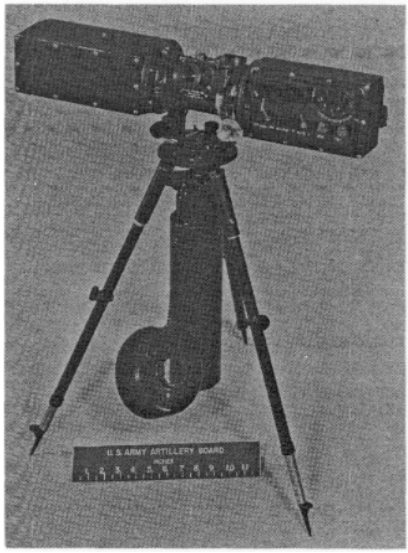


Figure 54. XM23 Laser

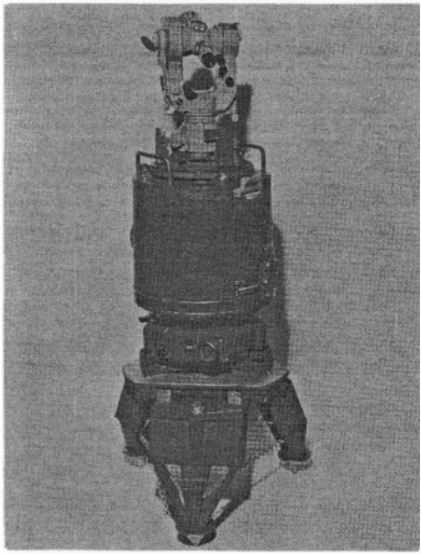


Figure 55. ABLE Surveying Instrument

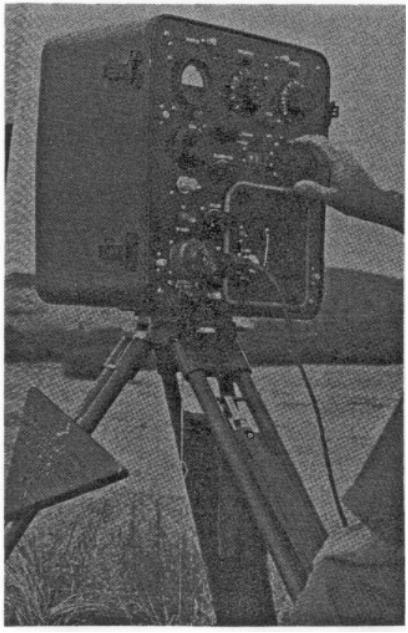


Figure 56. DME Surveying Instrument

Figure 57. T-16 Theodolite

METEOROLOGY

Rawin Set AN/GMD-1 (Figure 58)

The rawin set AN/GMD-1 is a transportable radio direction finder which automatically tracks the radiosonde, tunes itself to the transmitted frequency, and records angles to the radiosonde at a maximum rate of 10 times each minute. Recordings of time versus progressive elevation and azimuth positions are later converted to wind speed and direction. Received radiosonde signals are detected, amplified, and transmitted to a separate piece of equipment, the radiosonde recorder, for conversion to atmospheric values of temperature, humidity and pressure.

Radiosonde Transmitter AN/AMT-4 (Figure 59)

The radiosonde AN/AMT-4 is a meteorological instrument which is carried aloft by a balloon to obtain soundings of the temperature, pressure, and relative humidity of the lower atmosphere. This instrument automatically transmits radio-frequency signals, amplitude modulated at a frequency that varies in accordance with the conditions of temperature and humidity of the atmosphere encountered during the flight. A baroswitch connects the circuits of the transmitter successively, so that a repeating sequence of temperature, humidity, and reference signals is transmitted. These data are used in calculating corrections to compensate for the effects of nonstandard meteorological conditions for artillery fire.

Radiosonde Recorder AN/TMQ-5 (Figure 60)

The radiosonde recorder, AN/TMQ-5, is an assembly of electronic and electromechanical devices which receives meteorological data from the rawin set, AN/GMD-1. The input signal for the recorder consists of audio-frequency pulses that normally range from 10 to 200 cycles per second. These incoming signals are converted to direct current voltages which, by means of a servosystem, position a pen on a calibrated chart. The operation is continuous, so that the pen always marks the chart at a point corresponding to the data received from the balloonborne radiosonde. A preflight calibration establishes the relationship between audio frequency and both temperature and relative humidity.

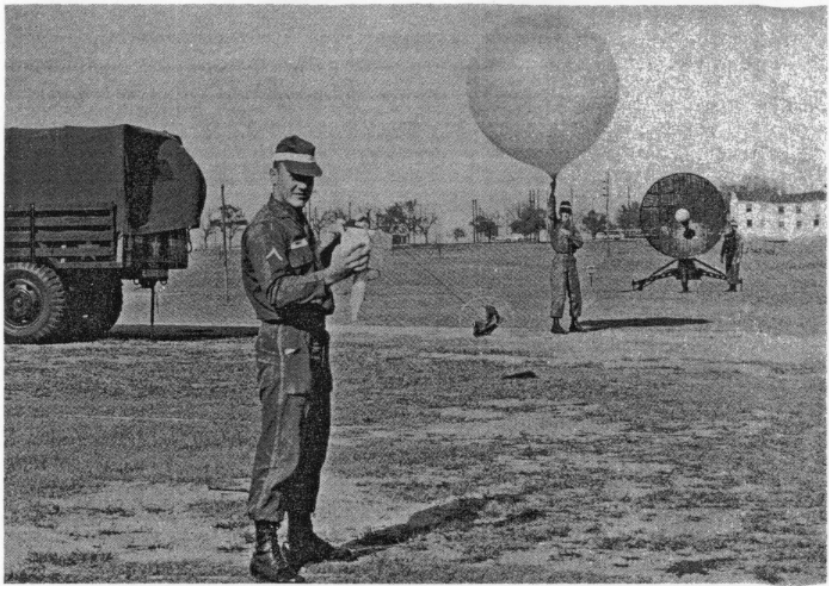


Figure 58. Launching metro balloon (Rawin set AN/GMD-1 in right background)

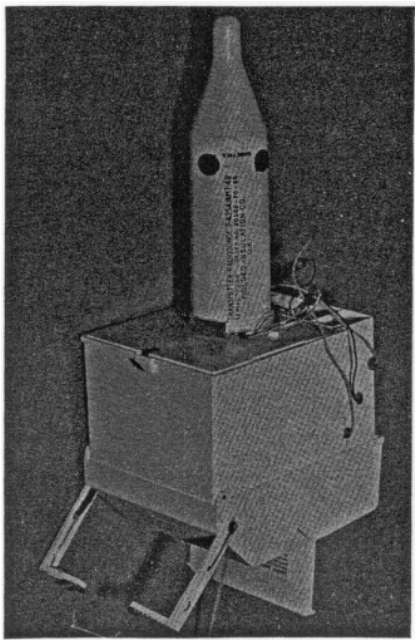


Figure 59. Radiosonde Transmitter AN/AMT-4

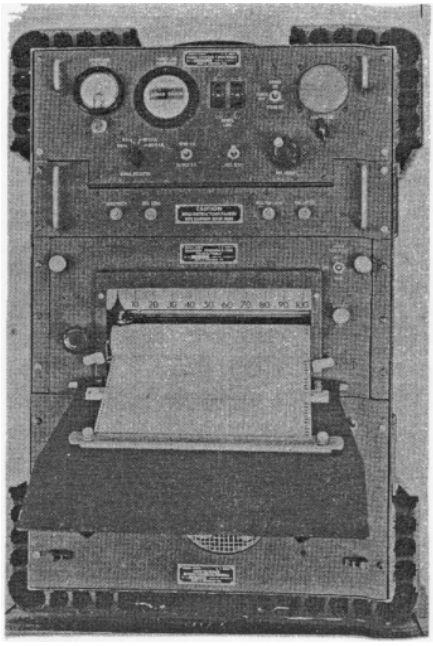


Figure 60. Radiosonde Recorder AN/TMG-5

COMMAND AND CONTROL

GUN DIRECTION COMPUTER M18 (FADAC)

The Computer, Gun Direction, M18 is a portable, general purpose solid state, non-volatile, digital computer designed to solve fire control and survey computations for the Artillery. As a general purpose computer, it will solve any computational task assigned for which a program has been written. The limiting factor is the size of the rotating magnetic disc memory (8,192 words). The size of the memory will allow the storing of parameters for a two caliber cannon ballistic trajectory solution or one rocket trajectory solution. A punched paper tape program representing ballistic parameters known for these weapons is read into the computer memory using the Signal Data Reproducer AN/GSQ-64 (performed only at authorized levels). The memory once loaded will not be altered by normal operator action. Additional information affecting the ballistics of the battery weapons may be inserted by the computer operator. Meteorological data may be entered into the computer memory by a self-contained mechanical tape reader or manually through the keyboard. The computer consists of a control panel assembly, a power supply assembly, plug-in modules and a magnetic memory disc assembly. Three phase, 120/208 volt, 400 cycle power must be supplied the computer from an external generator set through a cable and reel assembly.

Associated equipment consists of a computer table with integral power connection panel, a power cable and reel assembly, and a 3 kw, 120/208 volt, 400 cycle, three phase, four-wire generator.

Auxiliary equipment consists of the Signal Data Reproducer AN/GSQ-64 (SDR) and the Computer Logic Unit Test Set AN/GSM-70 (CLUT). The SDR is used by the organizational radio mechanic to load the various programs into the computer. The CLUT is used in conjunction with the SDR to determine which part of the computer has failed in the event of a malfunction.

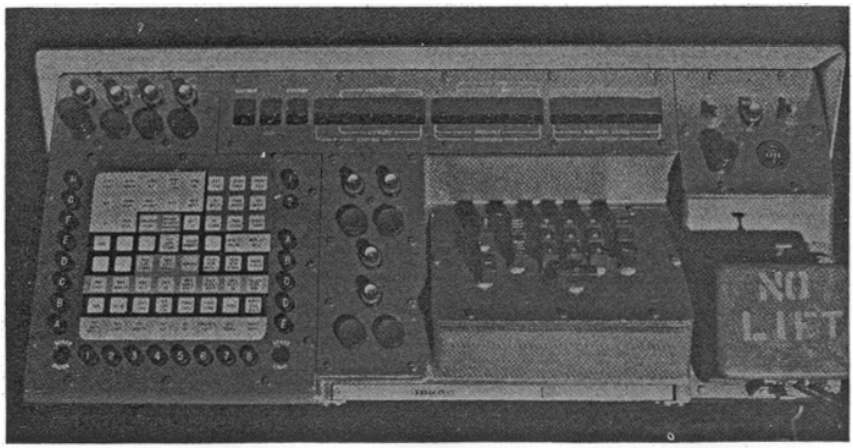
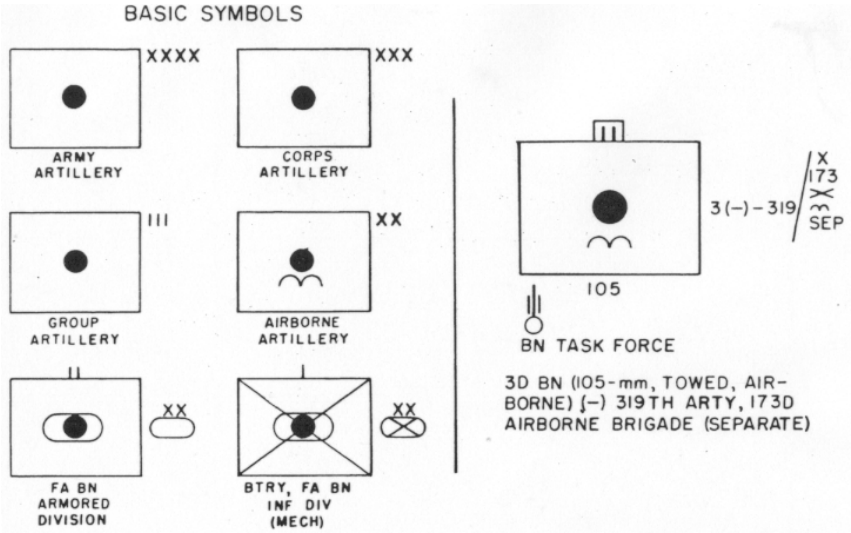
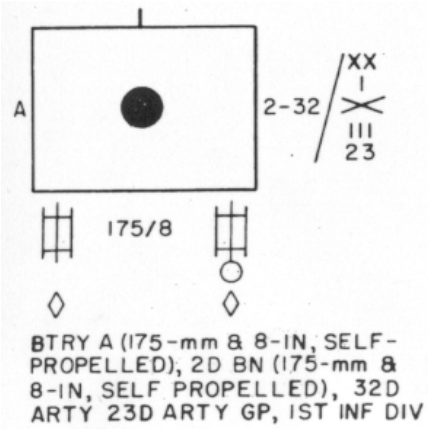


Figure 61. Gun Direction Computer M18



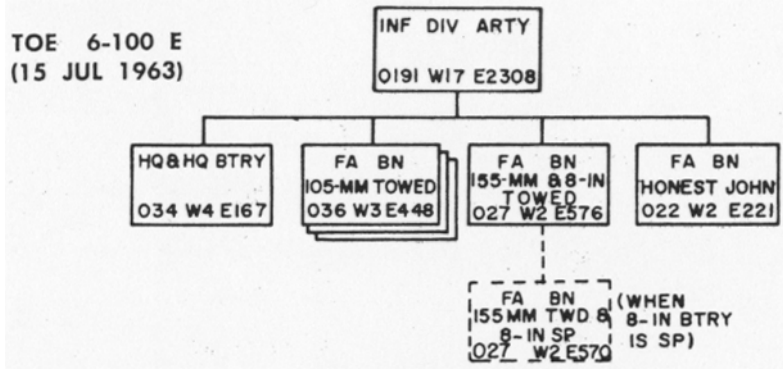
SECTION II
FIELD ARTILLERY ORGANIZATIONS



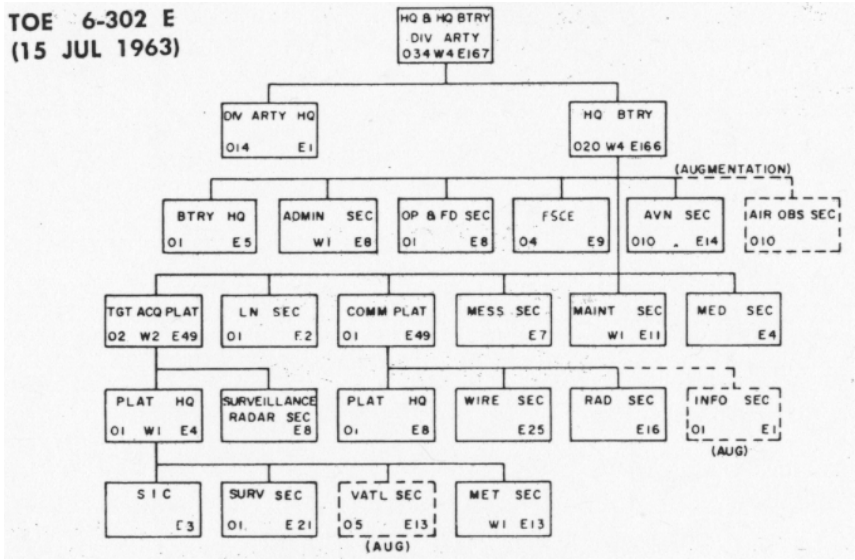
These are examples of the new unit symbols authorized in FM 21-30, June 1965.

Developed at Fort Belvoir by the US Army Combat Developments Command, Engineer Agency, these symbols are designed to permit the presentation of maximum information concerning units, on maps, overlays, etc.

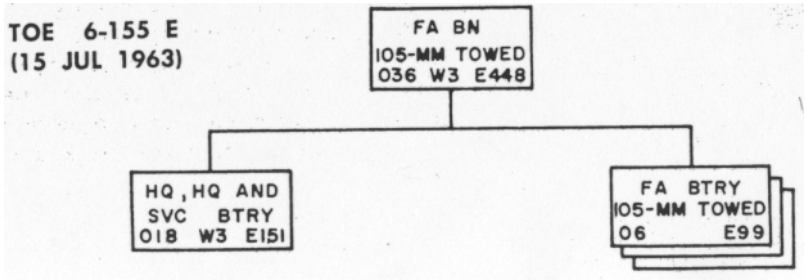
INF ARTY



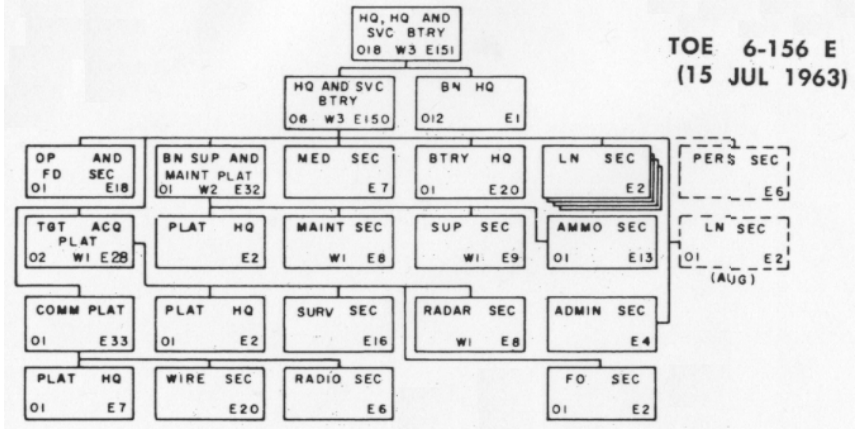
Infantry Division Artillery



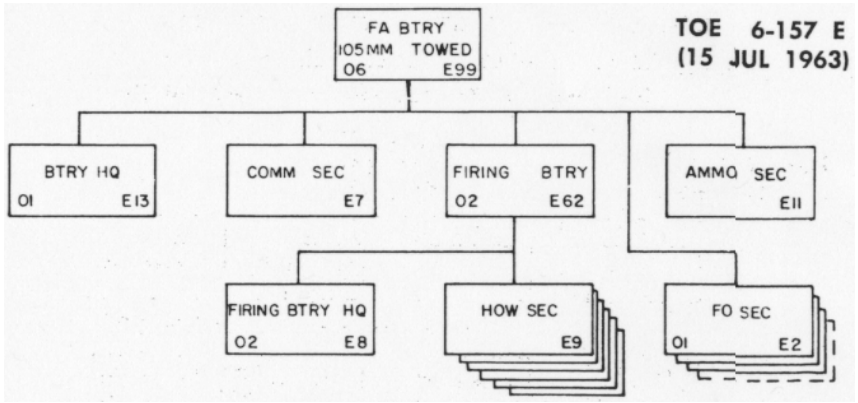
HHB Armd/Mech or Inf Div Arty



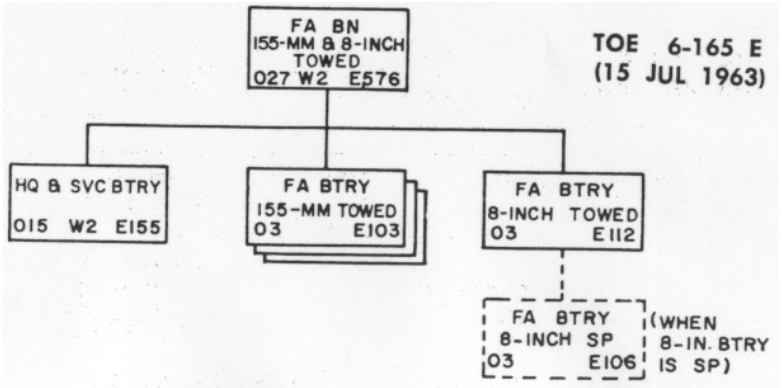
FA Bn, 105-mm, Twd Infantry Division



HHS Btry, FA Bn, 105-mm Twd, Inf Div

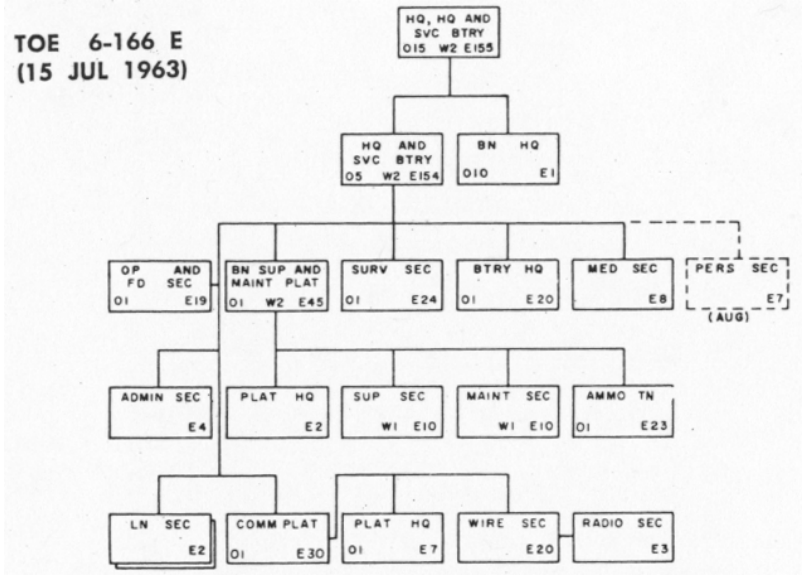


FA Btry, 105-mm Twd, FA Bn, Inf Div or Sep Inf Bde

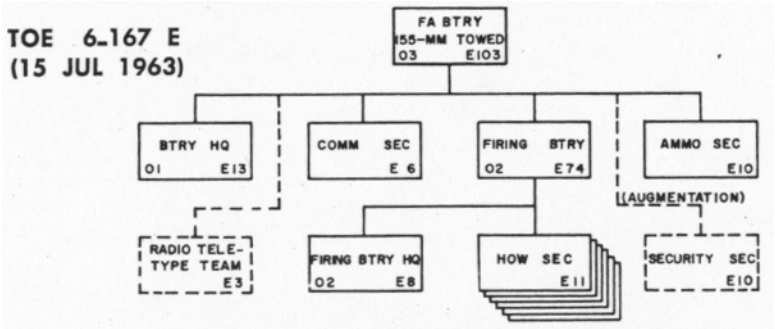


FA Bn, 155-mm, 8-in, Inf Div

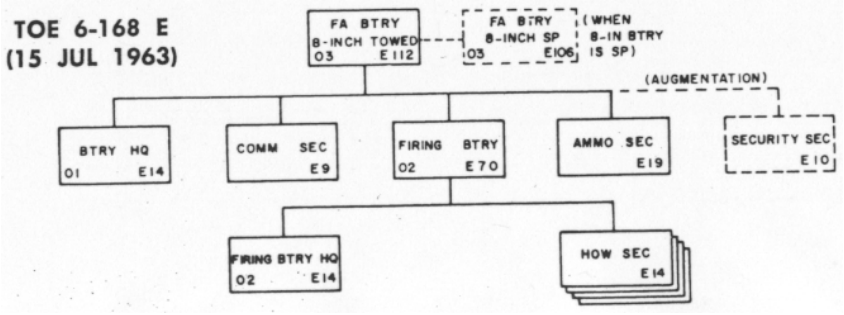
INF ARTY



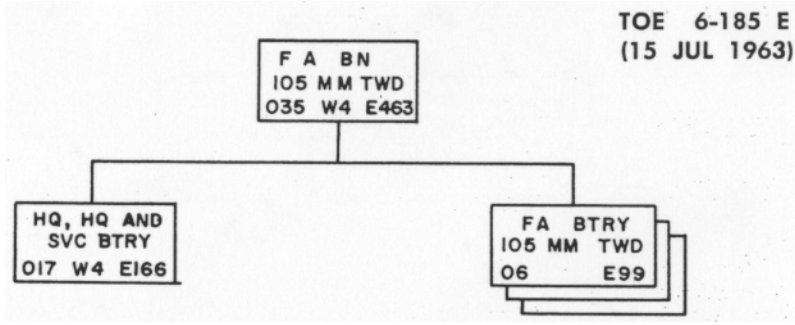
HHS Btry, FA Bn, 155-mm, 8-in Twd, Inf Div



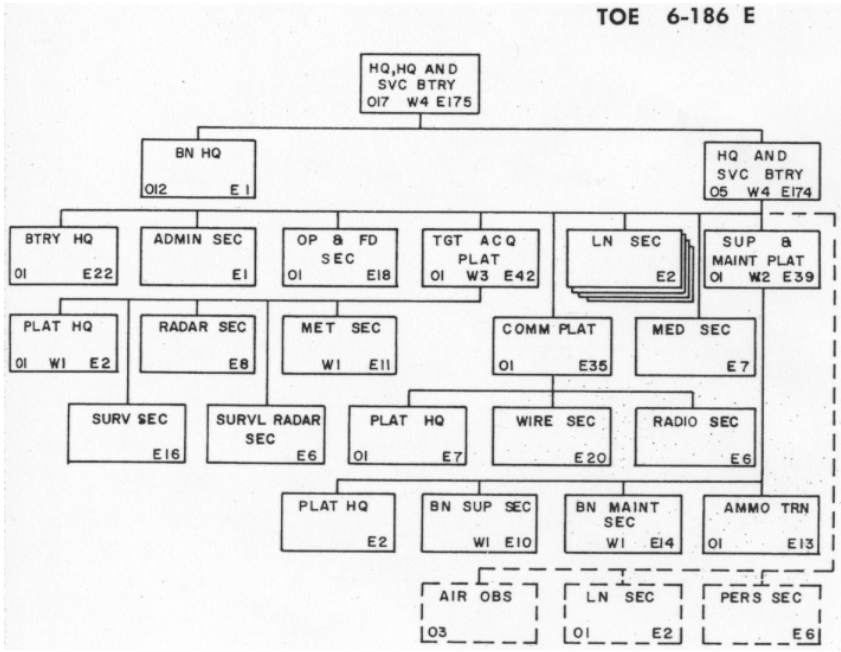
FA Btry, 155-mm, Twd, FA Bn, Inf Div



FA Btry, 8-in, Twd, FA Bn, Inf Div



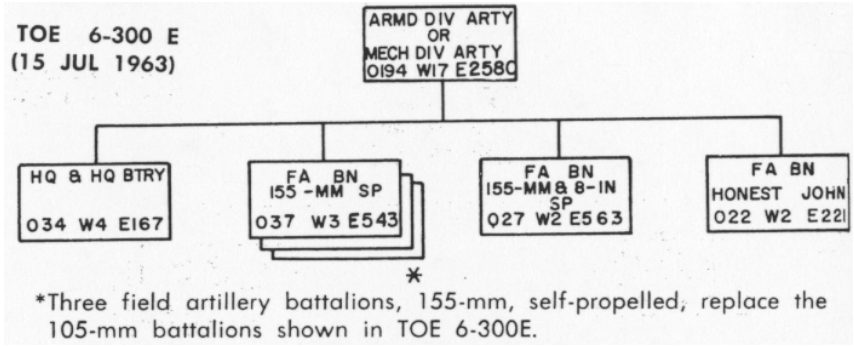
FA Bn, 105-mm Twd, Sep Inf Bde



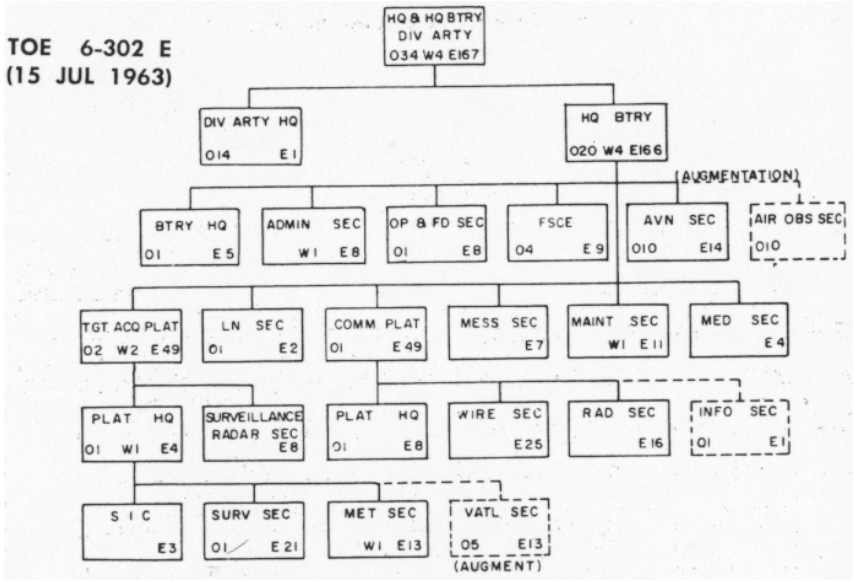
HHS Btry, FA Bn, 105-mm Twd, Sep Inf Bde

AUGMENTATION NOT INCLUDED IN TOTALS.

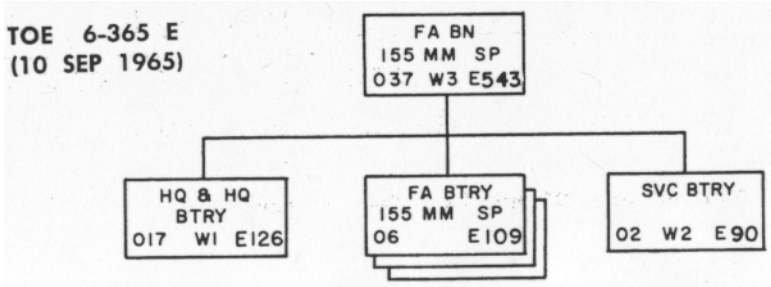
ARMD/MECH ARTY



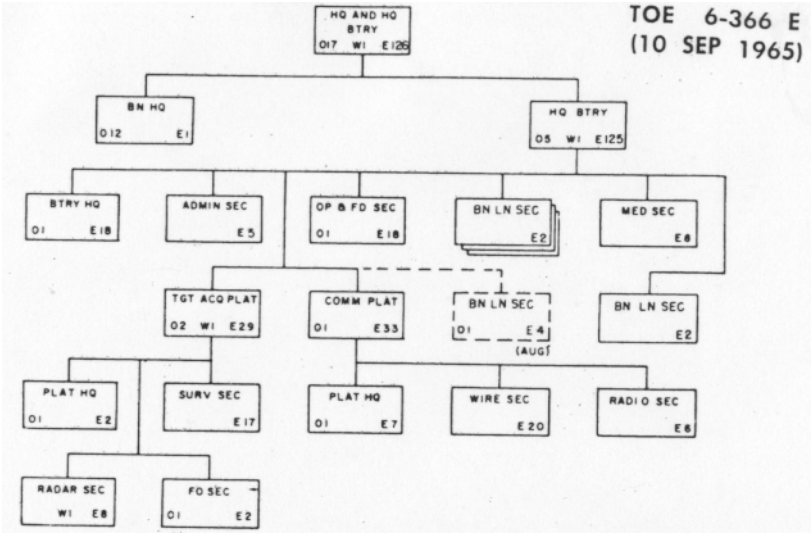
Armd/Mech Div Arty



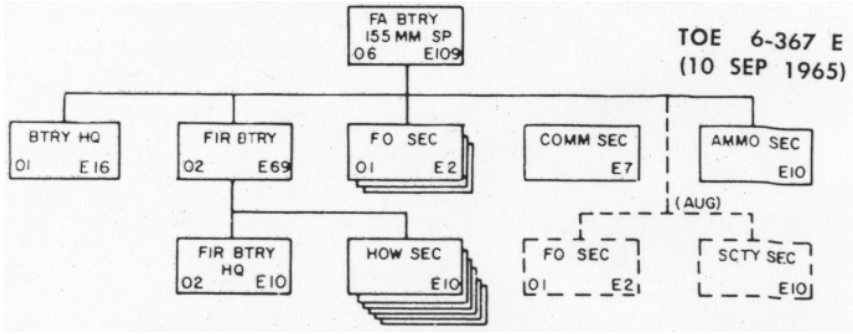
HH Btry, Armd/Mech or Inf Div Arty



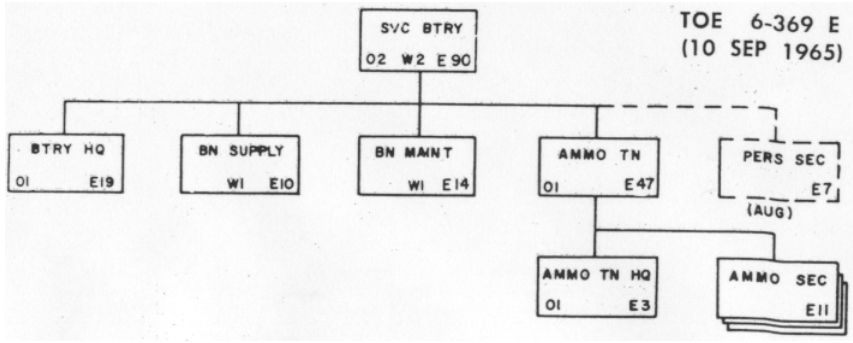
FA Bn, 155-mm SP, Armd/Mech Div



HH Btry, FA Bn, 155-mm SP, Armd Mech Div

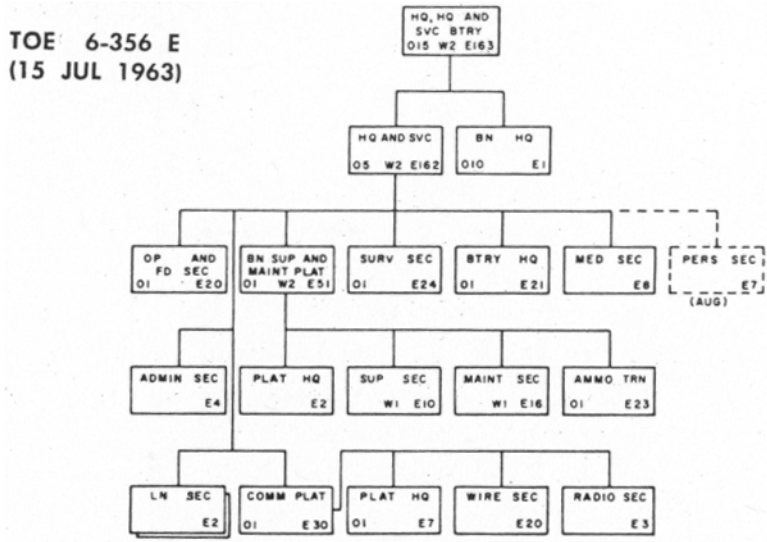


FA Btry, 155-mm, SP FA Bn, Armd/Mech Div

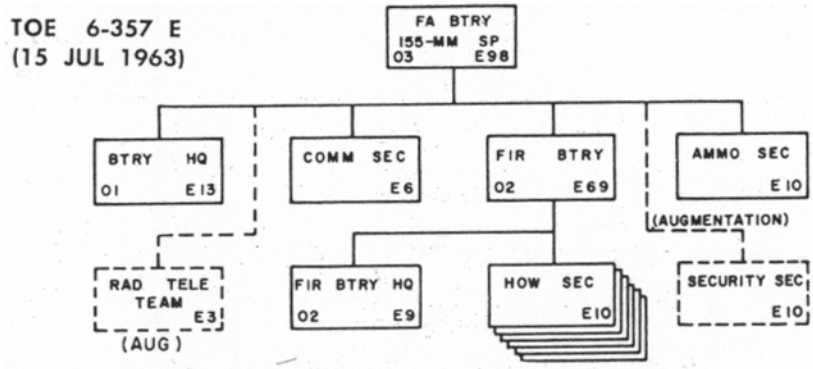


Svc Btry, FA Bn, 155-mm, SP Armd/Mech Div

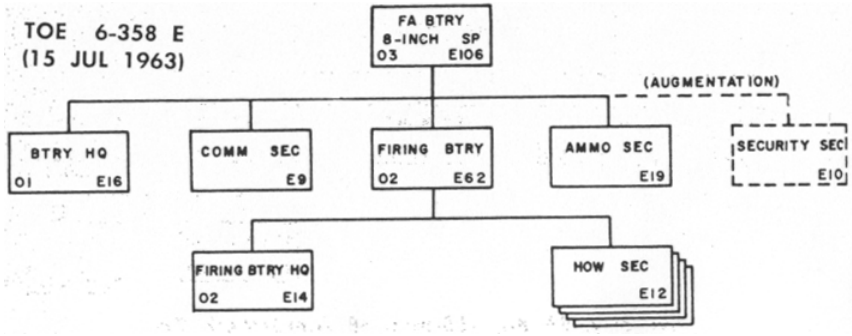
ARMD/MECH ARTY



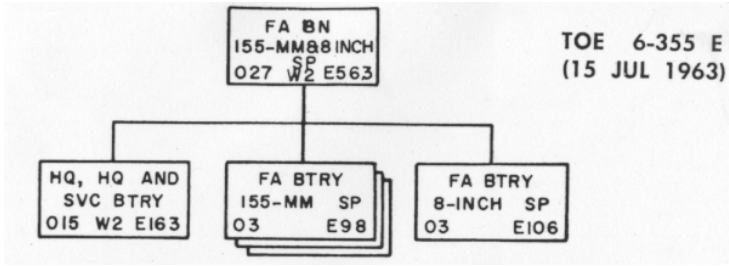
HHS Btry, FA Bn, 155-mm 8-in, SP, Armd/Mech Div



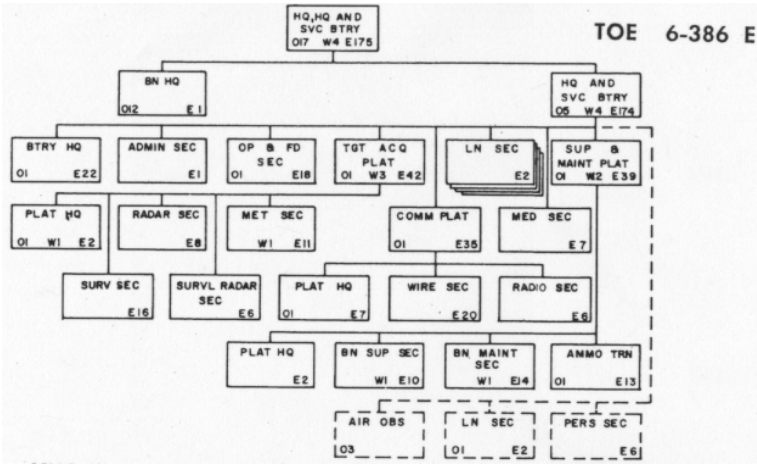
FA Btry, 155-mm, SP FA Bn, Armd/Mech Div



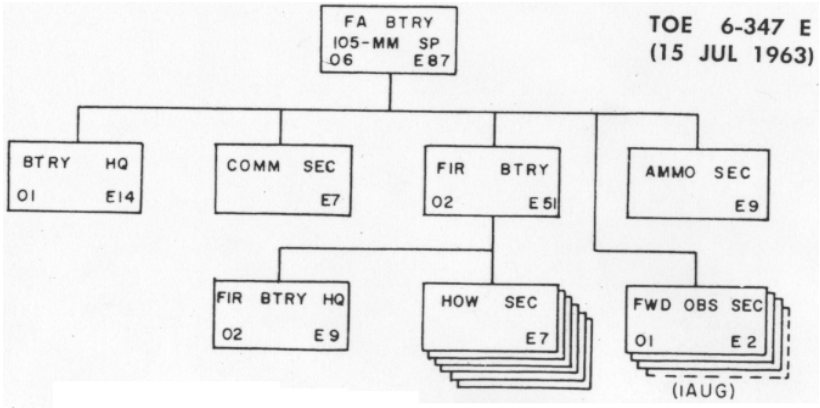
FA Btry, 8-in, SP FA Bn, Armd/Mech Div



FA Bn, 155-mm, 8-in SP, Armd/Mech Div



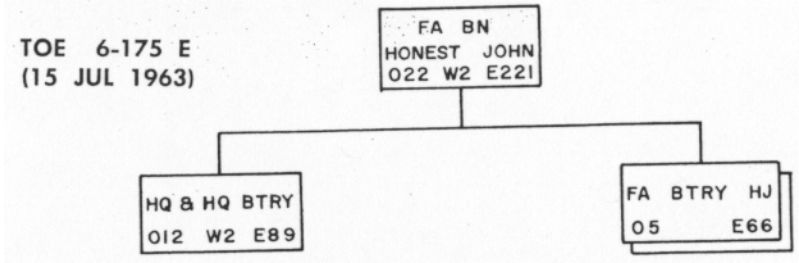
HHS Btry, FA Bn, 105-mm SP, Armd/Mech Sep Bde



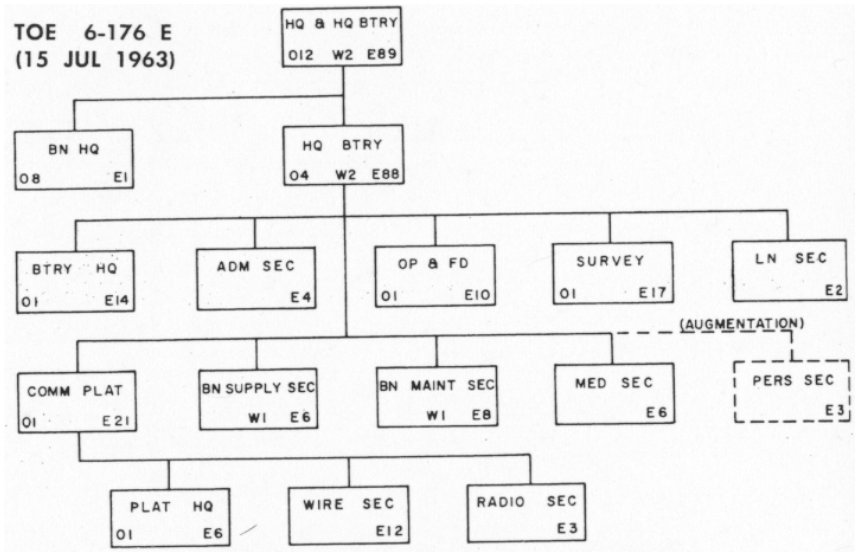
FA Btry, 105-mm SP, FA Bn, Armd/Mech Div and Sep Armd/Mech Bde

AUGMENTATION NOT INCLUDED IN TOTALS.

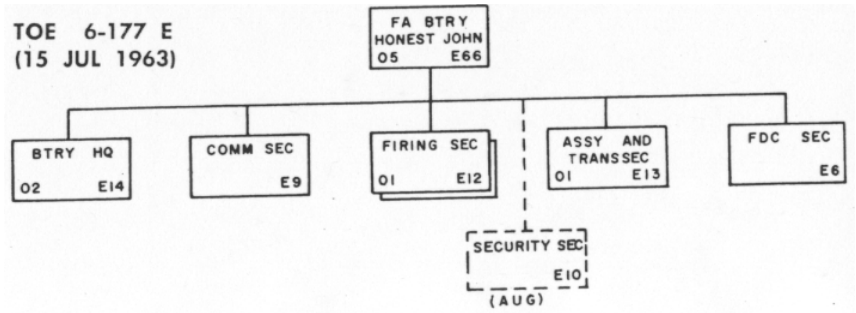
FA BN, HONEST JOHN



FA Bn, HJ, Armd/Mech and Inf Div



HH Btry, FA Bn, HJ, Armd Mech or Inf Div



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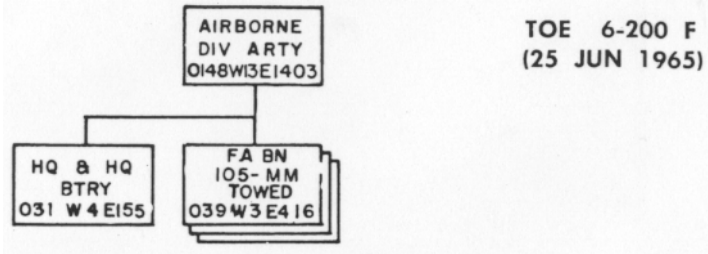
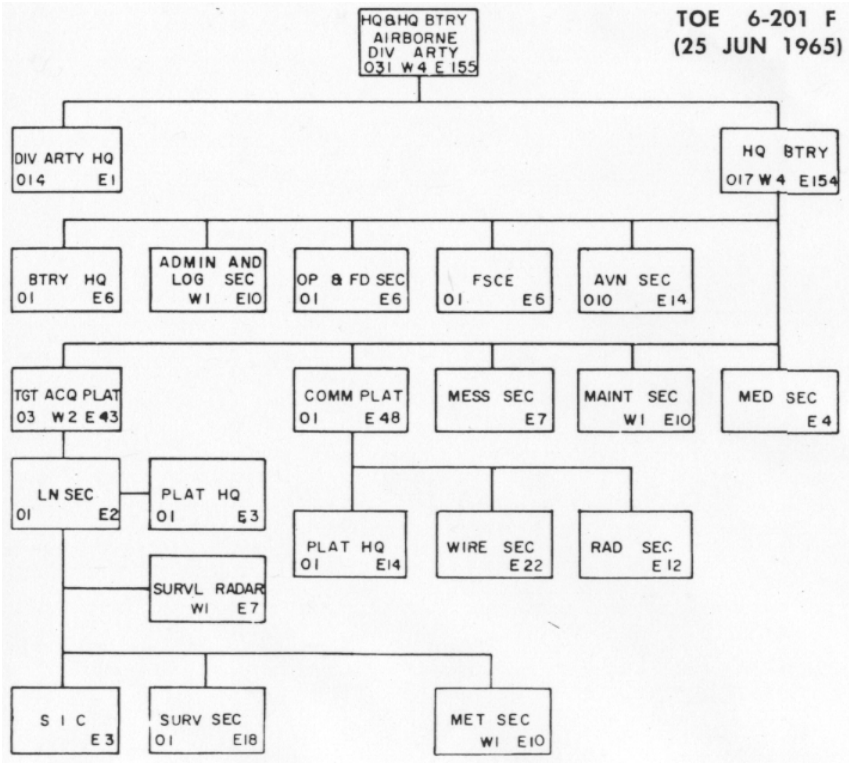
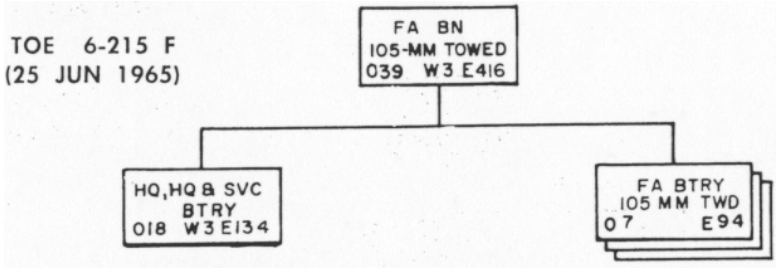


Abn Div Arty

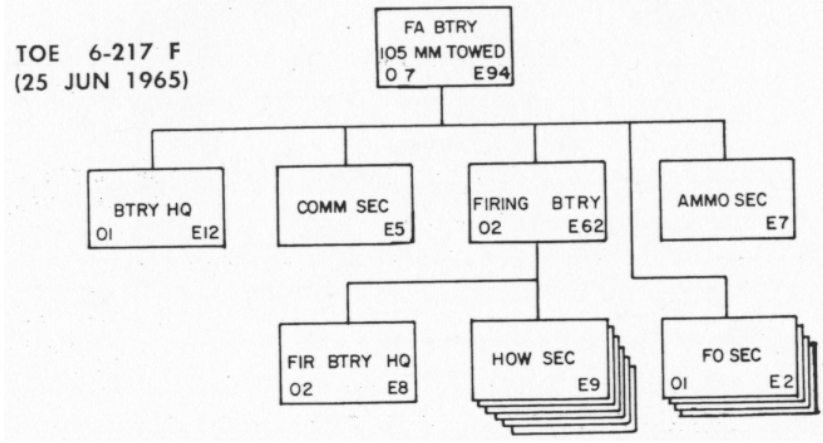


HH Btry, Abn Div Arty

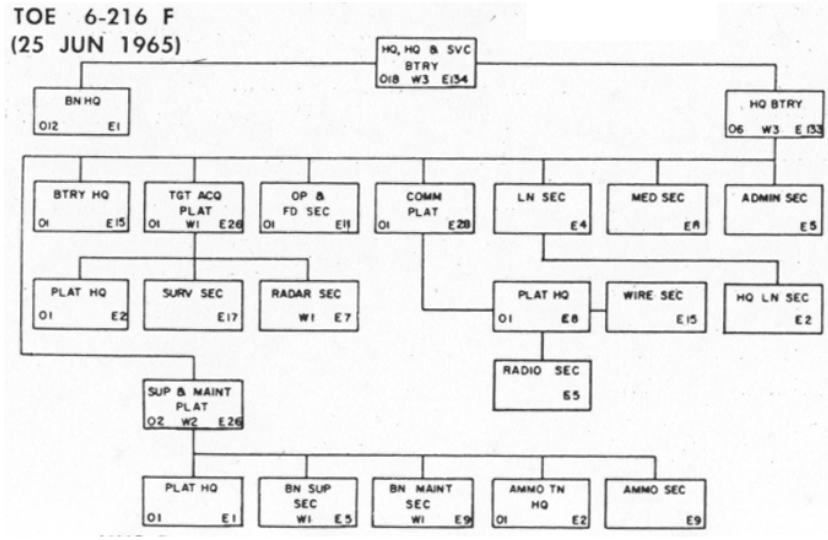
ABN ARTY



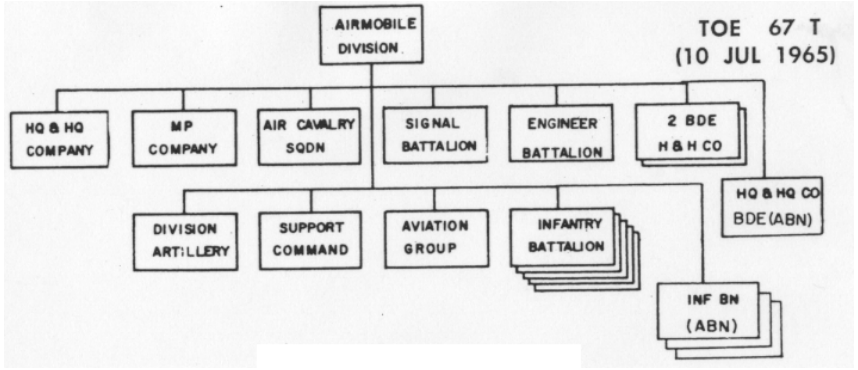
FA Bn, 105-mm Twd, Abn Div or Sep Abn Bde



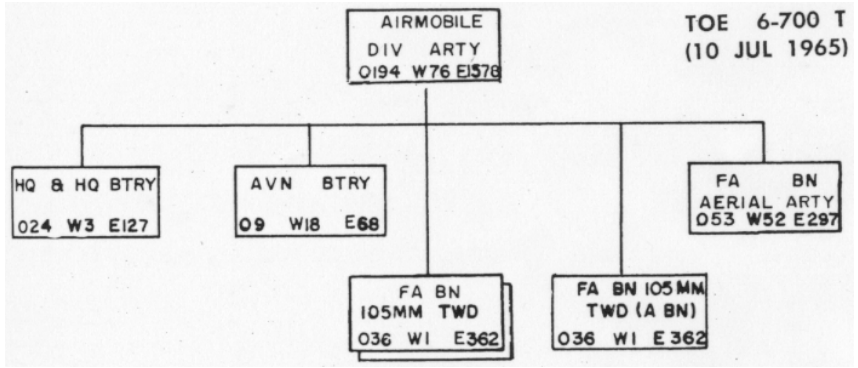
FA Btry 105-mm Twd, Abn Div or Sep Abn Bde



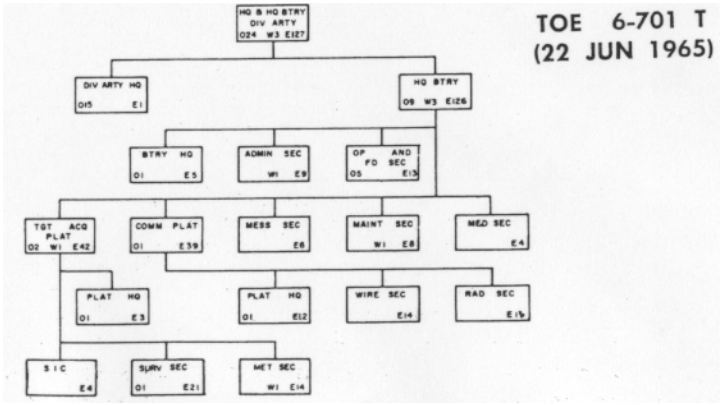
HHS Btry, FA Bn, 105-mm Twd, Abn Div or Sep Abn Bde



Airmobile Division

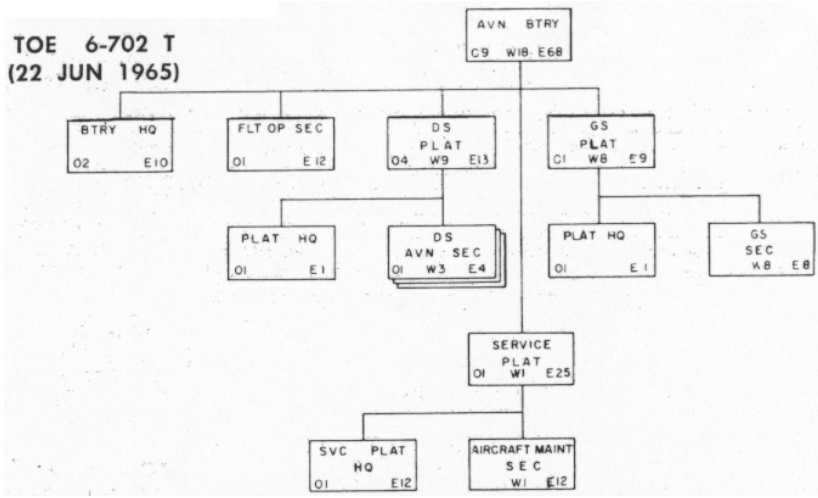


Airmobile Div Arty

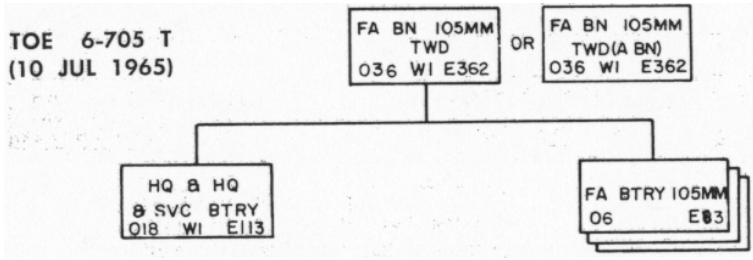


HH Btry, Airmobile Div Arty

AIRMOBILE ARTY



Aviation Btry, Airmobile Div Arty



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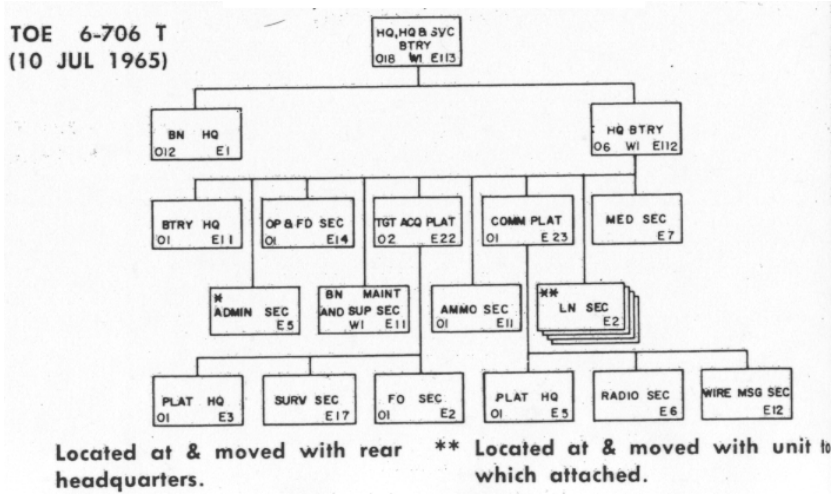

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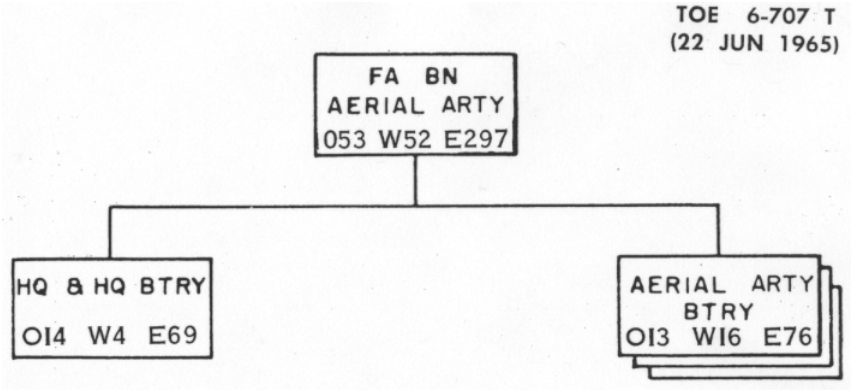
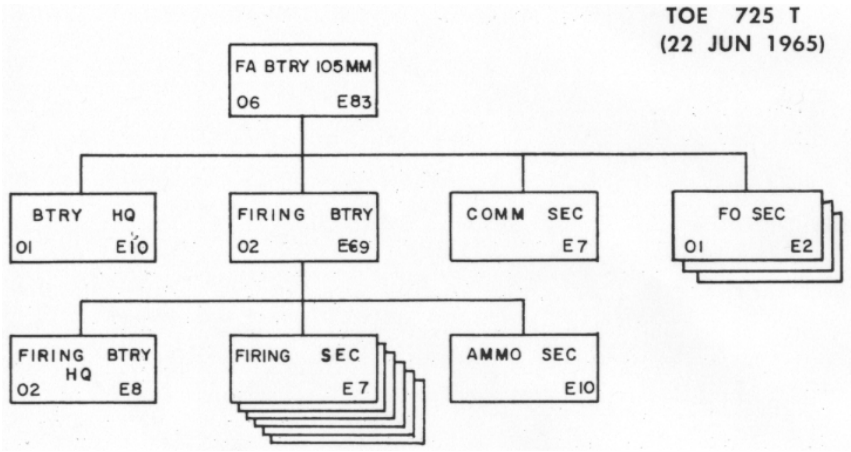
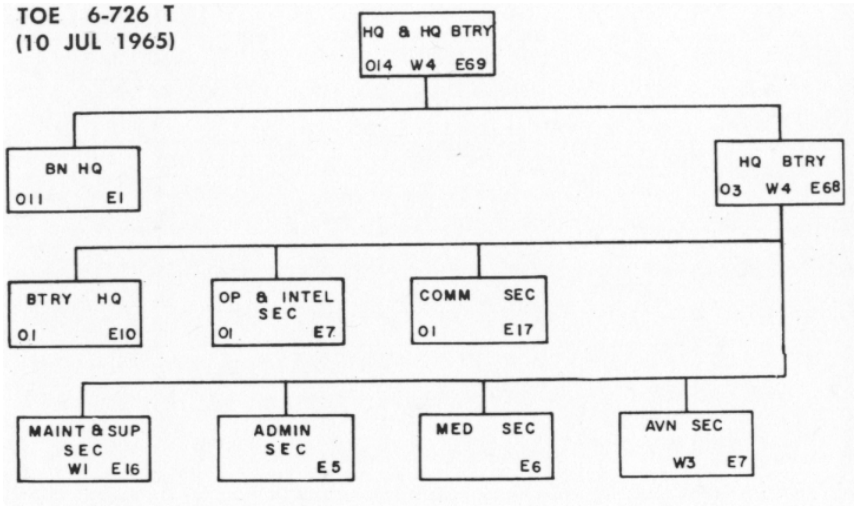


FA Btry, 105-mm, FA Bn, Airmobile Div

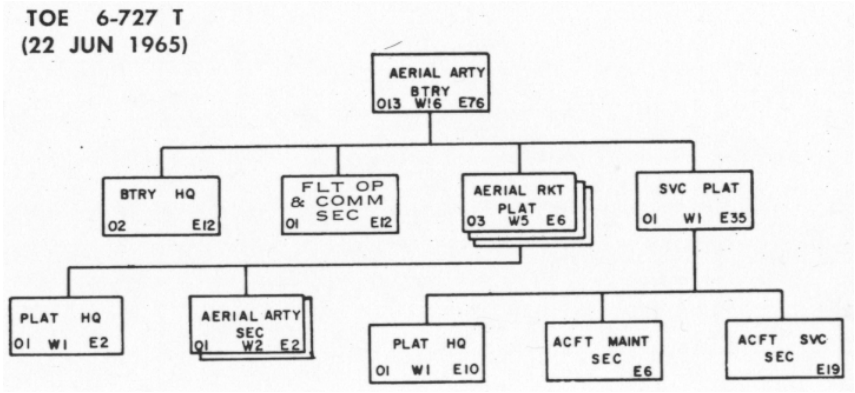


FA Bn, Aerial Arty, Airmobile Div

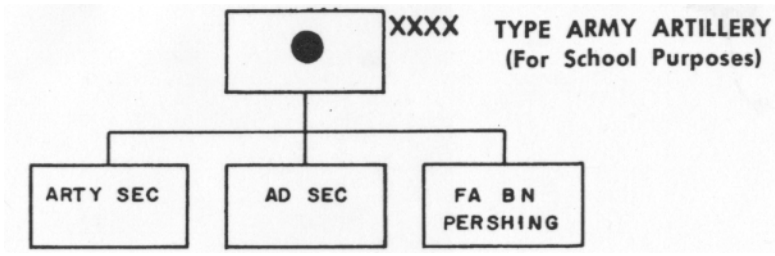
AIRMOBILE ARTY



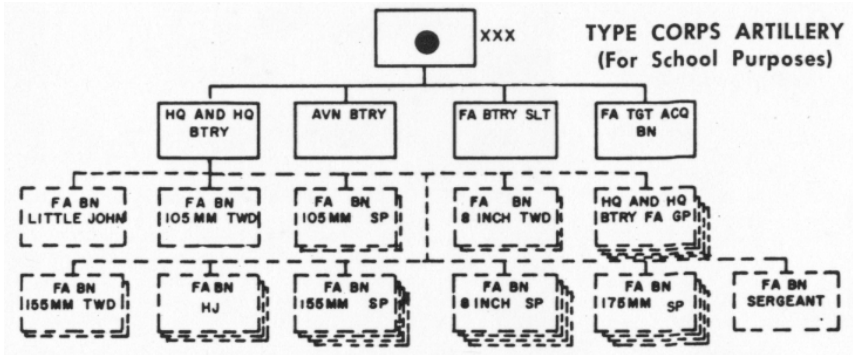
HHS Btry, FA Bn, Aerial Arty, Airmobile Div



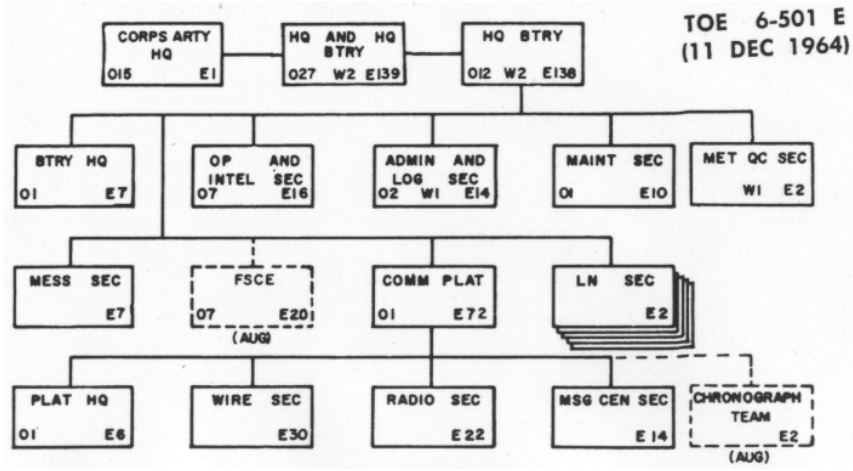
Aerial Arty Btry, FA Bn, Aerial Artillery, Airmobile Division



Type Army Artillery

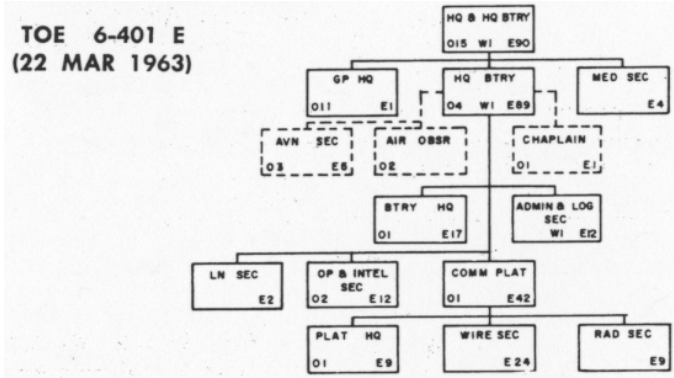


Type Corps Arty

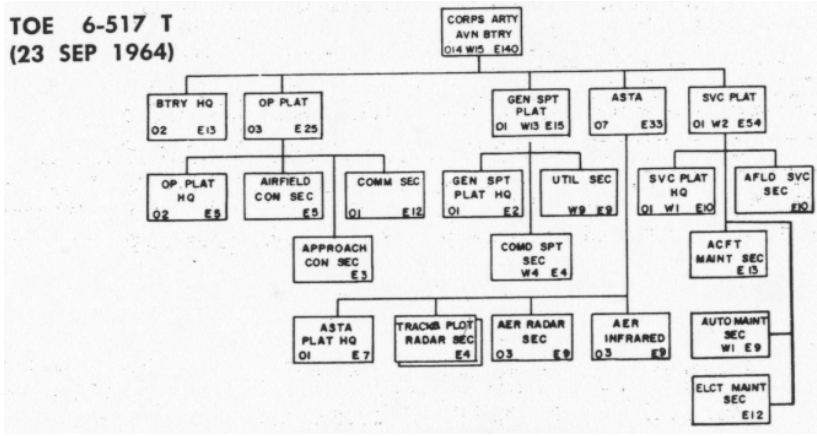


HH Btry, Corps Arty

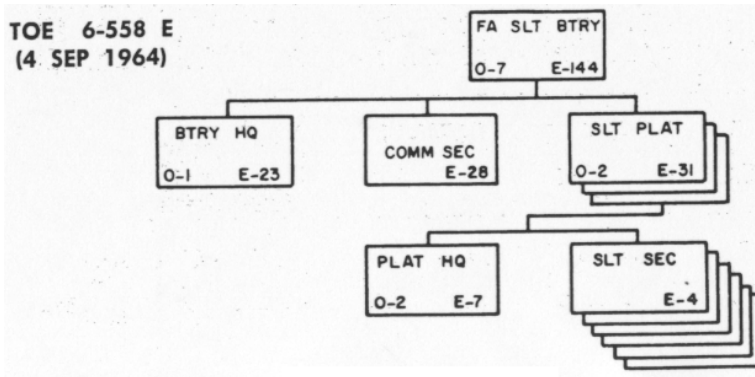
ARMY/CORPS ARTY



HH Btry, FA Group

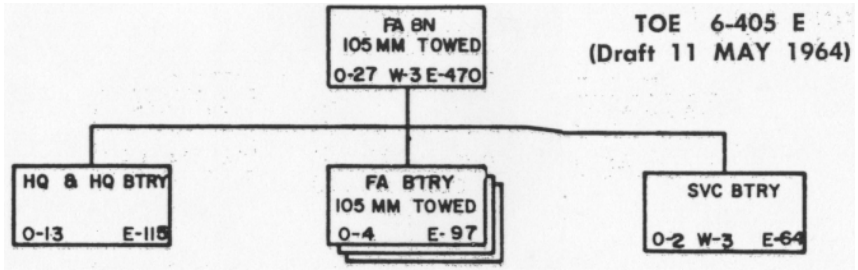


Aviation Btry, Corps Arty

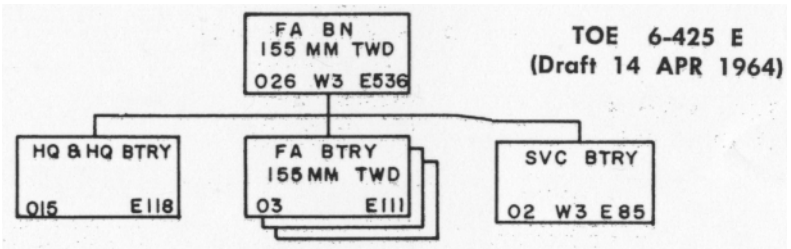


FA Btry, Searchlight

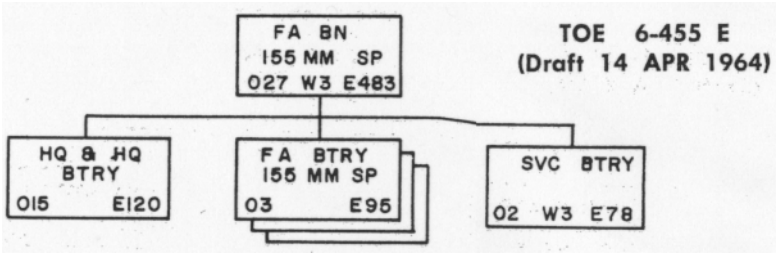
AUGMENTATION NOT INCLUDED IN TOTALS



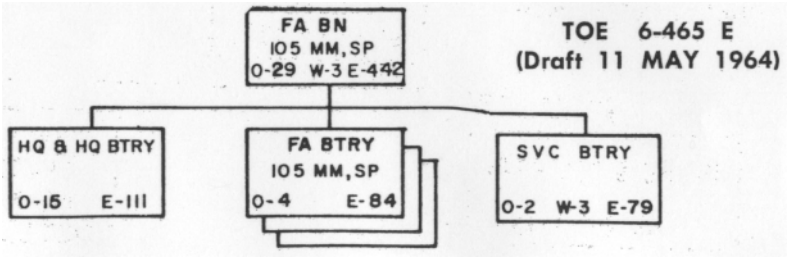
FA Bn, 105-mm Twd



FA Bn, 155-mm, Twd

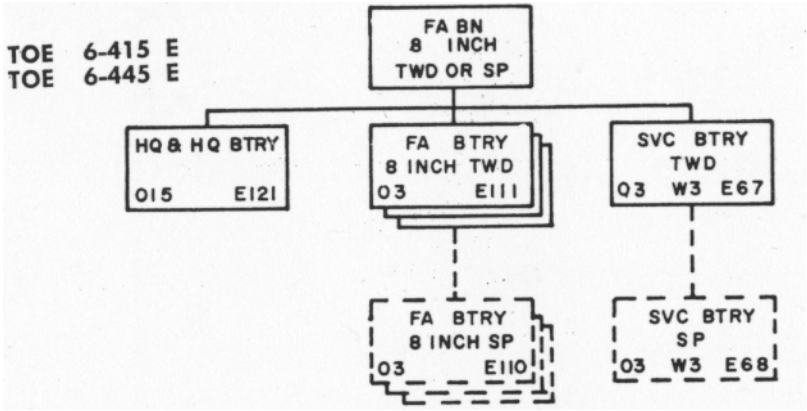


FA Bn, 155-mm SP

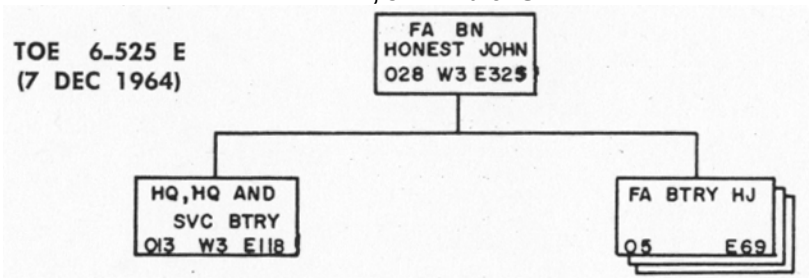


FA Bn, 105-mm SP

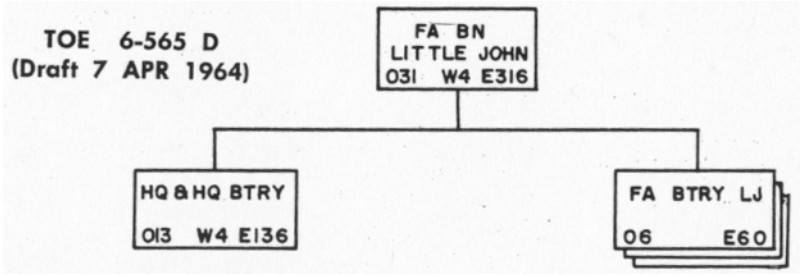
ARMY/CORPS ARTY



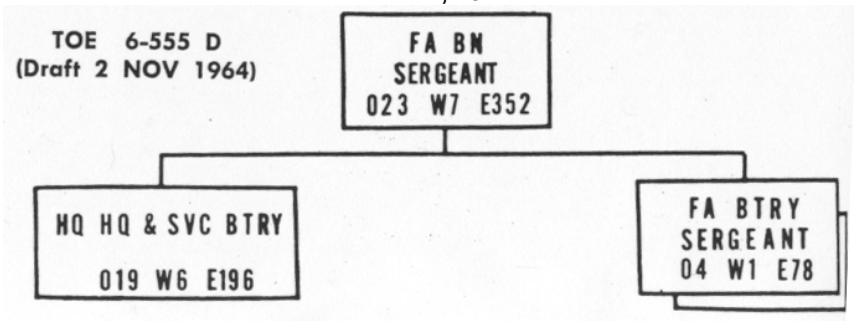
FA Bn, 8-in Twd or SP



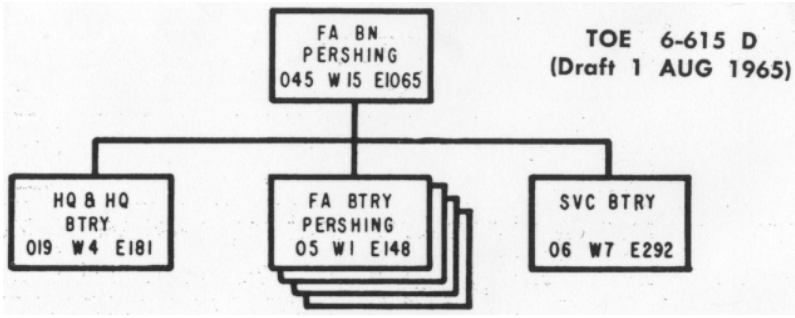
FA Bn, HJ



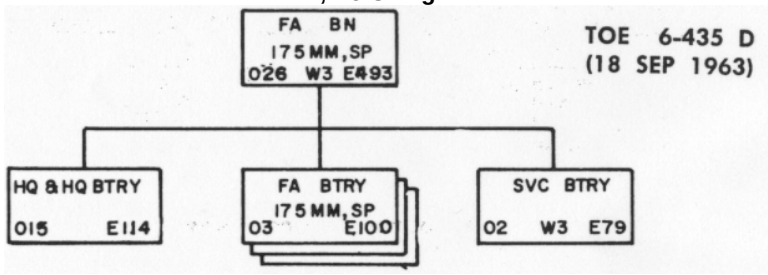
FA Bn, LJ



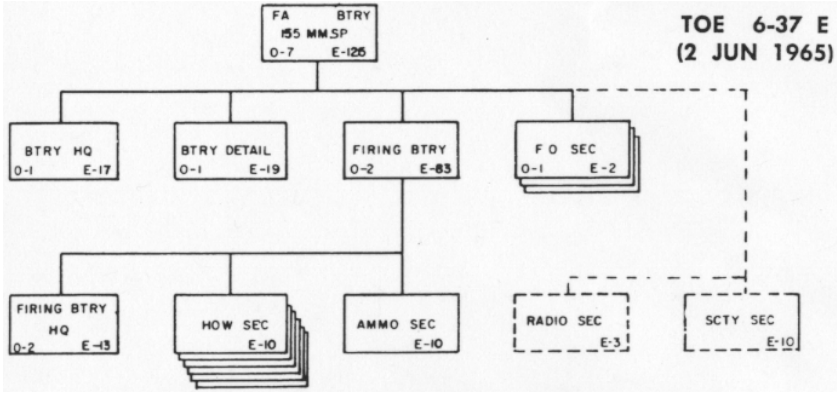
FA Bn, Sergeant



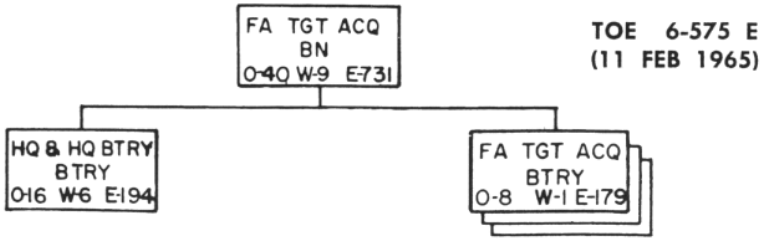
FA Bn, Pershing



FA Bn, 175-mm SP



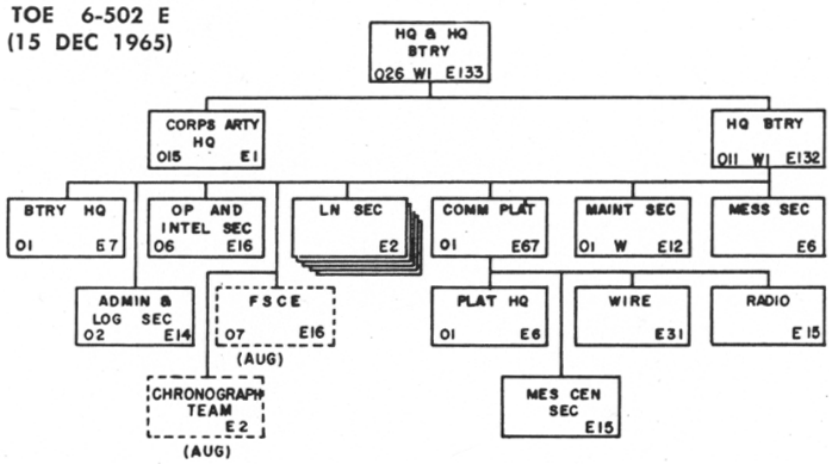
FA Bn, 155-mm SP, Armd Cav Sqdn, Armd Cav Regt



FA TAB

AUGMENTATION NOT INCLUDED IN TOTALS

ARMY/CORPS ARTY

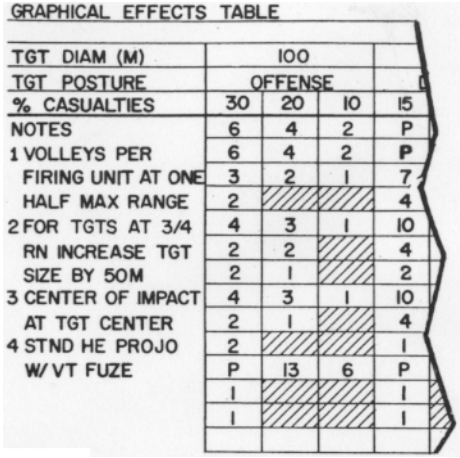


HH Btry, Abn Corps Arty

GRAPHICAL LETHALITY TABLE

Newly developed by the US Army Artillery and Missile School is a pocketsized graphical table for calculating the nonnuclear effects of mortars, cannon artillery, and air strikes.

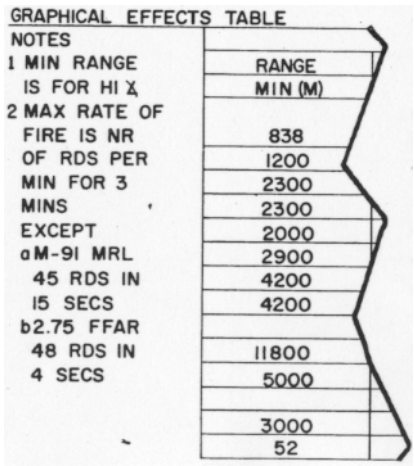
Side one (mortars and artillery) of the Graphical Lethality Table (GLT) is based on the unclassified nomographs in FM 6-141-1, Nonnuclear Employment of Field Artillery Weapons Systems (U), September 1964, classified CONFIDENTIAL.



GRAPHICAL EFFECTS TABLE

TGT DIAM (M)	100			
TGT POSTURE	OFFENSE			
% CASUALTIES	30	20	10	15
NOTES	6	4	2	P
1 VOLLEYS PER	6	4	2	P
FIRING UNIT AT ONE	3	2	1	7
HALF MAX RANGE	2			4
2 FOR TGTS AT 3/4	4	3	1	10
RN INCREASE TGT	2	2		4
SIZE BY 50M	2	1		2
3 CENTER OF IMPACT	4	3	1	10
AT TGT CENTER	2	1		4
4 STND HE PROJO	2			1
W/ VT FUZE	P	13	6	P
	1			1
	1			1

SECTION III
FIELD ARTILLERY OPERATIONS



GRAPHICAL EFFECTS TABLE

NOTES	
1 MIN RANGE	RANGE
IS FOR HI X,	MIN (M)
2 MAX RATE OF	
FIRE IS NR	838
OF RDS PER	1200
MIN FOR 3	2300
MINS	2300
EXCEPT	2000
aM-91 MRL	2900
45 RDS IN	4200
15 SECS	4200
b2.75 FFAR	
48 RDS IN	11800
4 SECS	5000
	3000
	52

In spite of its compactness, the GLT is capable of evaluating the effects of the 4.2-in mortar, 105-mm, 155-mm, and 8-in howitzers, and 175-mm gun on area and precision targets of various dimensions. Using this handy item it is possible to ascertain with a fair degree of reliability the number of volleys needed to achieve designated percentages of casualties against enemy troops in both offensive and defensive postures. The number of rounds necessary to destroy a precision target of a given size with one of the above weapons is also programmed into the GLT.

Side 2 contains data on the capabilities of artillery and 4.2-in mortar weapon systems and the projectile fuze combinations available for these systems.

GUNNERY

The fire order (and fire request on page 60) incorporates changes tentatively agreed upon by the artillery representatives of the armies of Australia, Canada, Great Britain and the United States working together as a quadrapartite ad hoc working group.

Final standard terminology to be accepted by the four countries is scheduled to become effective 1 September 1966.

FIRE ORDER

	Element	Example
* (1)	Battery(ies) to fire	BATTALION
(2)	Adjusting battery	BRAVO
(3)	Method of fire of adjusting battery	BATTERY LEFT
(4)	Basis for corrections	USE REGISTRATION POINT TWO
(5)	Distribution	SPECIAL CORRECTIONS, CONVERGE
(6)	Projectile	SHELL WP
(7)	Ammunition lot and charge	LOT X-RAY, CHARGE 5
(8)	Fuze	FUZE TIME
* (9)	Number of volleys	FIVE ROUNDS
(10)	Range spread or zone	RANGE SPREAD
(11)	Time of opening fire	AT MY COMMAND
*(12)	Target Number	TARGET ALFA BRAVO 101

* Items always included.

Registration by the Fork Bracket Method

Change 3 to FM 6-40, scheduled for publication the early part of 1966, describes a revised EVEN FORK BRACKET method of registration procedure and is designed to eliminate the 6 and 0 registration. Normally seven rounds after adjustment will be used to conduct a registration. From the first FDC positive range sensing of the first round in FFE, move one even fork in the opposite direction and fire one round. This procedure is repeated, if necessary, until a fork bracket is established. This bracket is split and firing continues until three positive FDC range sensings are obtained. Positive sensings are OVERs and SHORTs. The quadrant elevation is changed ½ fork in the direction opposite the preponderance of the sensings. This will result in firing at one of the QEs which established the even fork bracket. FFE is continued until two more positive range sensings are obtained. Compute the adjusted QE using the three positive rounds fired at center of fork bracket, the last two rounds fired, and the round which established the even fork bracket that was fired at the same QE as the last two rounds.

If the FO enters FFE as the result of a target hit, there is no requirement to establish a fork bracket, since the target hit yields both an OVER and a SHORT FDC sensing. Obtain two more positive FDC range sensings at the same QE. If there is no preponderance (T; —, +), obtain three more positive FDC sensings at the same QE and compute the adjusted QE. If there is a preponderance from the target hit with the next two rounds fired (T, —, — or T, +, +) move 1/2 fork opposite the preponderance and obtain three more positive FDC sensings. Using these six rounds compute the adjusted QE.

Summary of rules concerning valid/invalid and verification of registrations, using Fork Bracket Method

Situation	Registration is:	Varifying Procedure
5 overs, 1 short or 5 shorts, 1 over or 1 target, 5 shorts or 1 target, 5 overs	Normally valid. FDO has option to verify	1. Move 1/2F in appropriate direction and fire 1 round. 2. If sensing is opposite to preponderance, registration is valid (don't use verifying round in computing adj QE). 3. If sensing is same as preponderance, fire 2 more rounds. 4. If either of these rounds is in sense opposite of preponderance use last 6 rounds fired and compute adj QE. 5. If both of these rounds still in same sense as preponderance, registration is invalid. Move an Even Fork(s) in opposite direction of preponderance until a bracket is established and proceed as in initial fire for effect.
* * * * *	* * * * *	* * * * *
3 air, 3 graze or 4 air, 2 graze or 4 graze, 2 air	Valid	
* * * * *	* * * * *	* * * * *
5 air, 1 graze	Valid if mean height of burst is not greater than 15 meters. If mean height of burst is greater than 15 meters see below.	
* * * * *	* * * * *	* * * * *
5 air, 1 graze or 5 graze, 1 air	Suspect and must be verified.	1. Move 0.2 sec from last time fired. Subtract if preponderance is G, add if preponderance is A. 2. If sensing is opposite to preponderance, registration is valid. 3. If sensing is same as preponderance fire 2 more rounds at same time. 4. If either of these rounds is in the sense opposite to preponderance, compute adj ti using last 3 rounds fired and 3 rounds which were fired at time 0.2 sec away from the last 3 rounds fired. 5. If both of last 2 rounds are in the same sense as preponderance, registration is invalid, establish new 0.4 sec bracket and proceed as in initial time registration.

Laying the Battery

a. By Azimuth.

(1) Subtract the announced azimuth from the declination constant, adding 6,400 mils to the declination constant, if necessary. Example: ing 6,400 mils to the declination constant, if necessary. Example:

Declination constant.....	200	mils
	+6400	mils
	6600	mils
Minus announced azimuth	—5250	mils
Deflection to set on aiming circle	1350	mils

(2) With the single 0 of the aiming circle nearest you and the 0-3200 line pointing generally in the direction of the announced azimuth, turn the **upper** motion of the aiming circle clockwise, until its index is opposite the deflection determined in (1) above.

(3) Using the **lower** motion, center the magnetic needle.

(4) Using the **upper** motion, lay the battery reciprocally. Each tube is then parallel to the 0-3200 line of the aiming circle.

b. By Orienting Angle.

(1) Point the 0-3200 line of the aiming circle in the general direction of fire.

(2) Using the **upper** motion, set off the desired orienting angle on the scales of the aiming circle.

(3) Using the **lower** motion, sight on the end of the orienting line.

(4) Using the **upper** motion, lay the battery reciprocally so that each tube is parallel to the 0-3200 line of the aiming circle.

	INITIAL FIRE REQUEST		
1.	Identification	BIG STALLION 19 THIS IS BIG STALLION 31	
2.	Warning Order (FO may request size, of fire unit desired in FFE; e.g. Battery, all available)	FIRE MISSION—BATTALION	
3.	Target Location	GRID 6 7 2 1 5 9 2 3	(Formerly: Coordinates)
4.	Direction to Target from Observer	DIRECTION 4 7 9 0	(Formerly: Azimuth)
5.	Description of Target	COMPANY DIGGING IN ALONG RIDGE, 300×100	
6.	Method of Engagement (Close, High Angle, Amt. of rounds to be fired, Type of Shell or Fuze)	FUZE TIME	
7.	Control	ADJUST FIRE	(Formerly: Will Adjust)
	MESSAGE TO OBSERVER		
8.	Allocation of number of rounds	4 ROUNDS	(Formerly 4 Volleys)
9.	Target Number	TARGET AB 401	(Formerly: Concentration)
	CONDUCT OF FIRE		
10.	Announcement that round has been fired	SHOT	(Formerly: On The Way)
11.	a) Correction for 1st rounds	RIGHT 100 + 200 UP 10	Sequence of sending correction has changed.
	b) Subsequent Correction	+50 FIRE FOR EFFECT	
12.	FDC Report of Completion of FFE	ROUNDS COMPLETE	
13.	Termination of Mission and effect report by observer.	END OF MISSION 30 CASUALTIES	

Dimensions of Open Sheaf Volleys

CALIBER	Width (in meters) of open sheaf			Front (in meters) covered by an open sheaf		
	2-piece Btry	4-piece Btry	6-piece Btry	2-piece Btry	4-piece Btry	6-piece Btry
105-mm How	30	90	150	60	120	180 (1)
155-mm How	50	150	250	100	200	300
8-inch How	80	240	.....	160	320	.....
175-mm Gun	95	285	475	190	380	570
4.2-inch Mortar	50	150	250	100	200	300

(1) 200 meters for planning purposes.

Field Artillery Tactical Missions

A field artillery unit with a mission of—	General support.	General support reinforcing.	Reinforcing.	Direct support.
Answers calls for fire from—	Force artillery headquarters. Own observers.	Force artillery headquarters. Reinforced artillery unit. Own observers.	Reinforced artillery unit. Own observers. Force artillery headquarters.	Supported unit. Own observers. Force artillery headquarters.
Establishes liaison with—	No inherent requirement.	Reinforced artillery unit.	Reinforced artillery unit.	Supported unit (down to battalion level).
Establishes communication with—	No inherent requirement (internal communication only).	Reinforced artillery unit.	Reinforced artillery unit.	Supported unit.
Has as its zone of fire—	Zone of supported unit.	Zone of supported unit to include zone of fire of reinforced artillery unit.	Zone of fire of reinforced artillery unit.	Zone of supported unit.
Furnishes forward observer—	No inherent requirement.	Upon request of reinforced artillery unit subject to prior opproval of force artillery headquarters.	Upon request of reinforced artillery unit.	To each company sized maneuver element of supported unit.
Displaces when (2)—	Ordered by force headquarters. Ordered by higher artillery headquarters.	Ordered by force artillery headquarters, or upon request of reinforced artillery unit subject to prior approval of force artillery headquarters.	Requested by reinforced artillery unit, or ordered by force artillery headquarters.	Unit commander deems necessary or ordered by force artillery headquarters.
Has its fires planned by—	Force artillery headquarters	Force artillery headquarters.	Reinforced artillery unit.	Develops own fire plan.

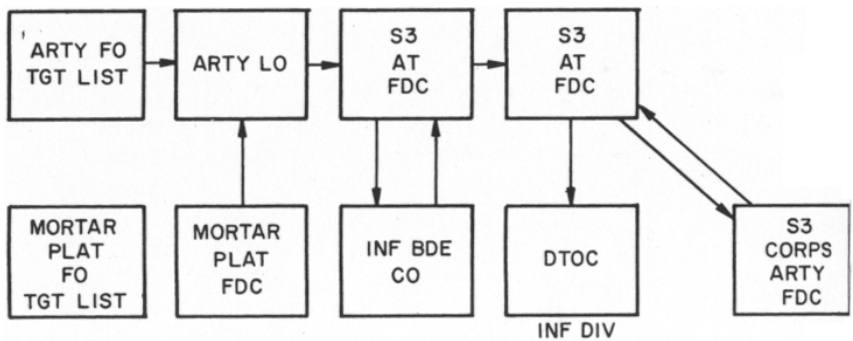
(2) Notifies the force artillery headquarters of time, position, and fire capabilities.

TACTICS

FIRE PLANNING

Very few jobs can be accomplished without prior planning. For this reason, the field artillery, in order to accomplish its job of supporting the close combat elements, engages in fire planning—a necessity for both offensive and defensive operations.

Artillery fire planning must be responsive to, and consistent with the changing requirements of the unit it is supporting. Fire planning procedures begin with the artillery forward observer at the close combat company and forward observers of the mortar platoon organic to the close combat battalion. Using the company's plan of attack as a basis, the observers prepare target lists which reflect the fires needed to support the company. The lists are forwarded to an artillery liaison officer at the combat battalion. When the target lists are consolidated here, they become artillery fire plans. The liaison officer adds any targets which he planned, based on information provided him by the infantry battalion. Each artillery target is assigned a concentration designation number, and each artillery forward observer is notified of the numbers. The liaison officer sends his fire plan to the direct support artillery battalion, which is the focal point for artillery fire planning at the infantry brigade level. The artillery battalion S3 prepares a fire plan for the brigade. Essentially the same process takes place at the division artillery level, where the division artillery S3 prepares the artillery fire plans for the division. The fire plan includes all the fires of interest to the whole division and those fires requested by the direct support battalions (fires beyond the range or capabilities of the DS Bn.)



Fires planned in the offense and in the defense are in the form of concentrations, groups, and series of fires which are to be fired on a time schedule or on call.

a. Offense. At all echelons fires to support an attack are planned—

(1) On enemy locations which could influence the attack of the supported unit.

(2) On identifiable terrain features. Concentrations are planned on identifiable terrain features, such as hilltops, road junctions, and recognizable manmade objects, to enable the artillery to deliver fires quickly when necessary. Protective concentrations, for example, are planned in the offense on identifiable terrain beyond and to the left and right of an objective. They are planned by the forward observer to enable him to deliver fast and effective fire while the infantry is consolidating and reorganizing. They are planned on identifiable terrain so that the forward observer can recognize the location and shift it if necessary. For further discussion of fire planning in the offense, refer to FM 6-20-2 (Jan 62), para 83a and b.

b. Defense. As in the offense, fires in support of a unit in the defense are planned on enemy locations and identifiable terrain features. Concentrations are planned in three general areas.

(1) Concentrations are planned in front of our position on likely avenues of approach and on identifiable terrain features. Fires in front of the FEBA are planned to engage the enemy as early as possible in order to inflict casualties, delay his advance, disrupt his organization, and destroy the integrity of his attacking force. If these fires in front of the FEBA fail to halt an attacking enemy, the final protective fires of the company are delivered to destroy him during his attack.

(2) Fires are then planned on top of our positions so that, if the enemy penetrates our defense and reaches our positions, we can bring fire on him immediately.

(3) Fires are planned behind the FEBA and within the battle area for a number of reasons—to give depth to the defense, to limit penetrations, to support the counterattacks of the supported unit, and to support withdrawal of friendly troops. For further discussion of fire planning in the defense, refer to FM 6-20-2 (Jan 62), paragraph 89.

NUCLEAR WEAPONS EMPLOYMENT

General

The general facts presented in this discussion have been extracted from field manuals and are considered useful to commanders, staff officers, and firing units involved in the employment of nuclear weapons. No attempt has been made to cover the detailed subject of Target Analysis, since the personnel directly concerned with that function have already received essential information by school and refresher training and must rely upon the complete treatises contained in appropriate reference manuals in order to perform their duties properly.

TACTICS

Command Guidance

Because of the magnitude and nature of nuclear weapons effects, their employment may very well be the decisive element of an attack or defense. The basic concepts which will guide their employment are:

a. The U. S. Army is organized and equipped to fight in nuclear warfare, nonnuclear warfare, or under the threat of nuclear warfare.

b. Nuclear weapons will be employed within the theater of operations when the theater commander announces that their use is authorized.

c. Once nuclear warfare has commenced, the authority to employ nuclear weapons is decentralized.

d. United States nuclear weapons may be employed in support of allied forces, using either United States or allied delivery means. The nuclear warhead sections (to include artillery projectiles) remain under the control of United States military personnel until time of launching or firing.

e. A commander who plans to employ a nuclear weapon coordinates with any adjacent unit commander into whose sector militarily significant weapons effects are expected to extend. Lacking concurrence, the commander requests authority to fire from the next higher commander who controls both sectors.

f. Nuclear firepower is a form of combat power. It is generally the most rapidly employable means for influencing the action. Nuclear weapons may on occasion be used alone to accomplish tasks which might otherwise require the maneuver of close combat units; however, most tasks require a combination of fire and maneuver. Plans for the employment of nuclear firepower, nonnuclear firepower and maneuver forces are integrated to provide decisive results.

g. Nuclear weapons are employed to destroy or degrade enemy combat capabilities. Consistent with the requirements imposed by the tactical mission, casualties among civilian personnel are held to a minimum. Destruction of man-made structures or natural terrain features and creation of high intensity residual contamination areas may cause adverse political effects as well as create undesired obstacles to movement. Consistent with military objectives, destruction and contamination should be held to a minimum.

h. Commanders employ the smallest available weapon that provides the desired results.

i. Commanders employ surface bursts when surface bursts accomplish the results desired more effectively than airbursts.

All commanders and staff officers must understand the effects of nuclear weapons, the capabilities and limitations of the various delivery systems, the combat service support requirements involved and the procedure for employing these weapons. Since nuclear weapons are classified as a form of combat power, the commander must devote the same thought and effort to the development of initial staff planning guidance concerning nuclear weapons employment as he does to the employment of maneuver forces and other fires. If there is little time for staff planning, this guidance may consist of a decision by the commander at the very outset. When more time is available, the guidance may include specific courses of action for the staff to consider during the development of staff estimation. Much of this guidance should be contained in unit standing operating procedures (SOP), but the commander must be ready in the course of an operation to give timely and specific guidance in keeping with the situation. Limited staff planning guidance normally falls into the following categories: types of targets to be attacked, priorities, allocations and assignments to subordinate units, and desired nuclear weapon reserve. The commander's initial staff planning guidance for the use of nuclear weapons varies as to content with the echelon concerned.

At division level, this guidance is normally confined to the type and priority of targets to be attacked with nuclear weapons and the weapon reserve desired. Frequently he will indicate specific weapons that will constitute his nuclear weapons reserve to be retained for attack of targets of opportunity.

At corps level, the initial guidance is more general as to assignments of weapons and the nuclear weapon reserve. Because of the scope and area of corps operations, the corps is the lowest echelon that retains a substantial reserve of nuclear weapons for future plans of an operation. Command guidance includes the nuclear fires desired in connection with the commitment of the corps reserve maneuver force.

At field army level, plans for an operation are made weeks or even months in advance of D-Day, necessitating even more general command guidance. Initially, the staff will develop tentative plans for each phase and seldom will specific targets be selected. At this level, we can expect to find specific guidance in determining priorities of logistical support.

Two terms used in initial guidance, as outlined in CON/ARSTRIKE Reg 525-2, dated 5 May 1965, are allocation and assignment. The difference in their meanings deserves our special attention. Planning is permitted when a unit is given a weapon allocation, but the expenditure of the weapon is not authorized. Prior to receipt of Presidential release, only allocations of nuclear ammunition will be made. When Presidential approval is received, the allocation may be designated as an assignment.

The term "assignment" carries with it authorization for the expenditure of a weapon. Assignments may be made for a specific period of time, for a phase of an operation, or to accomplish a particular mission. Any commander possessing an assignment may further assign it to units under his control. Assignments automatically expire at the conclusion of the mission for which the assignment was made.

Damage criteria and troop safety considerations are SOP matters. Command guidance in this respect is appropriate only when departure from the SOP is desired. The SOP should state the coverage required to destroy a target and the coverage required to neutralize a target. A probable minimum coverage of 30 percent of a unit is generally sufficient to destroy the unit's effectiveness. Coverage in excess of 50 percent is generally a waste of combat power. Neutralizing a unit generally requires the destruction of 10 percent of the unit. In considering troop safety, there are three degrees of risk which a commander may accept under different tactical conditions; i. e., negligible, moderate, or emergency risk. At a **negligible** risk distance, troops are completely safe with the possible exception of temporary loss of night vision, or dazzle. At a **moderate** risk distance, anticipated effects levels are tolerable, or at worst, a minor nuisance. At an **emergency** risk distance, the anticipated effects level may cause some temporary shock, a few casualties, and may significantly reduce the unit's combat efficiency. Normally, the commander will, as a matter of SOP, desire negligible risk to his own and adjacent units.

Nuclear weapons may cause undesired effects on the battlefield which, if unplanned for, may seriously hamper or alter an operation. Fallout occurring from surface bursts may cause casualties among our own troops or deny the use of large areas. The decontamination of equipment required in fallout areas may become a serious problem. Whenever an intentional surface burst is planned, a fallout prediction must be made to assist the commander in his guidance and final decision on the employment of the nuclear weapon. Other contingent effects which may be undesirable are induced radiation around ground zero, tree blowdown, craters, rubble, and fires. Because nuclear weapons effects are indiscriminating, man-made objects, such as bridges, valuable to our scheme of maneuver may greatly limit or even preclude the use of nuclear weapons.

The individual who has been trained in the employment of nuclear weapons and to whom the commander turns for advice is the nuclear weapons employment officer (NWEO). He must be ready to supply his commander with answers concerning target analysis, troop warning, fire planning, security accountability, resupply, analysis of own vulnerability, fallout prediction, operations in residual radiation areas and post-strike analysis. The technical advice given by the NWEO assists the commander in making his decision.

Employing nuclear weapons demands good intelligence of the enemy. We can expect the enemy to move rapidly and to avoid the massing of his forces as much as the situation allows. When a lucrative nuclear target does develop, speed in analysis and attack of the target is essential. A target analysis, warning and fire order to the delivery unit, staff planning, and commander's final decision are all necessary steps to be taken prior to the delivery of any nuclear weapon. The greatest assurance of success depends on these actions being conducted and carried out in the minimum amount of time.

Nuclear Weapons Employment Reference Material

FM 101-31-1, Feb 63, w/C 1, 2, and 3 provides specific doctrine concerning the facets of tactical operations which are applicable to active nuclear warfare. It contains the U. S. Army concepts for nuclear weapons employment and the command and staff actions required to carry out these concepts. Appendixes to this volume present detailed technical procedures concerning target analysis. This manual is unclassified.

FM 101-31-2, Feb 63, w/C 1 and 2 provides the necessary data for actual target analysis. This manual is classified SECRET, RESTRICTED DATA.

FM 101-31-3, Feb 63, provides data concerning a family of hypothetical nuclear weapons and data necessary for target analysis. This volume is designed specifically for use in training of the staff officer, particularly the Nuclear Weapons Employment Officer. It is not intended for field exercises or command post exercises by U. S. forces, but can be so used for non-U. S. forces. Facility in the use of FM 101-31-3 will insure facility in the use of FM 101-31-2. This manual is unclassified.

TM 23-200, Revised Edition, November 64, presents the phenomena and effects of a nuclear detonation. It provides the source material and references needed for the preparation of operational and employment manuals by the Military Services. This manual is classified CONFIDENTIAL.

Target Designation System

In order to provide a common system of target reference, the target designation system outlined in the following subparagraphs is used at USAAMS. The system is to be used with standard procedures for preparing hostile target lists. This system eliminates much duplication and identifies the planning source.

a. Target Designation.

(1) All target designations will consist of two elements—letters and numbers. The letters "I" and "O" will not be used in **any** designation. The letter "N" will not be used as a **first** letter except as specified in (4) below.

(2) **Corps.** Alphabetical designations within a type corps are as follows:

Unit	Letter
Corps	X
Attached army division in numerical order	A through G
Armored cavalry regiment (artillery)	H
Artillery groups of corps artillery	XA to XG
Corps artillery FDC	XJ
Attached units or as desired	XK, XL, etc

(3) **Divisions.** Within the divisions a second letter will be assigned to each major subordinate unit as follows:

Unit	Letter
Supporting weapons organic to major maneuver elements attached to brigades (brigades in numerical order)	A through E
Division artillery FDC	F
Artillery battalions in numerical order	G through L
Attached artillery or as desired	M, N, P, Q, etc

(4) **Nuclear Targets.** Each nuclear target will be designated by the letter "N" as its first letter, followed by the letters indicated in (2) and (3) above, which identifies the planning headquarters. Targets are then numbered consecutively by each headquarters.

(5) **Numerical Element of the Target Designation**

(a) **Corps and divisions.** Numbers will be assigned consecutively as the target is developed or planned.

(b) **Howitzer battalions.** The numerical elements of target designation within a howitzer battalion are allocated as follows:

Unit	Number
LO at brigade FSCC	1-99
LO with lowest numbered battalion or task force	100-199
LO with next higher numbered battalion or task force	200-299
LO with next higher numbered battalion or task force	300-399
LO with next higher numbered battalion or task force	400-499
Counterbattery targets	500-599
Artillery battalion FDC	600-799
Attached Units or as desired	800-999

(c) **Forward observer.** The targets planned by the forward observers will be assigned numbers by the liaison officer with the battalion or task force.

(d) **Brigades.** The numerical elements of target designations within the brigades are allocated as follows:

Unit	Number
Brigade Headquarters	1-99
Lowest numbered battalion attached	100-199
Next higher numbered battalion attached	200-299
Next higher numbered battalion attached	300-399
Next higher numbered battalion attached	400-499
Hv Mort FDC of lowest numbered battalion	500-599
Hv Mort FDC of next higher numbered battalion	600-699
Hv Mort FDC of next higher numbered battalion	700-799
Hv Mort FDC of next higher numbered battalion	800-899
As required	900-999

b. Modifications.

(1) It may be advisable to modify the system outlined herein to satisfy a particular need. For example, in order to facilitate the conduct of counterbattery activities, the counterbattery intelligence officer (CBIO) may wish to establish a system whereby counterbattery targets may be readily identified solely on the basis of the target designation. This can be done by adding an appropriate letter following the assigned designation; e. g., "A" for artillery, "M" for mortar, "R" for rocket or missile.

(**EXAMPLE:** XJ502A indicates an aggressor artillery location developed by the CBIO at corps artillery FDC.)

(2) Modifications to this target designation system should be confined to use within the headquarters making the modification. Such modifications should not be reflected in target information transmitted from one headquarters to another.

c. Target Lists.

(1) All target lists should clearly indicate which targets are confirmed and which are suspect.

(2) Targets of a similar nature, i. e., mortars, artillery, may be grouped to facilitate the preparation of the various programs of fires.

d. Examples.

XJ14 The 14th target planned by corps artillery FDC.

AF2 The second target planned by the lowest numbered division artillery FDC.

NA3 The third nuclear target planned by the lowest numbered division.

AG600 The first target planned by the FDC of the lowest numbered artillery battalion of the lowest numbered division.

e. Groups of fires will be designated with numeral placed between the identifying letters. For example, the second group of fires planned by the lowest numbered direct support battalion would be designated A2G.

f. Series of fires and programs of fire will be designated by code names.

TACFIRE

The Fire Direction System of the future is TACFIRE of ADSAF (Tactical Fire Direction System of Automatic Data Systems within the Army in the Field).

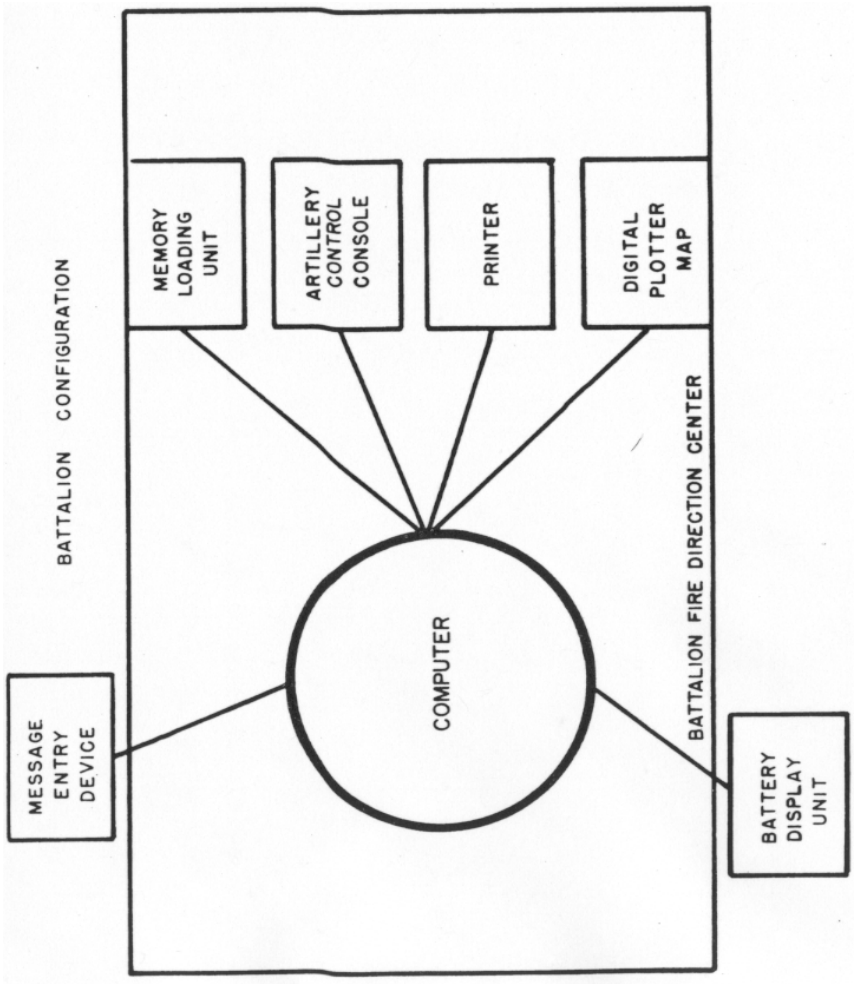
Formerly known as the Fire Support System of CCIS-70, TACFIRE in its final form will consist of a completely automated and computerized fire direction center capable of processing input from a wide variety of sources and coming up with a gunnery solution.

The operational programs for TACFIRE include Ammunition and Fire Unit Status, Fire Planning, Artillery Survey, Artillery Target Intelligence, Distribution of Meteorological Data, Tactical Fire Control, Technical Fire Control, Preliminary Target Analysis, Nuclear Target Analysis, Chemical Target Analysis, Fallout Prediction, and those programs needed for support and control of the system.

The TACFIRE system is sufficiently flexible to be utilized at any level from battalion to the highest echelons of artillery organization.

The diaggram on page 72 depicts the configuration of the equipment envisioned for the battalion fire direction center. A forward observer, using the message entry device, transmits the fire mission directly into the battalion fire direction center computer, which accepts and processes the mission almost instantaneously. By analyzing the information contained in the fire mission, the computer determines the units to fire, number of rounds, and types of ammunition and fuze, computes the ballistic solutions, and composes a complete set of fire commands for the firing batteries. The fire mission and the recommended solution are presented to the gunnery officer on the printer, and the digital plotter map shows the location of the target with respect to the terrain and the tactical situation. The gunnery officer can make any modification or change he wishes, since the computer is always under human control. Implementing the mission is a matter of pressing a button on the artillery control console, thereby sending fire commands to the firing batteries where they are displayed for the executive officers on the battery display units. Except for the time required for the S3's decision, the whole operation, from the time the forward observer depresses the transmit button on his message entry device until the commands are displayed at the batteries, is expected to take less than 10 seconds.

When the mission has been completed, the computer automatically composes a message containing all the information about the target, the ammunition expended, and the effect achieved. When approved by the S3, this message is transmitted in digital form to the computer center at division artillery.



COMMUNICATIONS

AREA COMMUNICATION SYSTEM

The division employs an area communication system designed to insure rapid and responsive communication to meet the requirements of command control. The division signal officer, who is also the signal battalion commander, is responsible for the establishment, operation and supervision of all phases of communication within the division. The division signal battalion provides the necessary personnel and equipment to establish, operate, and maintain the division area communication system and various internal and external radio systems.

Composition of the Division Area Communication System

The area communication system consists of command and area signal centers linked together by a multichannel, multiaxis network of radio relay and carrier systems. In addition to the radio relay and carrier equipment available at each signal center, there are various combinations of other facilities.

The facilities normally available in a division area communication system are:

a. Radio relay and cable system
b. Patching and switching facilities
c. Message center service
d. Messenger service
e. Radio/Wire Integration facilities

Field Army Area Communication System

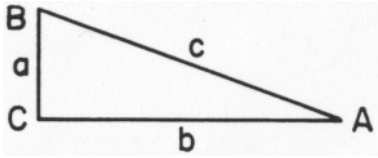
The corps signal battalion does not operate an area communication system. This battalion establishes direct contact with the divisions by sending operating personnel, radio relay and carrier equipment, and signal construction personnel and equipment to the division main command post. Field Army, which operates an extensive area communication system, sends personnel and equipment to the division rear and to the division support command post. This is done to link these installations to the nearest field army area communication signal center. Thus, the division can contact army headquarters or can channel traffic to army through the direct communication link with corps, which, in turn, is linked to both the army area system and to the army command post. This contact between corps and army is established by personnel and equipment from the field army signal group.

Artillery Use of The Division Area Communication System

Except for the division artillery headquarters, each artillery unit that desires to use the division area communication system, or is directed to do so, must install its own circuit to the nearest entry point into the area communication system. Time permitting, it is desirable that each artillery battalion and separate battery or battery with a separate mission install a circuit to the nearest signal center. Necessary circuits between the division artillery headquarters and its command center are installed by the division signal company.

Trigonometric Functions

In any right triangle, the ratio of one side to either of the other two sides depends directly on the size of the angle. As long as the angle remains the same, the sides, no matter how long, will maintain the same ratio.



$$\text{sine (sin) A} = \frac{\text{side opposite}}{\text{hypotenuse}} = \frac{a}{c} \qquad \text{tangent (tan) A} = \frac{\text{side opposite}}{\text{side adjacent}} = \frac{a}{b}$$

$$\text{cosine (cos) A} = \frac{\text{side adjacent}}{\text{hypotenuse}} = \frac{b}{c} \qquad \text{cotangent (cot) A} = \frac{\text{side adjacent}}{\text{side opposite}} = \frac{b}{a}$$

The Law of Sines

If any side and the angle opposite that side and any other side or angle are known in any triangle, the triangle can be solved by using the law of sines below.

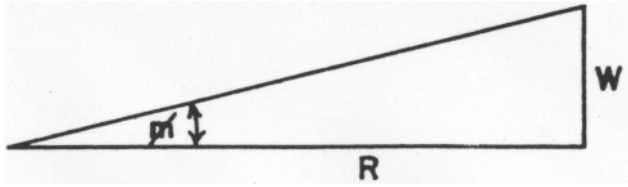
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Mil Relation

A mil is that angle subtended by an arc which is one 6400th of the circumference of a circle.

The mil relation is frequently used in field artillery computations for approximations of ranges and widths. For example, the forward observer uses the relation in conjunction with the mil scale on his binoculars, to adjust artillery fires. Since the distance so measured represents a width across two equal radii rather than a perpendicular to the observer-target line, the mil relation becomes inaccurate for large deviations, and rough sine factors (normally used with angles 600 mils or greater) should be used. The mil relation is depicted below.

$$mils = \frac{W}{R}$$



mils = angular measurement in mils between two points.
W = the lateral distance in meters between the points.
R = the mean distance to the points in thousands of meters.

ARTILLERY MATHEMATICS

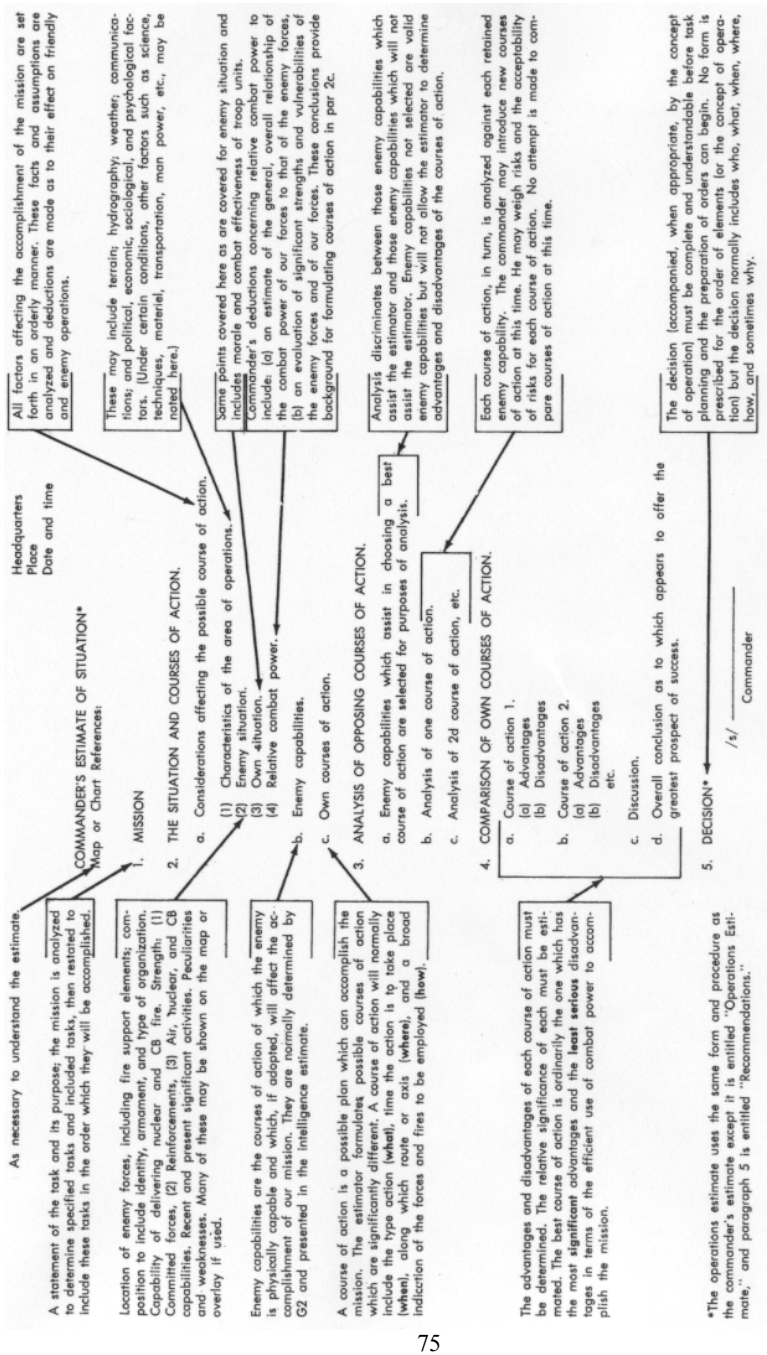
CONVERSION FACTORS

Multiply To Obtain	By	To Obtain Divide
Distance		
Inches	25.4	Millimeters
	2.54	Centimeters
	0.0254	Meters
	0.0833	Feet
	0.0278	Yards
Feet	12.0	Inches
	0.3333	Yards
	304.8	Millimeters
	30.48	Centimeters
	0.3048	Meters
Yards	3.0	Feet
	36.0	Inches
	914.4	Millimeters
	91.44	Centimeters
	0.9144	Meters
Statute Miles	5280.0	Feet
	1760.0	Yards
	1609.3	Meters
	1.6093	Kilometers
Nautical Miles	1.1508	Statute Miles
	1.852	Kilometers
	1852.0	Meters
	6076.0	Feet
Knots	1.1508	Miles per hour
	1.6878	Feet per second
	0.5144	Meters per second
Kilometers	1093.6	Yards
	3280.84	Feet
Miles per hour	1.4667	Feet per second
	0.447	Meters per second
Feet per second	0.3048	Meters per second
mach number	1100.0* (971-1231)	Feet per second
Angular		
Degrees	17.78	Mils
Minutes	0.296	Mils
Seconds	0.00494	Mils
Weight		
Ounces	0.0625	Pounds
Kilograms	2.205	Pounds
Tons (long)	2240.0	Pounds
Tons (short)	2000.0	Pounds
Tons (metric)	1.1023	Tons (short)
Volume		
Gallons (US liquid)	3.785	Liters
Cubic inches	0.01639	Liters

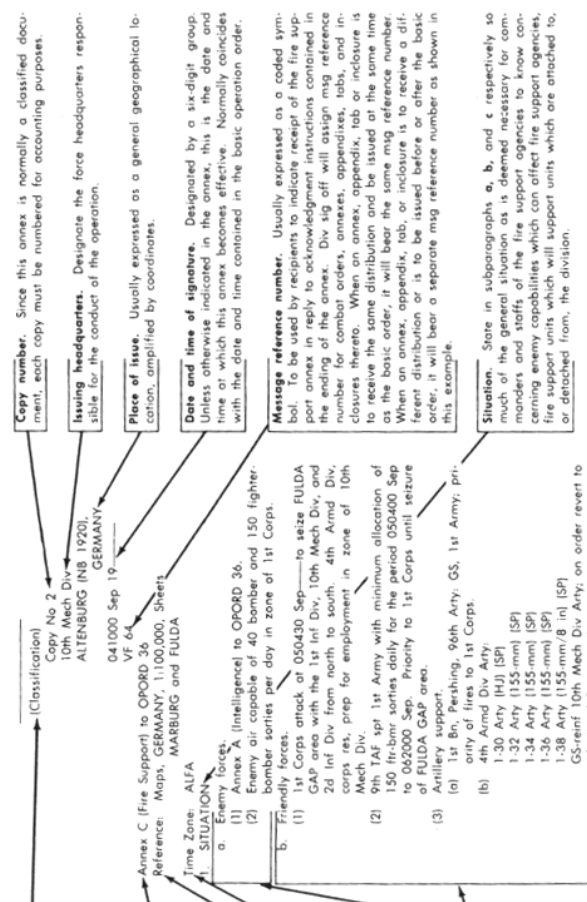
* Variable dependent upon meteorological conditions

NOTE: MEASUREMENT TON is a measure of cubic volume of cargo expressed in units of 40 cubic feet (AR 320-5, Dictionary of United States Army Terms, April 1965.)

Exploded Example — Estimate of the Situation



Exploded View — Fire Support Plan



Attachments and detachments. List fire support units now attached, or which are attached or detached by the operation order, together with the effective time and date.

c. Attachments and detachments.
(1) 2-50 Arty (155-mm) (SP) (atch eff 041700 Sep)
(2) 4-50 Arty (155-mm) (SP) (Remains attached)

Mission. State the mission of the force extracted verbatim from the operation order.

2. MISSION
Div atk 050430 Sep—— to seize high grd vic Hill 409 (5428), autobahn junction (4032), and BAD HERSFELD (5035). Secure crossing over AULA, FULDA and HAUNE Rivers. Be prep to cont atk to NE. Be prep for employment of 4th Armd Div in div zone.

Execution. In separate lettered subparagraphs, give a brief concept of the operation, then indicate fire support to be rendered by available fire support agencies, such as air, artillery, and naval gunfire. When available, nuclear, chemical, radiological, and biological weapons, although not separate fire support agencies, are listed separately to indicate the importance attached to their support. List fire support agencies in alphabetical order.

3. EXECUTION

a. Concept of operation. Annex B (Operation Overlay) to OPORD 36.

(1) Maneuver. Div penetrates Aggressor positions with two bdes attacking abreast supported by nuclear fires. 1st Bde, on the N, will make main atk, seize Obj 2 and 3. 3d Bde, on the S, secures crossings over FULDA and HAUNE Rivers and seizes Obj 1. 2d Bde, div res, fol 1st Bde. Div be prep to cont atk to NE. Be prep for employment of 4th Armd Div in div zone.

(2) Fires. At H-30 minutes, division will employ one BRAVO weapon on ea of the fol en positions: Hill 487 (NB 3531), Hill 400 (NB 727), and at NB 420226. A 28-minute nonnuclear preparation will be fired at H-28 minutes. A res of two BRAVO, one FOXTROT, and two GOLF wpns will be retained. 1st Bde will have priority of fires.

b. Air Support.

(1) General. 1st Army has been allocated 150 close air support sorties and 50 air reconnaissance sorties for the period 050400 Sep to 062000 Sep.

(2) Allocations.
(a) Priority of air support to div for period 050400 to 050900 Sep.
(b) FAC's allocated as follows:
1 TACP ea bde.
1 TACP ea maneuver bn.

(3) Miscellaneous. Appendix 1, Air Fire Support.

Concept of operation. In paragraph 3a, state the force commander's concept of the operation. In this case, paragraph 3 is divided into two subparagraphs. It may have been stated in a single paragraph. Considerable latitude is permissible in the preparation of the concept and it may be copied verbatim from the basic operation order. It is normal in the statement of the concept as contained in the fire support annex to condense the portion relative to maneuver (if extensive) and accent or elaborate the concept as applies to the fire support agencies.

Air Support. General. General information concerning air support available to corps or army, plus commander's desires on use of such air support, other than that specifically allocated, as may become available. **Allocations.** (First subparagraph) By higher headquarters and not further allocated to subordinate units (Second subparagraph) To subordinate units (air support or air control agencies, such as Tactical Air Control parties (TACP). **Miscellaneous.** Miscellaneous coordinating instructions and information concerning air support or the method and time of requesting planned airstrikes when such are not covered by SOP or if they constitute a change to SOP. As a minimum, this subparagraph must make a reference to the air fire support appendix.

c. Artillery support.
(1) Field Arty
(a) General. Artillery will support the attack with a nuclear preparation at H-30 minutes. A nonnuclear preparation will be fired from H-28 to H-hour.
(b) Organization for Combat.
1. 1-2 Arty: DS 1st Bde
1-4 Arty: GS-reinf 1-6 Arty, on O DS 2d Bde
1-6 Arty: DS 3d Bde
1-18 Arty: GS
1-20 Arty: GS
2-50 Arty: Reinf 1-2 Arty
4-50 Arty: GS-reinf 1-2 Arty; 1-2 Arty will plan fires for prep
2. Reinf Arty:
101st Arty Gp
1-50 Arty (155-mm) (SP)
1-60 Arty (175-mm) (SP)
2-70 (Arty) (8-in) (SP)
3-82 Arty (HJ) (SP)
(2) ADA
(a) General
(b) Organization for combat.
1-48 Arty (AW) (SP): Protect in priority div CP and spt cmd.
(c) Miscellaneous. Appendix 2, Arty Fire Support.
d. Nuclear support.
(1) General.
(a) 100 nuclear weapons are available to 1st Corps. Yields range from 0.5 KT to 50 KT. Corps retains a res of 40 weapons.
(b) Attack means available within corps are artillery cannon and missile. Tactical air support is available on request.
(2) Allocations and assignments. Weapons assigned to division:
155-mm 4 / ALFA
8-in 5 / BRAVO
Honest John 1 / FOXTROT
Honest John 2 / GOLF

Artillery support. Shows the echelons of artillery, such as corps or division artillery, that will support the operation. **General.** Give information of a preparation, if any, and its duration and indicate any restrictions placed on the use of higher echelon artillery with a primary mission of reinforcing division artillery.

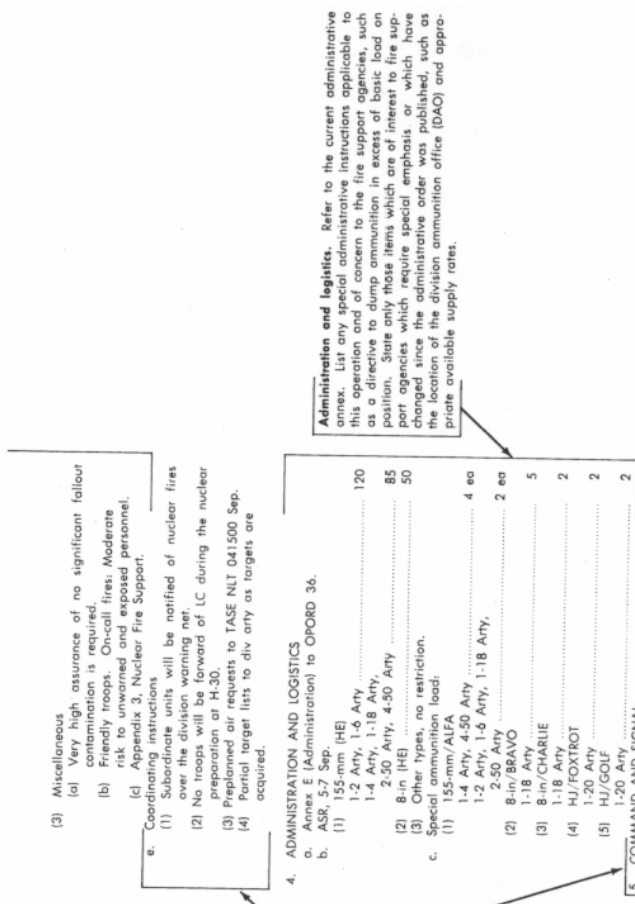
Organization for combat. Division artillery. Give organizations for combat of artillery units organic or attached to the command. A mission must be assigned to each. List division artillery units, organic or attached, in numerical sequence by regimental number; then list attached artillery groups in numerical order and show elements thereof. Batteries assigned a separate tactical mission under direct division artillery control are listed separately in alphabetical sequence immediately following the parent battalion. **Reinforcing artillery.** Give instructions to any artillery units **not** organic or attached which have a mission of reinforcing division artillery. Organization for combat of reinforcing units will be shown here if not shown in paragraph 1b.

Miscellaneous. Give miscellaneous instructions and information for artillery units, such as instructions on planning of fires, position areas, and zones of fire (usually a reference to an appendix or tab). As a minimum, this subparagraph will contain a reference to the artillery fire plan appendix.

Attached forward area weapons (FAW) ADA units. Should be listed following FA units. An air defense task will be assigned each such unit based on, and in priority approved by, the division commander.

Nuclear fire support. General. This section gives information of the nuclear weapons and delivery systems available to the higher headquarters. **Allocations.** This section gives allocation and assignment of nuclear weapons to the force and subordinate units. **Miscellaneous.** This section will include the commander's guidance for the employment of nuclear weapons, restrictions on use of nuclear weapons, and other items of information. The last item will be a reference to the nuclear (or appropriate) fire support appendix.

Note: When nuclear fires are planned for several targets, a separate nuclear fire plan may be prepared. Normally, all fires will be included on a single plan if they are to be delivered by one fire support agency.


(3) Miscellaneous
(a) Very high assurance of no significant fallout contamination is required.
(b) Friendly troops. On-call fires: Moderate risk to unwarned and exposed personnel.
(c) Appendix 3, Nuclear Fire Support.
e. Coordinating instructions
(1) Subordinate units will be notified of nuclear fires over the division warning net.
(2) No troops will be forward of LC during the nuclear preparation at H-30.
(3) Preplanned air requests to TASE NLT 041500 Sep.
(4) Partial target lists to div arty as targets are acquired.
4. ADMINISTRATION AND LOGISTICS
a. Annex E (Administration) to OPORD 36.
b. ASR, 5-7 Sep.
(1) 155-mm (HE)
1-2 Arty, 1-6 Arty 120
1-4 Arty, 1-18 Arty,
2-50 Arty, 4-30 Arty 85
(2) 8-in (HE) 50
(3) Other types, no restriction.
c. Special ammunition load:
(1) 155-mm/ALFA
1-4 Arty, 4-30 Arty ..... 4 ea
1-2 Arty, 1-6 Arty, 1-18 Arty,
2-50 Arty ..... 2 ea
(2) 8-in/BRAVO
1-18 Arty 5
(3) 8-in/CHARLIE
1-18 Arty 2
(4) HJ/FOXTROT
1-20 Arty 2
(5) HJ/GOLF
1-20 Arty 2
5. COMMAND AND SIGNAL 2
a. Signal. Annex F (Signal) to OPORD 36.
b. Command. SOP.
c. Axis of TOC displacement. DTOC displace to vic of NIEDERAULA (NB4227) on order.
Coordinating instructions. This is the last subparagraph of paragraph 3. Its actual letter designation depends on the number of fire support agencies available. This subparagraph contains instructions applicable to two or more fire support agencies, such as procedures for the marking of airstrikes by ground fires, restrictions in firing by ground and naval weapons while friendly aircraft are conducting airstrikes, procedures for coordinating flak suppression fires, and the time that fire plans must be submitted to the agency responsible for fire support coordination. Miscellaneous troop safety instructions, such as permissible exposure to radiation, protection during nuclear blasts, and notification to subordinate units of impending use of nuclear weapons by friendly forces, are also included when applicable. Further, items of interest to units, such as the location of the FSCL, may also be included.
Command and signal. Refer to the current signal annex and index to the signal operations instructions (SOI), if appropriate. Under command, state locations of the agency(s) responsible for fire support coordination, if other than that prescribed by SOP. Their locations may be shown, if desired, even when located as given in the SOP.
Administration and logistics. Refer to the current administrative annex. List any special administrative instructions applicable to this operation and of concern to the fire support agencies, such as a directive to dump ammunition in excess of basic load on position. State only those items which are of interest to fire support agencies which require special emphasis or which have changed since the administrative order was published, such as the location of the division ammunition office (DAO) and appropriate available supply rates.

Acknowledge.

HAY
Maj Gen

Acknowledgment instructions. If the issuing headquarters wishes acknowledgment of receipt of the plan by addressees, the word "acknowledge" will appear after paragraph 5. Acknowledgement connotes receipt and understanding. The message reference number is the code designation used when recipients are acknowledging receipt either by electronic or written communication.

Appendixes: 1. Air Fire Support
2. Artillery Fire Support
3. Nuclear Fire Support

Appendixes. If the fire support annex becomes so verbose and lengthy that recipients will have difficulty locating the instructions pertaining to them, appendixes may be used to keep the basic annex as short as possible. Appendixes will be referred to in the appropriate portion of the annex and listed under the heading of appendixes in the ending as shown.

Distribution:
A
1st Inf Div Arty
2d Inf Div Arty
4th Armd Div Arty
101st Arty Gp

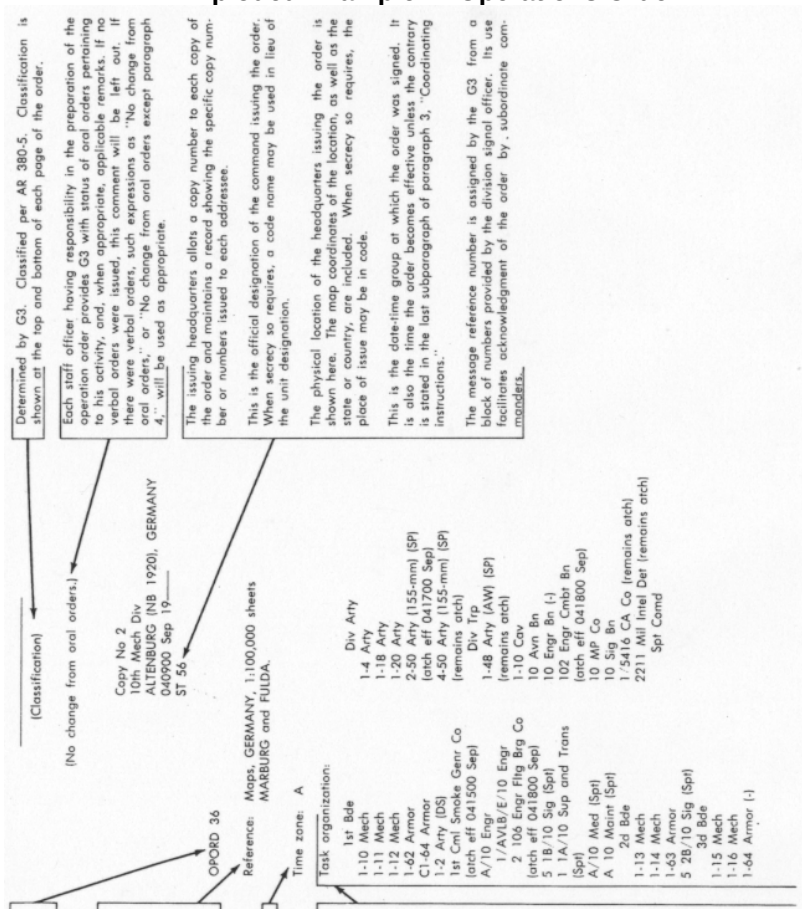
Distribution. If distribution is to be made according to a standard distribution list, it may be indicated for example, as Distribution A. In addition, recipients not included in the standard list must be shown separately. Care must be taken in that a standard distribution list may not be appropriate for the order being issued, and a separate appendix showing recipients, number of copies, and copy numbers may have to be prepared.

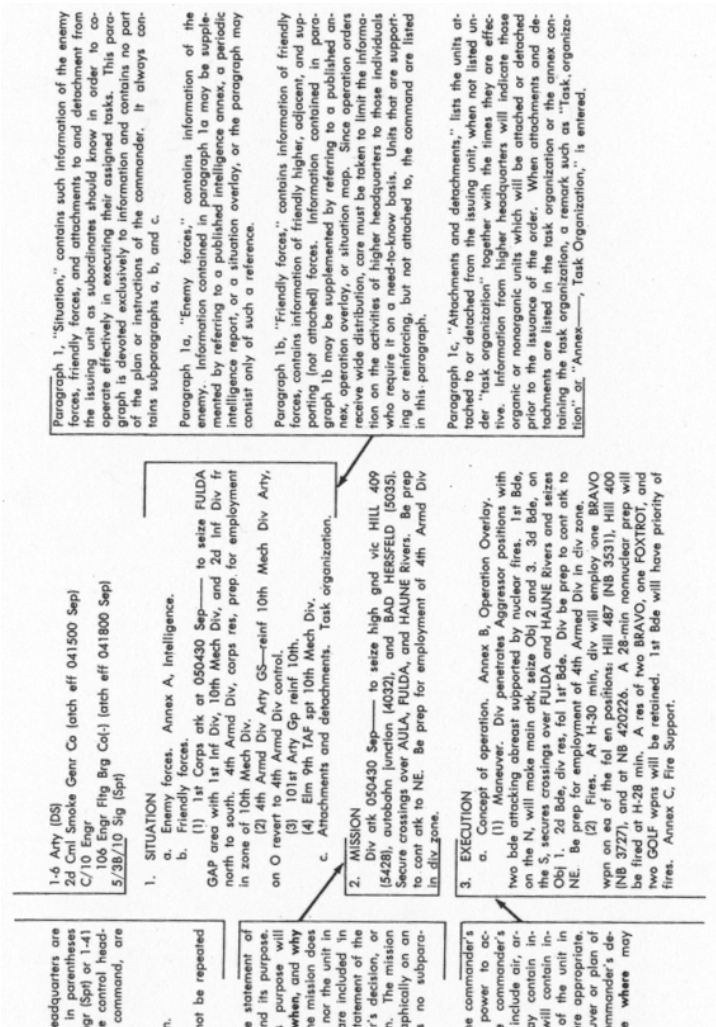
OFFICIAL:
/s/ Feinkiller
FEINKILLER
G3

Signature. As is the operation order, the original of the fire support annex is signed by the **force commander** or his authorized representative. The **authentication** is accomplished by the force G3 (S3) who has staff responsibility for integrating the fire support with the plan of maneuver.

(Classification)

Exploded Example — Operations Order




Units listed under a major subordinate control headquarters are in an attached status unless otherwise indicated in parentheses following the unit designation (Examples: A/52 Engr (Spt) or 1-41 Arty (DS)). Organic units of a major subordinate control headquarters, as in the case of the division support command, are usually omitted.
Missions are not assigned in the task organization.
Attachments reflected in task organization need not be repeated in paragraph 1c or in paragraph 3.
Paragraph 2, "Mission," contains a clear, concise statement of the task to be accomplished by the command and its purpose. A clear, concise statement of the task and its purpose will normally require the inclusion of the who, what, when, and why of the commander's decision. The statement of the mission does not include the how of the commander's decision nor the unit in making the main attack. When required, these are included in the concept of operation in paragraph 3a. The statement of the mission may include the where of the commander's decision, or it too may be included in the concept of operation. The mission is always written in full even though implied graphically on an operation overlay or map. Paragraph 2 contains no subparagraphs.
Paragraph 3a, "Concept of operation," contains the commander's amplification on the employment of his combat power to accomplish the mission. Normally it includes the commander's scheme of maneuver and employment of fires to include air, artillery, and nuclear weapons. In addition, it may contain instructions on the phasing of the operation. It will contain instructions on preparatory fires and designation of the unit in making the main attack in those operations where appropriate. The integration of fires with the scheme of maneuver or plan of defense may be explained. The how from the commander's decision may be included in the concept. The where may
1-6 Arty (DS)
2d Cml Smoke Genr Co (atch eff 041500 Sep)
C/10 Engr
106 Engr Fltg Brg Co(-) (atch eff 041800 Sep)
5/38/10 Sig (Spt)
1. SITUATION
a. Enemy forces. Annex A, Intelligence.
b. Friendly forces.
(1) 1st Corps atk at 050430 Sep—— to seize FULDA GAP area with 1st Inf Div, 10th Mech Div, and 2d Inf Div fr north to south. 4th Armd Div, corps res, prep. for employment in zone of 10th Mech Div.
(2) 4th Armd Div Arty GS—reinf 10th Mech Div Arty, on O revert to 4th Armd Div control.
(3) 101st Arty Gp reinf 10th.
(4) Elm 9th TAF spt 10th Mech Div.
c. Attachments and detachments. Task organization.
2. MISSION
Div atk 050430 Sep—— to seize high gnd vic HILL 409 (5428), autobahn junction (4032), and BAD HERSFELD (5035). Secure crossings over AULA, FULDA, and HAUNE Rivers. Be prep to cont atk to NE. Be prep for employment of 4th Armd Div in div zone.
3. EXECUTION
a. Concept of operation. Annex B, Operation Overlay.
(1) Maneuver. Div penetrates Aggressor positions with two bde attacking abreast supported by nuclear fires. 1st Bde, on the N, will make main atk, seize Obj 2 and 3. 3d Bde, on the S, secures crossings over FULDA and HAUNE Rivers and seizes Obj 1. 2d Bde, div res, fol 1st Bde. Div be prep to cont atk to NE. Be prep for employment of 4th Armed Div in div zone.
(2) Fires. At H-30 min, div will employ one BRAVO wpn on ea of the fol en positions: Hill 487 (NB 3531), Hill 400 (NB 3727), and at NB 420226. A 28-min nonnuclear prep will be fired at H-28 min. A res of two BRAVO, one FOXTROT, and two GOLF wpns will be retained. 1st Bde will have priority of fires. Annex C, Fire Support.
Paragraph 1, "Situation," contains such information of the enemy forces, friendly forces, and attachments to and detachment from the issuing unit as subordinates should know in order to cooperate effectively in executing their assigned tasks. This paragraph is devoted exclusively to information and contains no part of the plan or instructions of the commander. It always contains subparagraphs a, b, and c.
Paragraph 1a, "Enemy forces," contains information of the enemy. Information contained in paragraph 1a may be supplemented by referring to a published intelligence annex, a periodic intelligence report, or a situation overlay, or the paragraph may consist only of such a reference.
Paragraph 1b, "Friendly forces," contains information of friendly forces, contains information of friendly higher, adjacent, and supporting (not attached) forces. Information contained in paragraph 1b may be supplemented by referring to a published annex, operation overlay, or situation map. Since operation orders receive wide distribution, care must be taken to limit the information on the activities of higher headquarters to those individuals who require it on a need-to-know basis. Units that are supporting or reinforcing, but not attached to, the command are listed in this paragraph.
Paragraph 1c, "Attachments and detachments," lists the units attached to or detached from the issuing unit, when not listed under "task organization" together with the times they are effective. Information from higher headquarters will indicate those organic or nonorganic units which will be attached or detached prior to the issuance of the order. When attachments and detachments are listed in the task organization or the annex containing the task organization, a remark such as "Task organization" or "Annex——, Task Organization," is entered.

also be included if not already stated in paragraph 2. "Mission." The concept should clarify the purpose of the operation and be stated in sufficient detail to insure appropriate action by subordinates in the absence of additional specific instructions. Depending on the magnitude and complexity of the operation, paragraph 3a may be divided into two subparagraphs—maneuver and fires. If the concept of operation is particularly long or detailed, it may be included in an annex, with an appropriate reference to the annex in paragraph 3a.
Artillery subparagraph. The artillery subparagraph is divided into three numbered subparagraphs; the first covers field artillery, the second air defense artillery, and the third the fire support. The individual units are listed in numerical sequence by group or separate unit designation. The listing of a nonorganic artillery unit under the artillery subparagraph indicates that the unit has been further attached to the division artillery. All the details of the use of fires are found in the fire support plan annex; however, as a minimum, the body of the order should contain the organization for combat of the artillery units. The field artillery subparagraph is recommended by the division artillery commander. The air defense artillery officer (senior air defense unit commander) recommends the air defense artillery subparagraph.
Reserve element. The reserve subparagraph precedes the subparagraph "coordinating instructions;" and contains all elements of the command designated as in reserve, whether they are in reserve at the time the order becomes effective or at some future time. If an element of the command is not in reserve at the time the order becomes effective, a comment as to when it will be in reserve is included. If an element of the command in reserve is given a future mission, or is ordered to prepare plans for a possible future mission, that information is included in the reserve subparagraph following the element of the command to which it pertains. If the composition of an element of the command in
b. 1st Bde:
c. 3d Bde:
d. 1-10 Cav: Provide security for div rear area, priority to div MSR.
e. Arty:
(1) Field arty:
(a) 1-2 Arty: DS 1st Bde.
(b) 1-4 Arty: GS-reinf 1-6 Arty, on O DS 2d Bde.
(c) 1-6 Arty: DS 3d Bde.
(d) 1-18 Arty: GS.
(e) 1-20 Arty: GS.
(f) 2-50 Arty: Reinf 1-2 Arty.
(g) 4-50 Arty: GS-reinf 1-2 Arty.
(2) ADA: 1-48 Arty: Protect in priority div CP and spt comd.
(3) Annex C, Fire Support Plan.
f. 10th Engr Bn: Be prep to spt 2d Bde with one co when committed.
g. 102d Engr Cmbt Bn: GS, priority to div rear area.
h. Div Trp: Fol 1st Bde.
i. Spt Comd. Remain in present position. Prep to move to vic of FORST OBERAULA (3229) FORST HERZBERG (3326) on.
j. Div Res:
(1) 2d Bde: Fol 1st Bde.
(2) Two BRAVO, one FOXTROT, and two GOLF wpns.
k. Coordinating instructions.
(1) Task organization eff 041200 Sep.
(2) EEI: Will Aggressor reinforce his defense in div sector? If so, where, when, and in what strength?
(3) All units prep to assist passage of 4th Armd Div.
(4) Troop safety:
(a) Troop safety criteria for on-call nuclear wpns. Mod risk to unwarned exposed personnel.
(b) No div acft fwd of line NB 200280-NB 300130 during period 050350-050410 Sep.
(5) Annex D, Road Movement Plan.
4. ADMINISTRATION AND LOGISTICS
a. Annex E, Administration.
b. Materiel and services.
Major subordinate elements. Subordinate elements are listed in numerical order: combined arms headquarters; e.g., 52d Mech Div, 1st Bde, or TF 1/80 (in numerical order and descending order by size); then combat arms units—infantry, armor, cavalry, combat support units (alphabetically by branch), and reserves. The mission does not determine the sequence. Separate lettered subparagraphs, starting with subparagraph b, assigns specific tasks to the major elements. These subparagraphs are assigned in order (b,c,d, etc.) except units that are totally in reserve at the time of the order. Units totally in reserve are not listed in this normal sequence but only in the reserve subparagraphs. Subordinate elements are listed in the following order:
a. Combined arms commands in numerical or alphabetical order.
b. Infantry elements.
c. Armor elements.
d. Artillery.
e. Combat support elements (in alphabetical order).
f. Division troops (tactical instructions only).
g. Support command (tactical instructions only).
(Tasks shown graphically are not repeated in the body of the order.)
Combat support elements. Following the artillery subparagraph, the remaining elements of the command are listed in alphabetical sequence by arm or service, with separate subparagraphs for each. Normal support missions to signal, engineer, aviation, and military police are not included. Unless the support command is given a specific tactical mission, it is not assigned a separate subparagraph.
Coordinating instructions. The final subparagraph 3 of paragraph is always entitled "Coordinating instructions" and contains information applicable to two or more elements of the command. The instructions may contain essential elements of information (EEI) and others which the commander desires to emphasize, qualification on the time of attack, road priorities, references to annexes, and other instructions, the repetition of which in the other subparagraphs of paragraph 3 would be cumbersome. If the order is not effective upon signature, the effective time is indicated here. Signal instructions, which always appear in paragraph 5, are not listed here. In the case of the written order

reserve is indicated in the task organization for the command, such composition is not repeated in the reserve subparagraph. However, if the task organization is not shown, the composition of the element in reserve is shown to the extent practicable in the reserve subparagraph. The listing of two or more elements of the command in the reserve subparagraph does not indicate a single command. If one element is attached to another in reserve, the attachment is shown by the normal method unless it has been indicated specifically in the portion of the order reserved for the task organization. Nuclear weapons not committed by decision, concept, or plan are shown.

Paragraph 4, "Administration and logistics" contains pertinent administrative instructions to the command. In corps and higher units, these instructions usually are so voluminous that they require the issuance of an administrative order. At the division level and below, administrative instructions are normally published in an administrative annex to the OPORD, in paragraph 4 of the OPORD, in the support command commander's OPORD, unit SOP, or any combination of the above. When paragraph 4 of the OPORD is used to disseminate administrative instructions, it will contain such subparagraphs and headings as are necessary and follow the sequence of the administrative order.

Operation orders must be acknowledged. This acknowledgment means that the order has been received and understood; the word "Acknowledge" may suffice. Special acknowledgment instructions are given when security or communication facilities available at the time so require.

Annexes are listed by letter and title, appendixes are listed by letter and title, and inclosures to tabs are listed by Arabic numeral and title.

(1) C1 III.
(a) Priority to 1st Bde.
(b) Cml smoke genr units draw fog oil fr SUPPT 29 at NB 257175.
(2) C1 V.
(a) ASR 5-7 Sep:
1. 155-mm (HE)
1-2 Arty, 1-6 Arty 120
1-4 Arty, 1-18 Arty, 2-50 Arty
4-50 Arty 85
2. 8-in (HE) 50
3. Other types, no restriction.
(b) Special ammunition load: Annex C, Fire Support Plan.

5. COMMAND AND SIGNAL
a. Signal. Annex F, Signal
b. Command.
(1) CP 2d Bde at NB 275213
(2) CP spt comd at HOPFGARTEN (NB 2197)
c. Axis of CP displacement. Div CP prep to displace to vic of NIEDERAUA (NB 4227) on O.

Acknowledge.

HAY
Maj Gen

Annexes: A. Intelligence
B. Operation Overlay
C. Fire Support
D. Road Movement Plan
E. Administration
F. Signal

without an overlay, many of the items which would appear on the overlay must be included; i.e., objectives, boundaries, line of departure, assembly areas, etc. Troop safety measures applicable to the nuclear battlefield may be shown here.

Paragraph 5, "Command and signal," contains instructions relative to command and the operation of signal communication.

Paragraph 5a, "Signal," may refer to a standard plan or to a signal annex, when issued. If a signal annex is not issued, the subparagraph should contain, as a minimum, a reference to the index of signal operation instructions which is currently in effect. Any special instructions relating to signal communication, such as instructions on the use of radio or pyrotechnics and restrictions on the employment of any means of communication should be placed in this subparagraph.

Paragraph 5b, "Command," shows the location of the command post of the issuing unit, the locations of the command posts of the subordinate units, when known, and (when desired) the location of the next higher headquarters.

A distribution list is essential in order to insure that the order is issued to every officer or unit directly concerned with its execution. The distribution may be listed in detail on the order, or a reference may be made to a standard distribution list (for example, Distribution A) already adopted, which shows the distribution used. Reinforcing, supporting, and adjacent units are added to the distribution list since they are not normally included in the standard distribution lists. When orders are for inter-Allied use, the distribution list is stated in full, either in the order or in a separate annex.

Distribution: A

The authentication consists of the word "OFFICIAL," the signature, typed or printed name, and the title "G3."

OFFICIAL

FEINKILLER
G3

Paragraph 5c, "Axis of command post displacement," shows the successive future command post locations.

Paragraph 5 may also include subparagraphs concerning recognition and identification instructions, code words, code names, etc.

Most of the items in paragraph 5 can be, and usually are, shown graphically on the operation map or operation overlay; in this case, they need not be written out in paragraph 5.

The original (first) copy is signed by the commander, personally, or by the chief of staff in the name of the commander, using the phrase "FOR THE COMMANDER." All copies of the order, unless they are exact mechanical duplicates of the original signed by the commander or the chief of staff, are authenticated by G3.

Examples of signature blocks for copy 1 of the order, annexes, appendixes, tabs, and inclosures:

a.

HAY
Maj Gen

b. FOR THE COMMANDER:

ROBERTS
Chief of Staff

INFORMATION LETTERS

Information Letters are designed to inform certain groups of field artillery personnel of new developments occurring within their specific areas of interest. Normally unclassified, these letters bring to the artilleryman data on the latest techniques, procedures, equipment, and equipment modifications at an earlier date than would otherwise be possible in official TM and FM publications.

Date	Number	No. of pages
METRO		
June 1959	1	6
August 1959	2	9
October 1959	3	15
January 1960	4	9
October 1960	6	7
April 1961	7	7
May 1961	8	19
June 1961	9	12
August 1961	9A	3
May 1963	10	10
January 1966	11	11
HONEST JOHN/LITTLE JOHN		
October 1963	4	17
February 1964	5	17
September 1964	6	35
June 1965	7	24
October 1965	8	23
May 1966	9	32

Date	Number	No. of pages
PERSHING		
July 1963 (C)	1	45
February 1964 (C)	2	15
April 1966 (FOUO)	3	13
SERGEANT		
November 1963 (C)	1	6
June 1964 (C)	2	5
TELLUROMETER		
August 1959	—	10
WILD T16 THEODOLITE		
April 1960	—	10
115-MM ROCKET SYSTEM		
August 1963	—	11
155-MM HOWITZER SYSTEM		
January 1965 (C)	1	2
August 1965 (C)	2	4
8-INCH HOWITZER		
February 1964	—	9
175-MM GUN		
July 1963	1	2

COMMANDANT'S LETTER

Commandant's Letters are summaries of recent artillery developments released under the signature of the U. S. Army Artillery and Missile School Commandant.

An average of 4 a year are distributed to senior U. S. artillery commanders throughout the world (see back cover).

Date and classification	Number	No. of pages
March 1960	1	3
August 1960	2	6
November 1960	3	6
March 1961 (SRD)	4	8
May 1961 (C)	5	5
August 1961 (S)	6	12
December 1961 (SRD)	7	12
February 1962 (SRD)	8	13
May 1962 (S)	9	10
August 1962 (S)	10	17
November 1962 (SRD)	11	17
February 1963 (S)	12	12
May 1963 (S)	13	12
August 1963 (SRD)	14	13
December 1963 (S)	15	11
February 1964 (SRD)	16	6
June 1964 (CRD)	17	9
September 1964 (S)	18	7
January 1965 (SRD)	19	14
June 1965 (SRD)	20	12
December 1965 (S)	21	16

L 1136 ARMY-FT. SILL, OKLA.