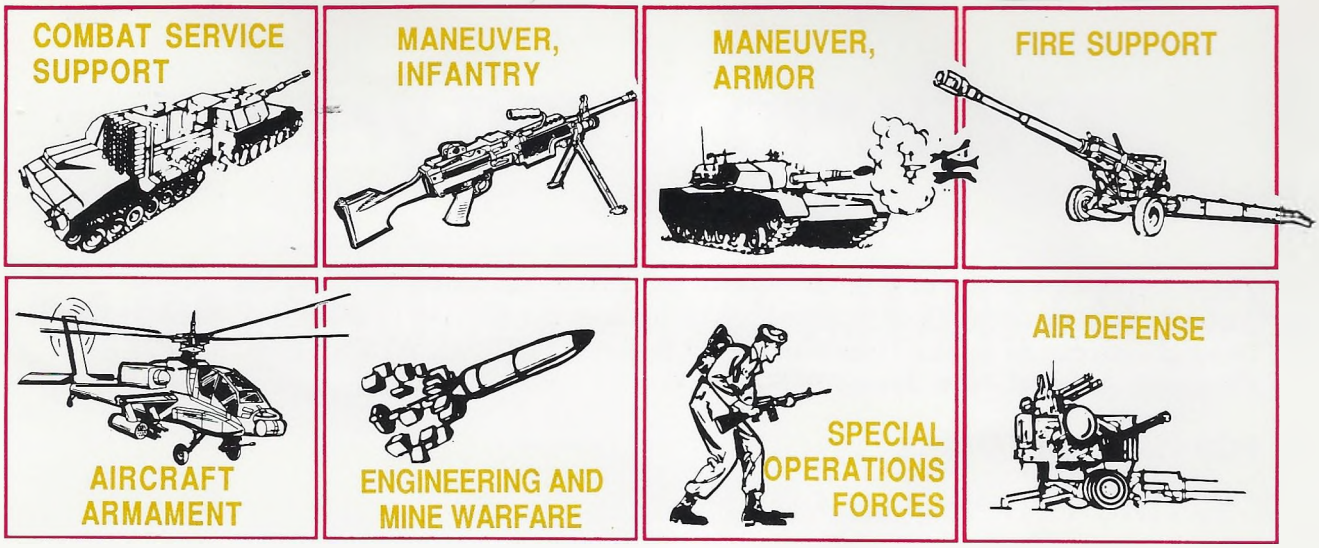

New Developments in Armament & Munitions

Featuring

Active Projects FY91

STEJP-CO

U.S. Army Armament, Munitions & Chemical Command

ARMAMENT RESEARCH, DEVELOPMENT & ENGINEERING CENTER

PICATINNY ARSENAL, N.J.

The proponent agency of this circular is the Program Support Office, U.S. Army Armament Research, Development and Engineering Center (ARDEC). Users are invited to send comments to the Commander, U.S. Army ARDEC, ATTN: SMCAR-PM, Picatinny Arsenal, New Jersey 07806-5000.

FOR THE COMMANDER:

OFFICIAL:

ALFRED A. COPPOLA
CPT, GS
Adjutant

RICHARD M. GILLIGAN, JR.
Colonel, GS
Chief of Staff

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ARDEC CIRCULAR 70-1
MAY 1991

NEW DEVELOPMENTS IN ARMAMENT AND MUNITIONS

U.S. ARMY
ARMAMENT, MUNITIONS
& CHEMICAL COMMAND

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Expires December 1992

COMMANDER'S FOREWORD

The Armament Research, Development and Engineering Center aggressively pursues its role of providing the soldier with weapons and munitions of the highest quality. Reliability, lethality, survivability, and producibility are optimized while cost is minimized. These superior weapon systems enhance battlefield effectiveness by providing, in effect, force multiplication. The Center maintains life cycle responsibility for materiel systems supporting eight critical Army mission areas. During Fiscal Year 1990 ARDEC efforts led to the Type Classification of thirty-two items of new high performance armament materiel. We have significantly increased the firepower of our troops by fielding highly effective new armament such as the 105mm Lightweight Towed Howitzer and the Ranger Anti-Armor Anti-Personnel Weapon System (RAAWS). These items are described briefly within this circular along with fifty-eight additional programs which were active during Fiscal Year 1990. The publication is intended for use as a handy, quick reference for management and technical personnel involved in the materiel acquisition process.

WILLIAM R. HOLMES
Brigadier General, USA
Commanding

PREFACE

This publication provides background and reference information to personnel involved in the materiel acquisition process and informs operations and school personnel of AMCCOM items in various phases of the life cycle. The items are categorized into Army Mission Areas.

The information contained herein is subject to change as research, development, testing and production efforts progress. This publication will be updated on an annual or biannual basis by the Program Support Office, Armament Research, Development and Engineering Center, AMCCOM.

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INTRODUCTION

PURPOSE: This publication provides a brief description, use, and status of sixty armament and munition items. The information is primarily intended to familiarize materiel field maintenance technicians, school personnel, and commissioned/non-commissioned officers in gaining commands, as well as serving as a ready reference for management and technical personnel who are responsible for the materiel acquisition process.

SCOPE: This book presents data pertaining to materiel development by the Armament Research, Development and Engineering Center and Program Executive Officer and AMCCOM directed Project/Product Managers. Provided are brief technical descriptions, information on development, production, and fielding status, information on the use, and photographs or illustrations of the munitions in the following mission areas and technology base:

Maneuver, Armor
Maneuver, Infantry
Fire Support
Engineering & Mine Warfare
Special Operations Forces
Aviation
Air Defense
Combat Service Support
Significant Technology Base Programs

UPDATING INFORMATION: Information in this document is subject to change. Revisions will be published annually or biannually. Users are encouraged to report errors, omissions, and recommendations for improvement (using DA Form 2028, Recommended Changes to Publications) to:

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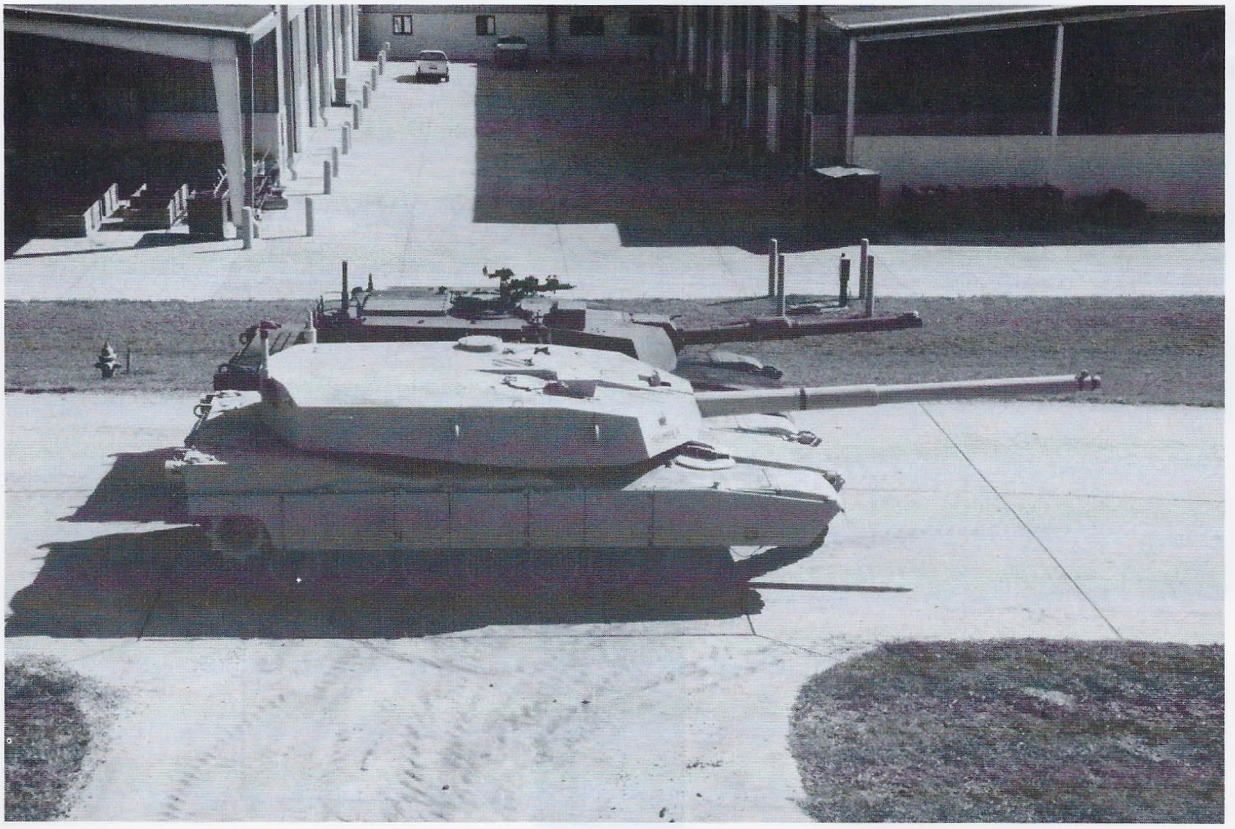
MANEUVER, ARMOR

ADVANCED TANK CANNON (ATAC) SYSTEM

1. SYSTEM DESCRIPTION: The ATAC System Program consists of four elements: gun, autoloader, three round family of ammunition, and fire control. All elements are being integrated in-house by the U.S. Army Armament Research, Development and Engineering Center. The system has the capability of firing all 120mm rounds as well as future 140mm rounds. The autoloader will store and transfer inventory as well as load all ammunition. The three round ammunition family consists of kinetic energy and chemical energy cartridges along with a ballistically similar training round. The fire control system provides M1A1 comparable "shoot on the move" capability.

2. USE: The ATAC System Program is the Proof of Principle demonstration for the combined technologies of the advanced tank cannon, advanced fire control, and automatic loading.

3. STATUS: Four guns have been fabricated, one of which has fired several hundred standard and developmental cartridges from a test stand. Another was installed in an A1 test tank along with a modified hydraulic Gun/Turrent Drive and Stabilization System (GTD&SS). The tank was then tested on the Anniston Army Depot bump course. The ATAC tank main gun is an unbalanced system. In order to compensate for this unbalance, the GTD&SS was modified by adding equilibration for static balancing and acceleration feed forward for dynamic unbalance compensation. Results indicated that the maximum stabilization system error experienced was less than the M1A1 System Specification. Anniston Army Depot has fabricated a new tank turret to house the System. This turret is being utilized for the demonstration and validation of the complete ATAC System. Testing began in November 1990. Completion is projected at the end of July 1991.



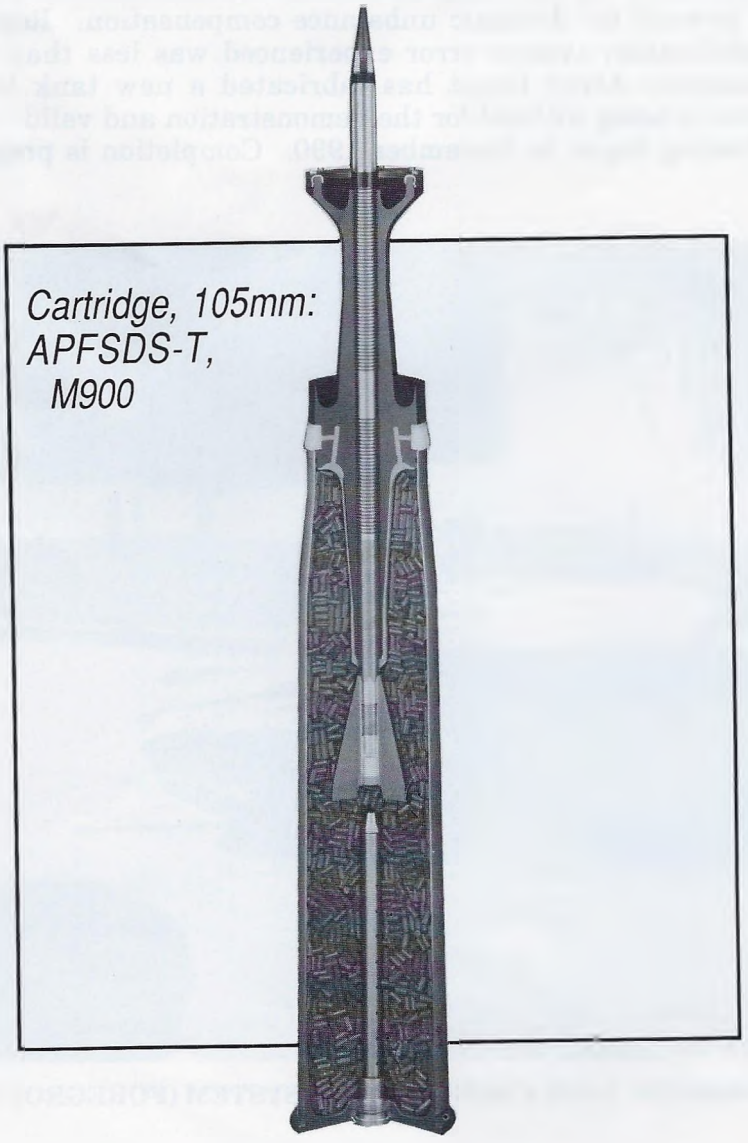
ADVANCED TANK CANNON (ATAC) SYSTEM (FOREGROUND)

CARTRIDGE, 105MM: APFSDS-T, M900

1. SYSTEM DESCRIPTION: The M900 cartridge is the fourth and latest generation of 105mm APFSDS-T cartridges. The M900 is the first system to be Type Classified with High Energy Low Vulnerability Ammunition M43 propellant. The propellant is loaded into a standard 105mm M148A1B1 steel cartridge case and ignited with an M128 primer. The M128 primer is a typical bayonet type primer except for the presence of a 3 hole spitter type tip. The projectile used on the M900 cartridge consists of a three segment aluminum sabot enclosing a high L/D depleted uranium penetrator. The nose of the penetrator is capped by a steel and aluminum windshield and the tail by a six-bladed aluminum fin. The fin contains an M13 tracer. Spin is controlled by a slipping nylon obturator, riding on a polypropylene sealing band.

2. USE: The M900 Cartridge is designed for use in the 105mm M68 and M68A1 cannons on the M1 and M1IP Abrams Tank System. The M60A3 Tank may also be modified to accept the M900.

3. STATUS: The M900 was Type Classified-Low Rate Production in December 1989, and is currently in low rate production. Conditional Materiel Release occurred in August 1990.

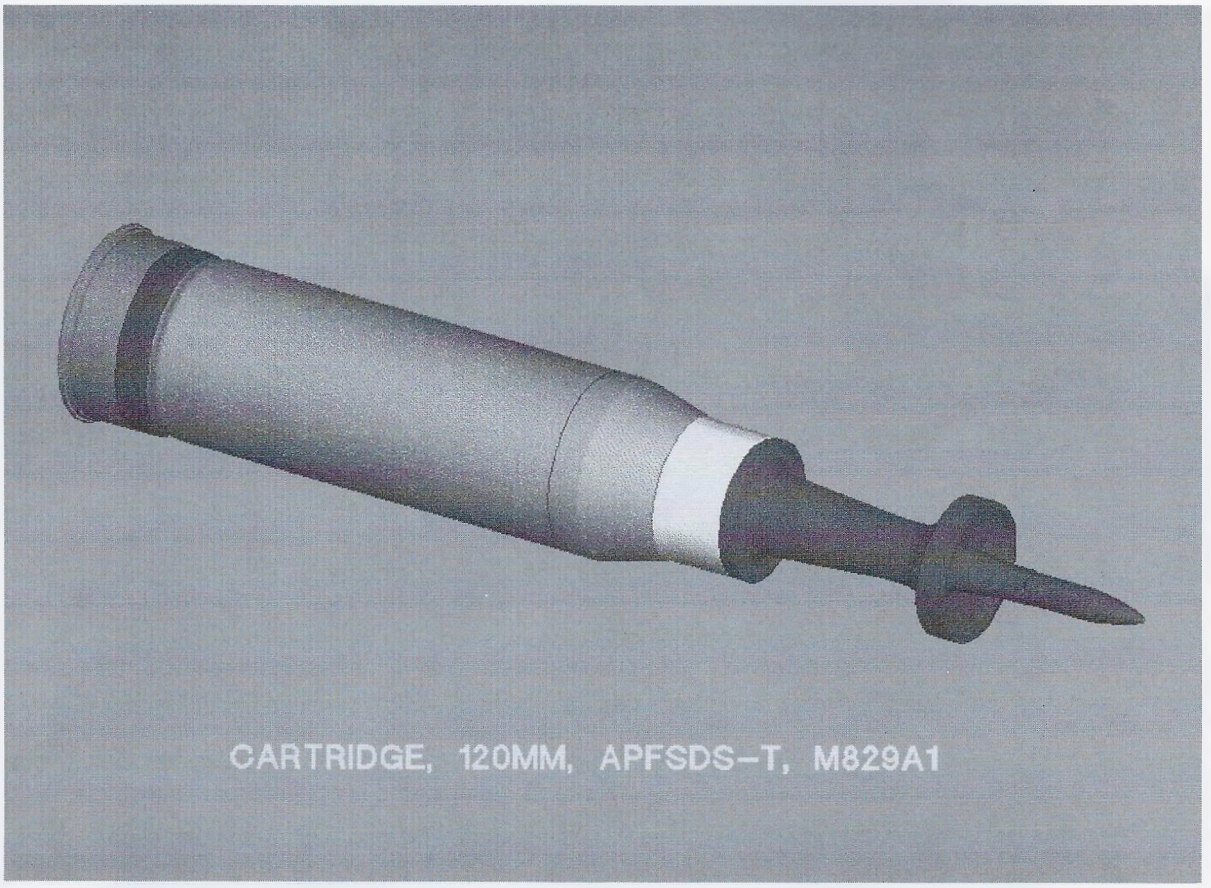


CARTRIDGE, 120MM: APFSDS-T, M829A1

1. SYSTEM DESCRIPTION: The M829A1 is an advanced 120mm tank cartridge. Through the use of optimized component design, improved terminal performance has been achieved. The M829A1 contains a kinetic energy projectile consisting of a depleted uranium penetrator assembled with aluminum sabot, windshield, and fins. Other major components consist of a combustible cartridge case and case adapter, steel case base, an electrically initiated bayonet primer, and JA-2 propellant. Optimization of components has provided greatly improved terminal performance over that of the predecessor M829.

2. USE: The 120mm M829A1 is designed for use in the 120mm, M256 Cannon on the M1A1 Abrams Main Battle Tank.

3. STATUS: The cartridge was Type Classified-Standard in October 1988. Materiel Release occurred during 2d Quarter FY 89. It is currently in production.

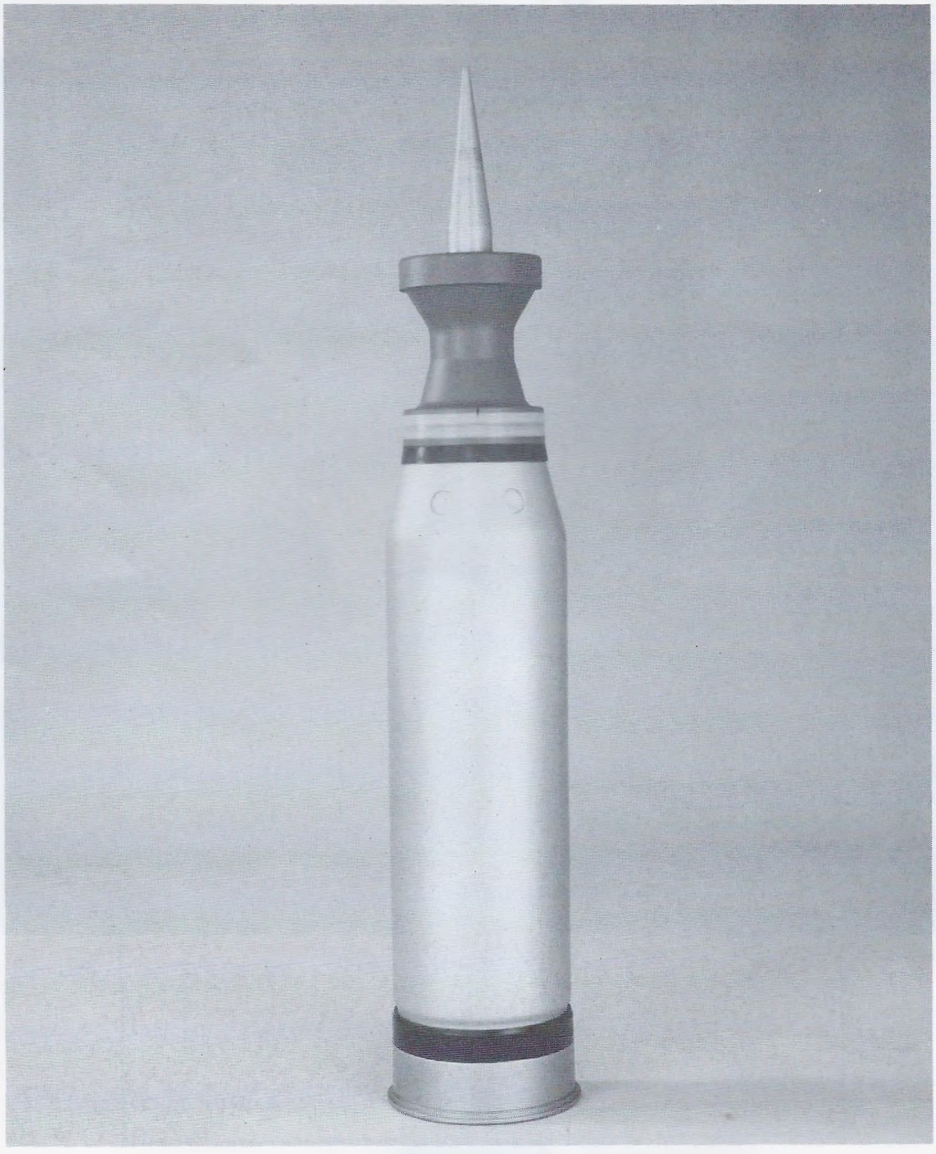


CARTRIDGE, 120MM: TPCSDS-T, M865

1. SYSTEM DESCRIPTION: The M865 Cartridge is a kinetic energy, target practice round for use with the 120mm smooth bore M256 cannon. It features a unique cone stabilized sub-caliber projectile to provide basic accuracy at target ranges, while at the same time limiting maximum projectile travel to permit the round to be used on most tank gunnery ranges in the U.S. and Europe. Value Engineering modifications consisting of a shortened sabot and replacement of the steel cone with a slotted aluminum cone resulted in hit probability and target impact dispersion better than those of the early production cartridges.

2. USE: The 120mm M865 is the kinetic energy training (target practice) cartridge for use in the M1A1 Abrams Main Battle Tank.

3. STATUS: The modified cartridge achieved full Materiel Release during the 2d Quarter FY 89. It is currently in production.



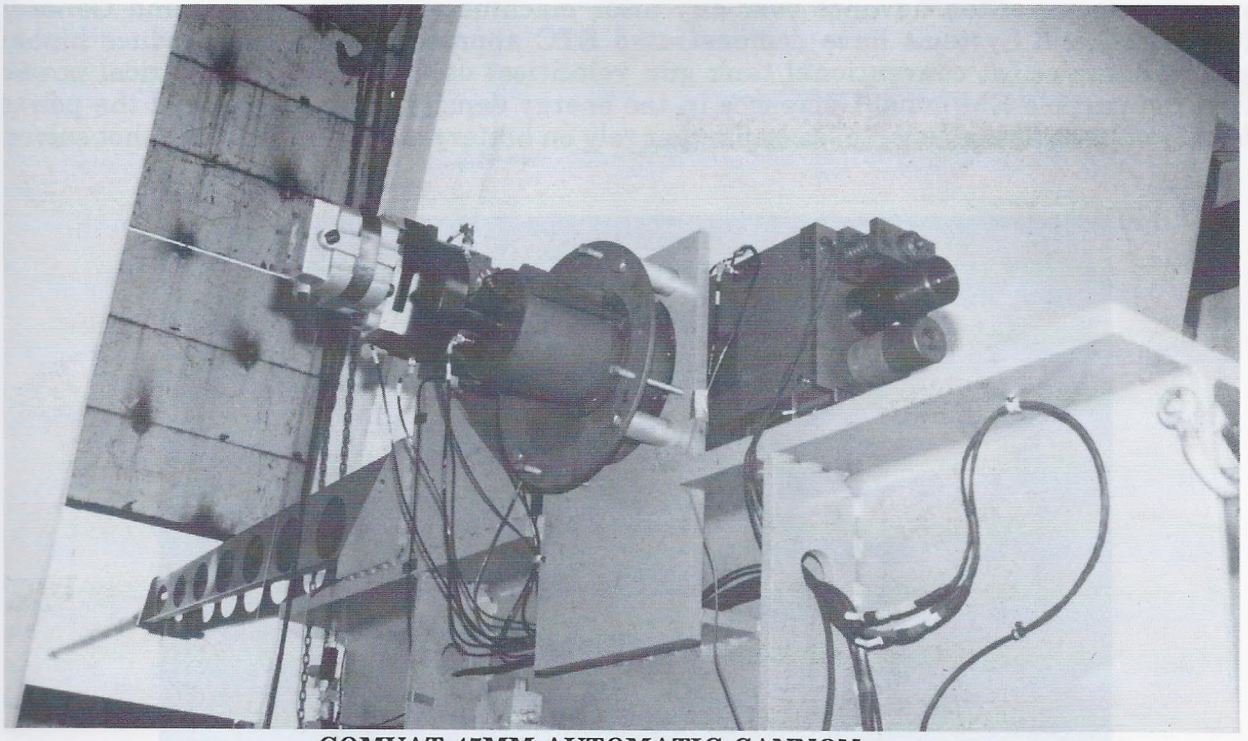
CARTRIDGE, 120MM, TPCSDS-T, M865

COMBAT VEHICLE ARMAMENT TECHNOLOGY (COMVAT)

1. SYSTEM DESCRIPTION: The COMVAT Program is developing the XM295 automatic cannon and ammunition to serve as the primary armament system on future Infantry Fighting Vehicles or a possible Bradley upgrade. The system consists of high performance 45mm cased telescoped ammunition, 45mm autocannon fed through the trunnion into a rotating chamber, and a rapid reload linkless feed system.

2. USE: This system will provide the capability to defeat the 1995-2020 BMP threat. The COMVAT system will significantly enhance the infantry's performance by providing an armament system which can defeat a more formidable target using fewer rounds.

3. STATUS: The COMVAT is a three phase, 6.2 Exploratory Development program. The design work of the autocannon was completed during the first phase of development. Phase II was completed at the end of FY 90 with a developmental demonstration firing of both, single shot and burst firings. The FY 91 Phase III will include: further testing and refinement of the system; the development of a High Explosive-Incendiary round; hot and cold environmental testing; advanced armor penetration testing; and exploratory work on puller sabot and insensitive propellant technologies. Ongoing gun and Armor Piercing Fin Stabilized Discarding Sabot and Target Practice-Traced performance testing is being conducted using the XM295 autocannon. The Exploratory Development program for COMVAT will conclude with a system demonstration during the summer of 1991.



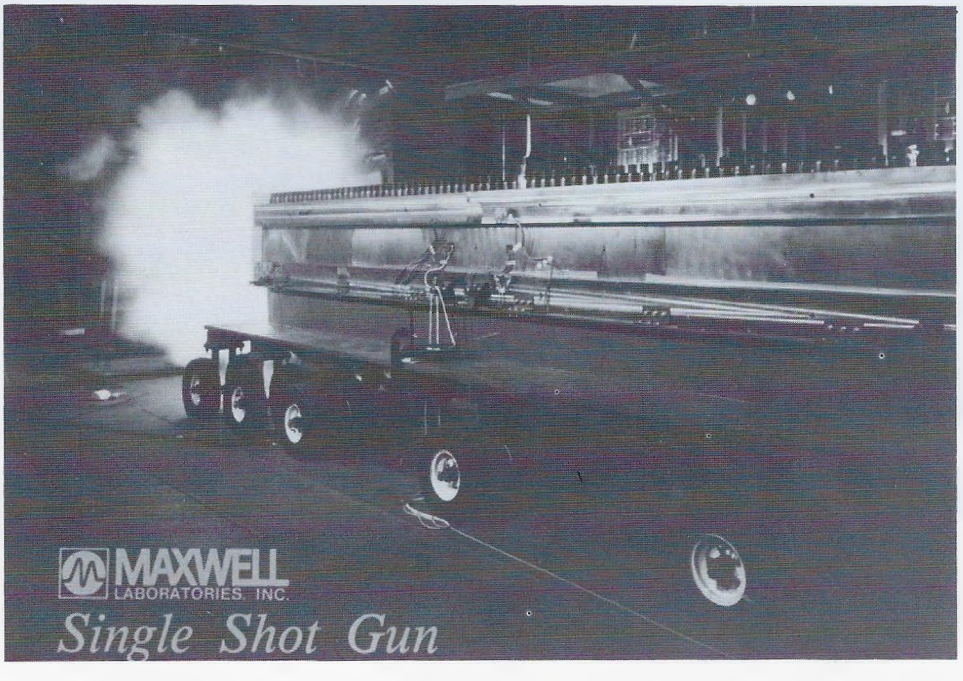
COMVAT 45MM AUTOMATIC CANNON

ELECTRIC GUN PROGRAM

1. SYSTEM DESCRIPTION: There are three candidate electric gun approaches: electromagnetic (EM) railguns, EM coilguns, and electrothermal-chemical (ETC) guns. All employ electrical pulse power to generate the energy needed to fire projectiles at higher performance than conventional systems. The EM guns use intense magnetic fields, and can achieve velocities not otherwise possible. The ETC guns use electrical energy to initiate and control chemical reactions in energetic propellant formulations. Primary benefits of electric guns are the potential for substantially increased muzzle energy, enhanced system performance, and the absence of conventional explosive propellant.

2. USE: Advanced tank guns will require increased muzzle energies (15-20 megajoules) to defeat projected advanced armors. There are additional opportunities for increased lethality through the use of hypervelocity projectiles. Air defense scenarios are target specific, but increased muzzle velocity makes gun solutions more attractive because of increased hit probability at a given range, and increased keepout distance for a given hit probability. Advanced indirect fire support weapons require extended range as well as reduced system vulnerability and logistics burden without compromising accuracy and reliability.

3. STATUS: Single-shot 90mm EM railguns are operational at the University of Texas and at Green Farm Test Site, Miramar Naval Air Station (operated by Maxwell Labs). The guns are nearing their muzzle energy goal of 9 MJ (equivalent to a 120mm tank gun) having fired a 2.44 kilogram (kg) projectile at 2.56 kilometers/second (km/sec) and a 1.6 kg projectile at 3.3 km/sec. The University of Texas is fabricating a self-contained, multiple shot railgun system weighing 25 metric tons for FY 91 demonstrations at Yuma Proving Ground. Their "compulsator" (compensated pulsed alternator) power supply will be a factor-of-ten advance over any prior machine of its size. FMC and General Dynamics Land Systems have demonstrated ETC approaches that can produce higher muzzle energies (at conventional tank gun velocities) using much less electrical power than comparable EM guns. Increases in the energy density of capacitors and the power density of batteries have led to concepts that rely on battery storage of multiple shot salvos.



MANEUVER, INFANTRY

ADVANCED COMBAT RIFLE (ACR)

1. SYSTEM DESCRIPTION: The ACR technology program is intended to demonstrate state-of-the-art rifle technology as compared to the current Army rifle, the M16A2. Technologies are focused on salvo controlled burst; compact, lightweight ammunition; and improved fire control. Contractor developed hardware designs were assessed in a joint user/developer field experiment which was conducted from January 1990 through September 1990 on a specially instrumented range at Fort Benning, Georgia. Effectiveness is being measured in terms of probability of hit, probability of incapacitation, and kills per combat load.

2. USE: The ACR technology is expected to provide the successor to the M16A2.

3. STATUS: Final results are being analyzed by the Army Materiel Systems Analysis Activity and will form a basis for the Army's Small Arms Master Plan decision in 4th Quarter FY 91.

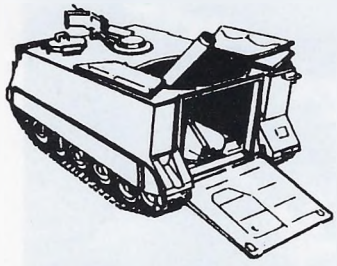
ACR CONTRACTOR DEVELOPED DESIGNS

BATTALION MORTAR SYSTEM (BMS), 120MM

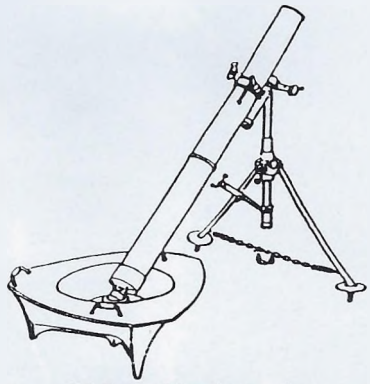
1. SYSTEM DESCRIPTION: The 120mm BMS will be supplied in two configurations: the M120 Towed Mortar transported on a two wheeled trailer towed by a High Mobility Multipurpose Wheeled Vehicle, and the M121 Carrier Mortar transported within a modified M106A2 vehicle. Also included in the 120mm BMS is a full family of interim Non-Developmental Item (NDI) ammunition (M57 HE, M68 Smoke and M91 Illumination) and Enhanced ammunition currently under development (XM933/934 HE, XM929 Smoke and XM930 Illumination).

2. USE: The 120mm BMS features a smooth-bore muzzle-loaded weapon whose principal mission is delivery of high angle, indirect fire. The 120mm BMS will enhance the firepower of mechanized infantry, armor, cavalry, and motorized units by providing greater range, lethality, illumination and smoke screening capabilities over its predecessor the M30 4.2 inch mortar. The M120 mortar and NDI ammunition are required for early fielding to the 9th Infantry Division, Fort Lewis, Washington. The M121 mortar and enhanced ammunition are required for follow-on fielding to mechanized units.

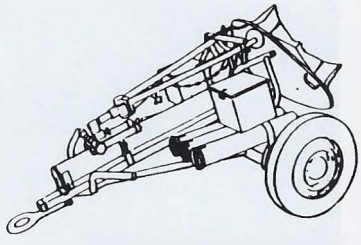
3. STATUS: The M120 Towed Mortar and NDI ammunition were Type Classified-Limited Procurement (Urgent) (TC-LPU) in March 1990. The NDI ammunition completed Lot Acceptance Testing in December 1990. The TC-LPU items are scheduled to be fielded in 3d Quarter FY 91. The M120 will be Type Classified-Standard (TC-S) in August 1991. The M121 Carrier Mortar was Type Classified-Low Rate Production (TC-LRP) in April 1990, with TC-S scheduled for August 1991. The Enhanced ammunition is currently undergoing TTII testing which will be completed in March 1991. It is expected to be TC-LRP in July 1991, with TC-S scheduled in FY 1992. The M121 mortar and Enhanced ammunition is scheduled to be fielded in late FY 93.



M121 Carrier Mortar

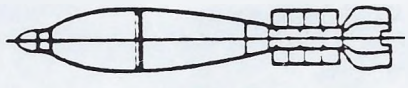


120mm Mortar in Ground Configuration



M120 Towed Mortar on Trailer

SMOKE ROUND



HE ROUND

ILLUMINATION ROUND

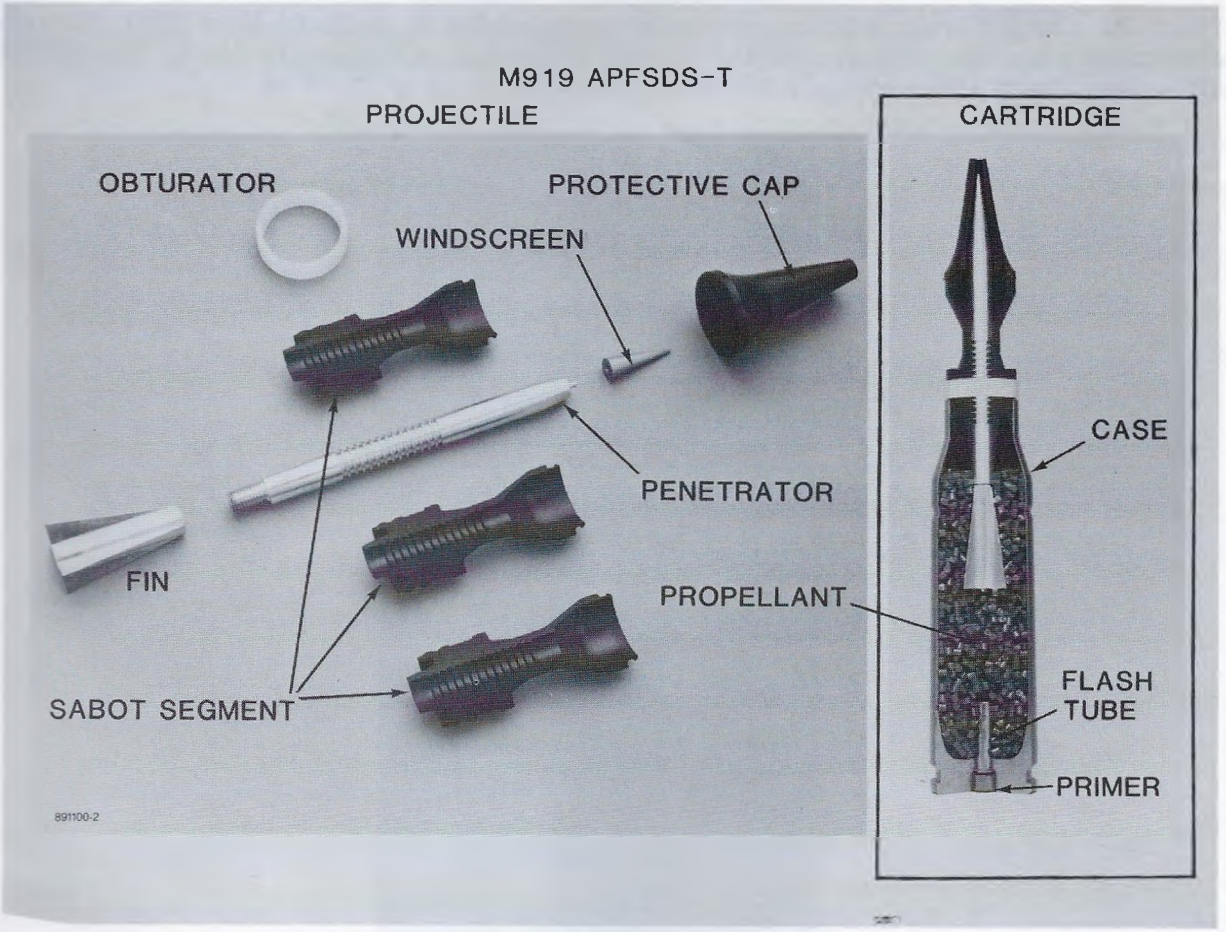
BATTALION MORTAR SYSTEM (BMS), 120MM

CARTRIDGE, 25MM: APFSDS-T, M919

1. SYSTEM DESCRIPTION: The M919 incorporates the latest long rod penetrator technologies, high energy propellants and improved penetrator core materials. It utilizes a windscreen for aeroballistic efficiency, a fin for stabilized flight and a three piece discarding sabot. The projectile is decoupled from the full spin effects of the rifled gun barrel with a slip obturator. A protective cap protects the penetrator tip during rough handling and is a feed guide for cycling in the weapon systems.

2. USE: The M919 is the crux of the Materiel Need for the Bradley Fighting Vehicle Systems (BFVS) Block II Modification to increase its effective defeat range against the enemy light armor threat and enhance vehicle and crew survivability. The M919 will replace the M791 APDS-T as the primary armor piercing cartridge for use in the 25mm M242 Automatic Gun mounted on the M2/M3 BFVS.

3. STATUS: Type Classification-Limited Procurement (Urgent) was approved on 30 September 1989. A Low Rate Initial Production (LRIP) contract was awarded in June 1990. Type Classification-Standard is scheduled for the 3d Quarter FY 91 to initiate Full Production in the same fiscal year. It is anticipated that a second source producer will be qualified to enter LRIP also in FY 91. Two qualified sources will compete for out year production requirements.



CARTRIDGES, 25MM: APTP-T, M910 AND M910E1

1. SYSTEM DESCRIPTION: The M910 is an Armor Piercing Target Practice with Tracer (APTP-T) round designed to be used in gunnery training. It is a limited range cartridge having a lightweight steel subprojectile and a high mass flow tracer to aerodynamically tailor the trajectory. This combination provides a ballistically similar trajectory to the M791 and M919 armor piercing cartridges to a range of 2000 meters yet restricts the maximum range to 8000 meters. This will permit the M910 to be used on available direct fire training ranges, most of which are barred for the M791 and M919 due to their lengthy maximum ranges. The exterior contour of the M910 is similar to the M791 and the sabot material is colored blue to indicate the training round function. New requirements have been approved for an improvement of the M910 cartridge; this new cartridge has been designated the M910E1. The M910E1 will have a trajectory that more closely simulates the M919 cartridge to a range of 2500 meters, while maintaining a maximum range of less than 8000 meters. It will also have a trace signature that replicates that of the M919.

2. USE: The M910 and M910E1 will be used in the M242 25mm Automatic Cannon during Bradley Fighting Vehicle live fire gunner training and qualification in conjunction with the M793 TP-T Cartridge.

3. STATUS: The M910 was Type Classified-Limited Procurement in December 1987. Type Classification-Standard occurred in September 1988. Materiel Release for the Low Rate Initial Production was approved in April 1990. With the fielding of this new cartridge, numerous CONUS and OCONUS ranges previously denied will become available. The M910E1 Training Device Requirement was approved May 1990. The lead development contract was awarded to Aerojet Ordnance in September 1990. The M910E1 will replace the M910 starting in FY 93.

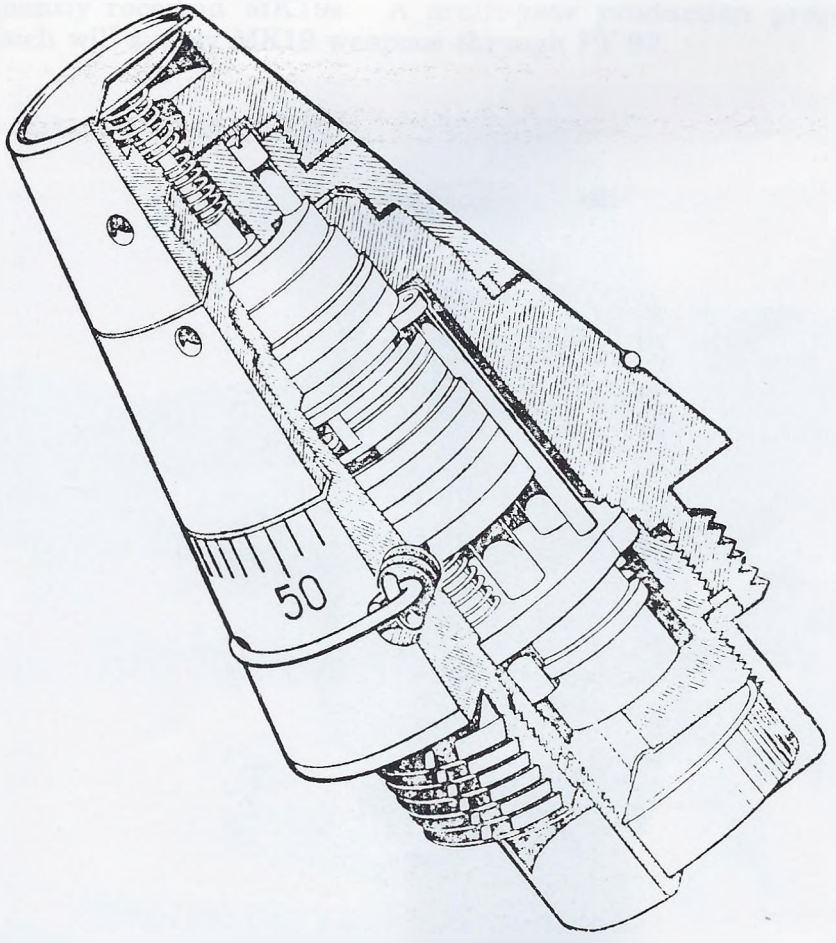
CARTRIDGE, 25MM, APTP-T, M910

FUZE, MORTAR, MECHANICAL TIME, SUPERQUICK: M776 (DM93)

1. SYSTEM DESCRIPTION: The M776 is the U.S. Army nomenclature for the German DM93 Mechanical Time, Superquick Fuze. It is settable for time functions between 6 and 54 seconds. The setting is left in the shipping position for superquick function. Safety is provided by a pull wire and setback mechanism. Arming is delayed after firing for approximately 1 second by the timing mechanism. When the set time is reached, a firing pin is released which initiates a detonator, which in turn initiates a black powder charge. For superquick function, the firing pin initiates the detonator on impact.

2. USE: The M776 is used on the 60mm, M721 Illumination round. The DM93/M776 is used on the 120mm, M91 Non-Development Illumination round and the XM930 Enhanced Development Illumination round.

3. STATUS: The M776 was Type Classified-Standard with the 60mm, M721 Illumination round in September 1987. A production contract was awarded in January 1989. There have been no production or quality problems. The DM93 was Type Classified-Limited Procurement (Urgent) on the 120mm, M91 in March 1990. All required fuzes have been produced. The DM93/M776 will also be Type Classified on the 120mm, XM930 in March 1991.



FUZE, MORTAR, M776 (DM93)

FUZE, MORTAR, PRECISION TIME: XM778

1. SYSTEM DESCRIPTION: The XM778 is an electronic time fuze for use with illumination cartridges of 60mm mortars and the illumination and RP smoke cartridges of the 81mm mortar. The XM778 will replace existing mechanical time fuzes, improving accuracy at reduced cost. The fuze has a back-up Point Detonating mode, in which initiation is accomplished electrically by means of an impact switch. The fuze is settable for time functions between 3.0 and 99.8 seconds in 0.1 second increments without use of a fuze wrench. The fuze can be set in the dark and while wearing chemical and/or Arctic protective clothing. Fuze safety is assured during handling and firing by means of a Safe and Arm Mechanism.

2. USE: The XM778 will be used on the following rounds: 60mm M721E1 Illumination, 81mm M819E1 RP Smoke and 81mm M853A1E1 Illumination.

3. STATUS: The fuze effort is a Product Improvement Program for the M721, M819 and M853A1 rounds. A contract was awarded for the second phase of the program in September 1990. Type Classification is scheduled for FY 92.

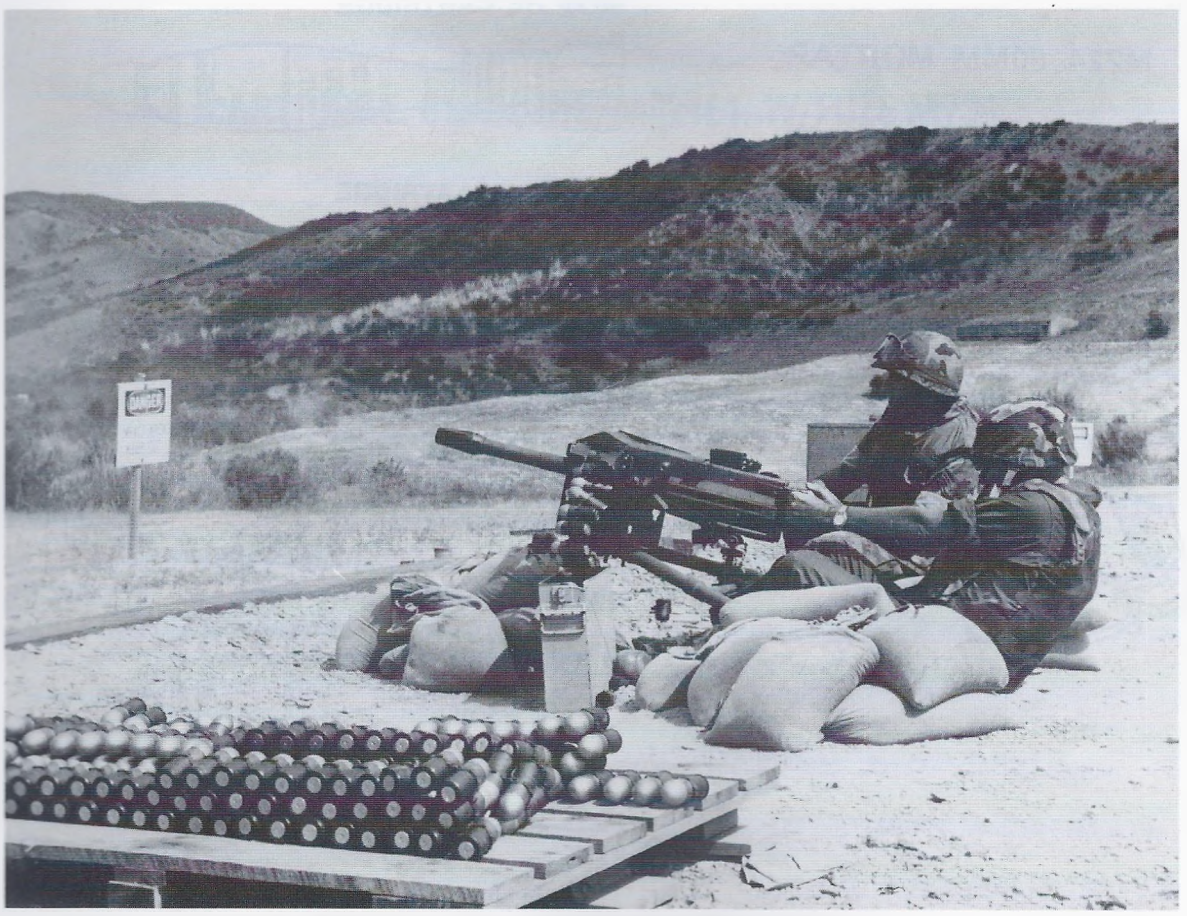
FUZE, MORTAR, PRECISION TIME, XM778

GRENADE MACHINE GUN: MK19 MOD3

1. SYSTEM DESCRIPTION: The 4Omm MK19 MOD3 Grenade Machine Gun is an automatic grenade launcher which fires 40mm antipersonnel and anti-light armor grenades at a rate of 350 rounds per minute to a maximum effective range of 1500 meters for point targets and will provide suppressive fire up to 2200 meters. Vehicle or ground mounting applications are accommodated by use of the MK64 MOD7 mount on a tripod or pedestal. The prime combat round is the 4Omm, M430 High Explosive, Dual Purpose Cartridge. It contains a high fragmentation projectile body assembly and copper shaped charge liner giving it anti-personnel and anti-materiel capability. The 40mm, M918 Target Practice Cartridge is the training round.

2. USE: The MK19 is currently employed on the M3 Tripod, the High Mobility Multipurpose Wheeled Vehicles, M113 Armored Personnel Carriers and the M88Al Recover Vehicle. It will also be employed on five ton cargo trucks.

3. STATUS: The MK19 MOD3 was Type Classified for Army use in 2d Quarter FY 86. Initial production testing was successfully completed in 3d Quarter FY 88 with a Materiel Release approved in 4th Quarter FY 89. The first fielding to the 9th Infantry Division, Fort Lewis, Washington occurred in 1st Quarter FY 90. Several other units have subsequently received MK19s. A multi-year production program is currently underway which will supply MK19 weapons through FY 92.



GRENADE MACHINE GUN, MK19 MOD3

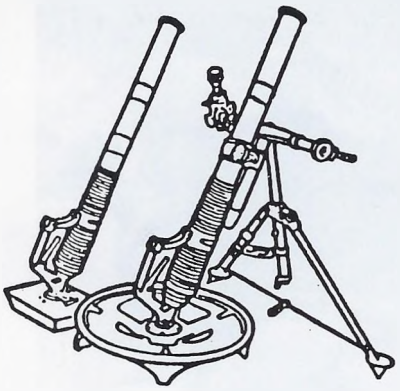
LIGHTWEIGHT COMPANY MORTAR SYSTEM (LWCMS): 60MM

1. SYSTEM DESCRIPTION: The 60mm LWCMS includes a lightweight, manportable, high angle of fire mortar cannon. This mortar can be operated in the conventional bipod mode and the hand held mode. The 60mm, M224 Mortar can sustain 20 rounds per minute rate of fire. The minimum range of impact is 70 meters, and the maximum range is 3500 meters. The family of ammunition includes the following cartridges: M720 HE, M888 HE, M721 Illumination, M722 WP Smoke, and M840 Training. The cartridges utilize the following fuzes respectively: M734 Multi-Option, M935 Point Detonating (PD), M776 Mechanical Time, M745 PD, and M775 PD.

2. USE: The LWCMS provides airborne, air assault, light infantry, mountain, and ranger companies with a lightweight indirect fire weapon. The mortar can also be used in conjunction with the AN/GVS-5 hand-held laser range finder.

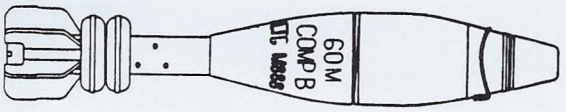
3. STATUS: The M224 Mortar was Materiel Released in March 1981. The M720/M888 HE Cartridges were Materiel Released in March 1983. The M721 Illumination Cartridge Materiel Release is scheduled for April 1991. The M722 WP Smoke Cartridge Materiel Release is scheduled for August 1991. The M840 Training Cartridge was Type Classified-Generic October 1990.

M224 60MM MORTAR

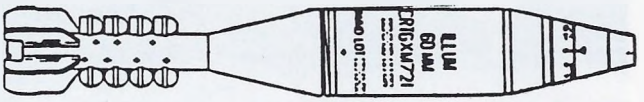


M720 HE CARTRIDGE

M888 HE CARTRIDGE



M721 ILLUMINATING CARTRIDGE



M722 WP SMOKE CARTRIDGE

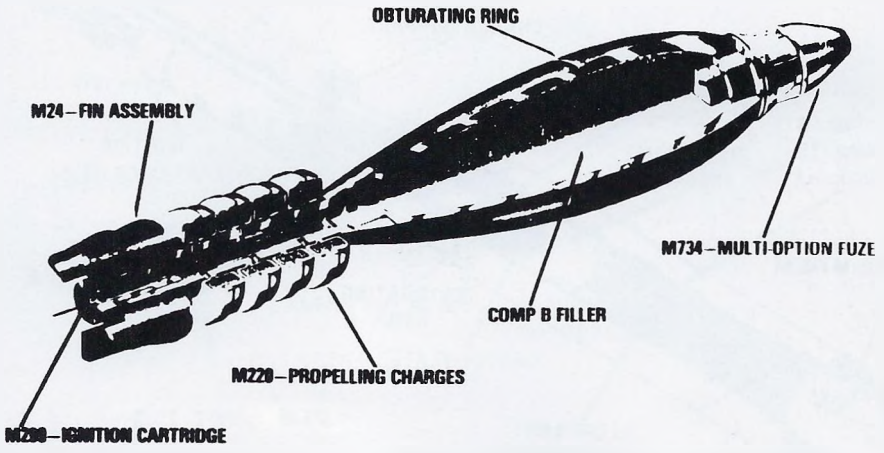
MORTAR CARTRIDGES, 81MM: HE, M821E1/M889E1

1. SYSTEM DESCRIPTION: The M821E1/M889E1 High Explosive (HE) Cartridges are a U.S. designed version of the M821/M889 Cartridges that are currently manufactured by Royal Ordnance in the UK. The purpose of the Product Improvement Program is to have the capability to produce on-shore while maintaining or increasing the safety, performance, durability and reliability characteristics of the UK produced round. The U.S. design changes include a high fragmentation steel body instead of a cast body. In addition, the US design utilizes the M24 fin assembly, M299 ignition cartridge, and M220 propelling charge that are used on the I81mm M879 Full Range Practice Cartridge. The only difference between the M821E1/M889E1 is that the M821E1 cartridge utilizes the M734 Multi-Option Fuze, while the M889E1 Cartridge utilizes the M935 Point Detonating Fuze.

2. USE: The M821El/M889El HE Cartridges will replace the currently UK manufactured M821/M889 HE Cartridges for use with the I81mm Mortar. These cartridges will be used in both the tactical battlefield and in live fire training exercises.

3. STATUS: The M821E1/M889E1 HE Cartridges are scheduled to be Type Classified-Standard 3d Quarter FY 91.

CARTRIDGE, 81mm: HE, M821E1, W/FUZE M734



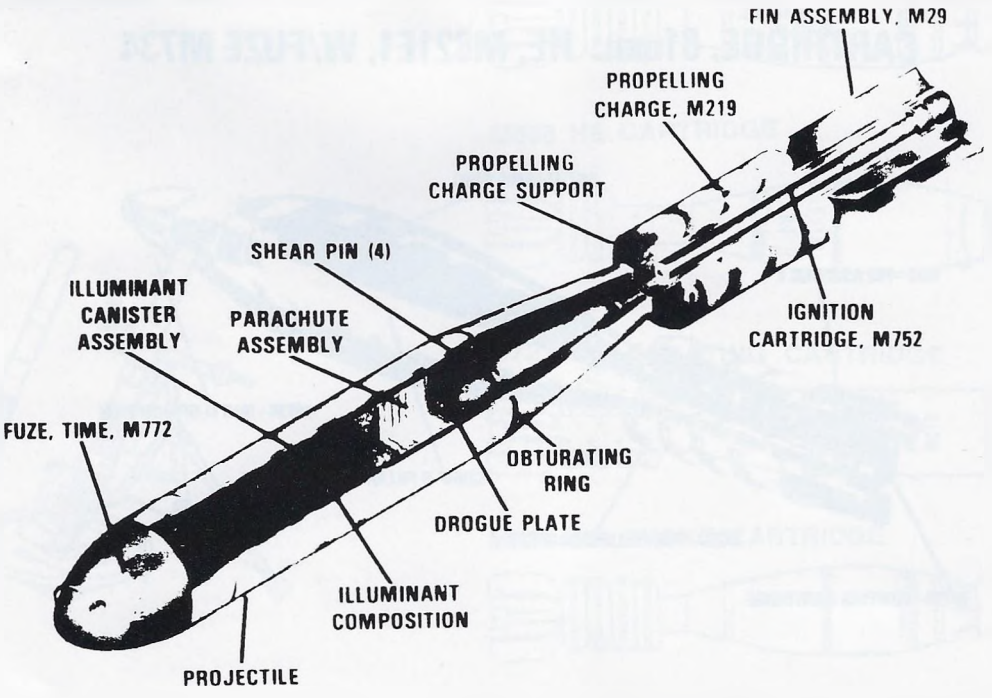
MORTAR CARTRIDGE, 81MM: ILLUMINATION, M853A1

1. SYSTEM DESCRIPTION: The M853A1 Illumination Cartridge is an improved round for use in the M252 improved 81mm Mortar System. The Cartridge has a range of 5150 meters to burst, 72 percent greater than the standard M301A3 round. It will illuminate out to the full range of the M821 and M889 High Explosive Cartridges (5600 meters). The M853A1 Cartridge will illuminate an area 207 percent greater than the M301A3. The M772 Mechanical Time Super Quick (MTSQ) fuze used on this round will result in increased accuracy. The payload consists of a parachute and improved candle, which is ignited and base ejected as an aerial event upon functioning of the M772 MTSQ fuze, 475 meters above the ground. The candle provides illumination for 50 seconds minimum at 525,000 candlepower.

2. USE: The M853A1 Illumination Cartridge is used for night illumination missions with the M252 improved 81mm Mortar System. Customers include the U.S. Army, U.S. Marine Corps, U.S. Air Force and U.S. Navy.

3. STATUS: The M853A1 is presently in Full Scale Production.

MORTAR CARTRIDGE, 81MM, ILLUMINATION, M853A1

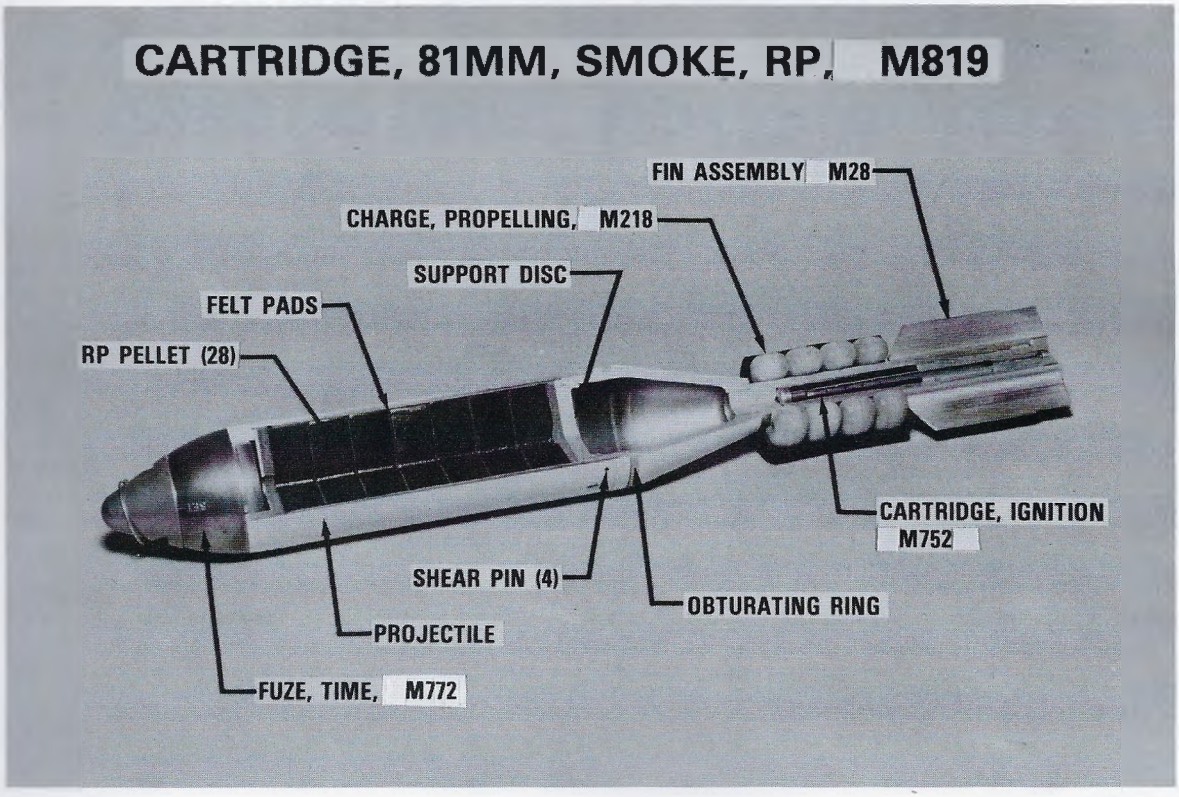


MORTAR CARTRIDGE, 81MM: SMOKE, RP, M819

1. SYSTEM DESCRIPTION: The M819 RP Smoke Cartridge is an improved ground screening round for use with the improved M252, 81mm Mortar System. The improved cartridge provides obstruction effectively to 93 percent of the maximum range of the M821 and M889 High Explosive Cartridges (5600 meters). The payload consists of 28 red phosphorus wedges which are ignited and base ejected as an aerial event upon functioning of the M772 Mechanical Time Super Quick fuze 175 meters above the ground. Three rounds will produce effective ground screening for a duration of five minutes under normal conditions. The M819 is five times more effective than the standard M375A3 white phosphorus smoke cartridge.

2. USE: The M819 RP Smoke Cartridge is used for obstruction and spotting missions with the M252 improved 81mm mortar system. Customers include the U.S. Army and U.S. Marine Corps.

3. STATUS: The M819 is presently in Full Scale Production.



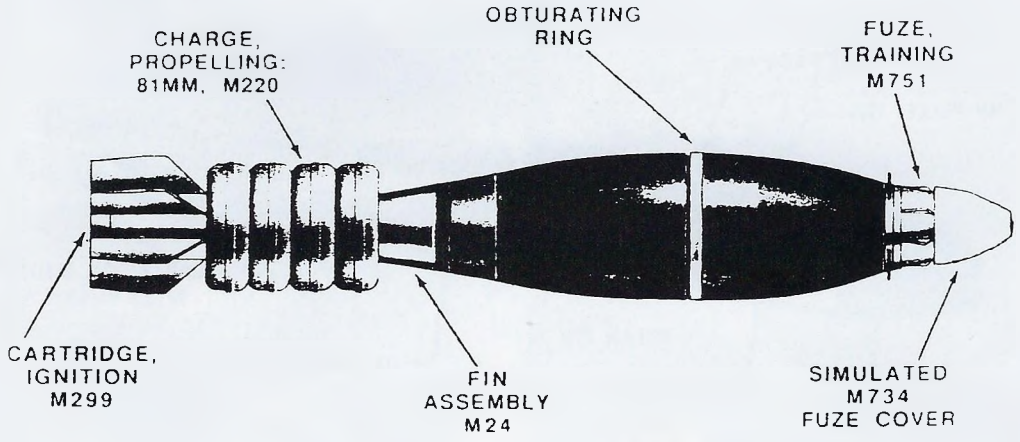
MORTAR CARTRIDGE, 81MM: PRACTICE, M879, FULL RANGE

1. SYSTEM DESCRIPTION: The M879 Practice Cartridge is intended to be a low cost cartridge for use in training. The M879 will have ballistic characteristics similar to the M821E1 Cartridge and provides a smoke, flash and bang signature upon impact. The cartridge consists of a steel projectile body with a Hydrocal filler, practice fuze M751, M24 fin assembly with M299 ignition cartridge and a plastic obturator. Four equal horseshoe-shaped M220 propellant increments are fitted to the boom of the fin assembly.

2. USE: The M879 is a Full Range Practice Cartridge which simulates the M821 High Explosive (HE) Cartridge with the M734 Fuze. This cartridge will provide 81mm Mortar training without the risk of severe injury due to the absence of HE fill.

3. STATUS: The M879 Cartridge production program experienced some delay due to M751 Fuze failures. The problem has been remedied and the program is back on track.

Cartridge, 81MM: Practice, M879



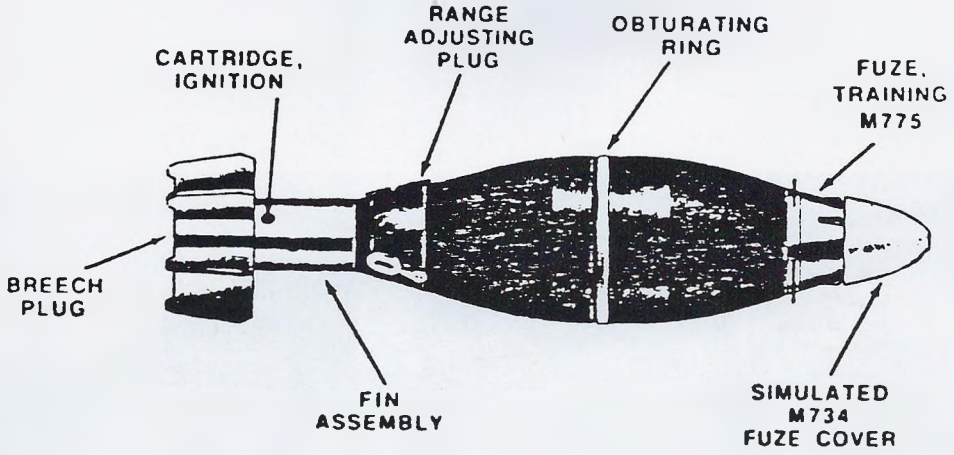
MORTAR CARTRIDGE, 81MM: PRACTICE, M880, SHORT RANGE

1. SYSTEM DESCRIPTION: The M880 Short Range Practice Cartridge was evaluated under an International Materiel Evaluation program which led to Type Classification in March 1986. This cartridge also provides a smoke, flash, and bang signature upon impact at approximately 1/10 the range of the M879.

2. USE: The M880 is a Short Range Practice Cartridge which is fired on clean ranges and retrieved for reuse. The cartridge, once refurbished, can be fired again or stored for the next training exercise.

3. STATUS: The contractor first lot has been delivered. The Lot Acceptance Test will take place in February 1991.

Cartridge, 81MM: Practice, M880



SQUAD AUTOMATIC WEAPON (SAW), 5.56MM: M249

1. SYSTEM DESCRIPTION: This 16 pound weapon is a one-man portable, gas operated, open bolt machine gun that is capable of accurate, sustained fire at extended ranges. The SAW fires M855 ball and M856 tracer 5.56mm ammunition packed with disintegrating links in 200 round disposable plastic containers. It can also fire unlinked 5.56mm ammunition from the standard M16A2 magazine. The gun is easily field-strippable and has a quick change barrel that can be replaced in less than 10 seconds.

2. USE: The M249 Machine Gun is deployed primarily in infantry fire teams in the U.S. Army and the U.S. Marine Corps.

3. STATUS: Fielding of SAW began in 1984. In 1985, a design modification program was initiated to improve reliability and weapon/soldier interface. Some of the major changes included: A reconfigured buttstock, a hydropneumatic buffer, a fixed single orifice gas system, a barrel heat shield, a folding barrel change handle, and the same muzzle device as the M16A2 rifle. The initial weapons procured from the OCONUS source will receive a modification kit in calendar year 1991. However, the new CONUS production will incorporate these design improvements during fabrication. Award of the contract for the CONUS production occurred in September 1988. Production deliveries are scheduled for 1991.

SQUAD AUTOMATIC WEAPON (SAW) M249

TILE, ARMOR: M3-M7

1. SYSTEM DESCRIPTION: The Bradley applique armor system consists of 105 tiles of five different types, mounted on the front, sides, and turret sections of the vehicle. The tiles are attached to the Bradley M2A2 and M3A2 vehicles by means of hardware that is bolted to the vehicle at various attachment points. Once the tiles are mounted, camouflage covers are placed over the front and side sections.

2. USE: The original designs were developed primarily to protect against the hand-held-HEAT class of missiles and to provide some additional protection from kinetic energy projectiles. The new designs will protect the Bradley from higher performance missiles (threat descriptions are classified) as well as KE rounds.

3. STATUS: A reactive armor tile system was developed and Type Classified in December 1987 for the Bradley application. Recently, improved armor tile systems were procured from three contractors based upon a Non-Developmental Item approach. Sample hardware was procured for delivery and testing to start in January 1991. Dependent upon the results of these tests, one of the tile systems will be selected for final qualification tests, leading to Type Classification and production authorization planned for 3d Quarter FY 92.

BRADLEY FIGHTING VEHICLE WITH ARMOR TILES

FIRE SUPPORT

ADVANCED FIELD ARTILLERY SYSTEM (AFAS)

1. SYSTEM DESCRIPTION: The AFAS is the next generation 155mm self-propelled howitzer system capable of providing revolutionary fire support capabilities to the maneuver force. It is composed of an artillery mission module mounted on an Armored Systems Modernization (ASM) common component chassis. Through use of state-of-the-art and emerging technologies, AFAS will provide substantial improvement over the current M109 series howitzer in lethality, survivability, mobility, deployment, and sustainability. Projected payoffs over the M109A6 include the ability to operate autonomously (both technical and tactical fire control), 33 percent reduction in crew size, 33 percent range increase, 50 percent ammunition payload increase, 250 percent survivability increase, 300 percent horsepower increase, and 300 percent rate-of-fire increase. With AFAS, the artillery force commander will deliver unprecedented firepower permitting an 8-gun AFAS unit to match the lethality of a 24-gun M109A6 Howitzer battalion.

2. USE: The AFAS will provide continuous, indirect fires in support of brigade, regimental and division elements close-in, laterally, and in-depth. The system will fulfill the traditional roles of direct support of maneuver forces and general support. The AFAS will displace the M109A6 Howitzer.

3. STATUS: The AFAS will enter the Advanced Technology Transition Demonstration in 1991 to examine and select appropriate technologies and operationally evaluate them. This will be followed by a Prototype Development program to demonstrate the objective AFAS mission module on the selected ASM common component chassis prior to entering Full Scale Development in 1998. Technology Base work in advanced propellants (solid unicharge and liquid) is proceeding with a decision between the two alternatives planned for 4th Quarter FY 91. In addition, advanced development work for the armament and fire control subsystems has begun with transition of these subsystems to the objective system planned for FY 95.

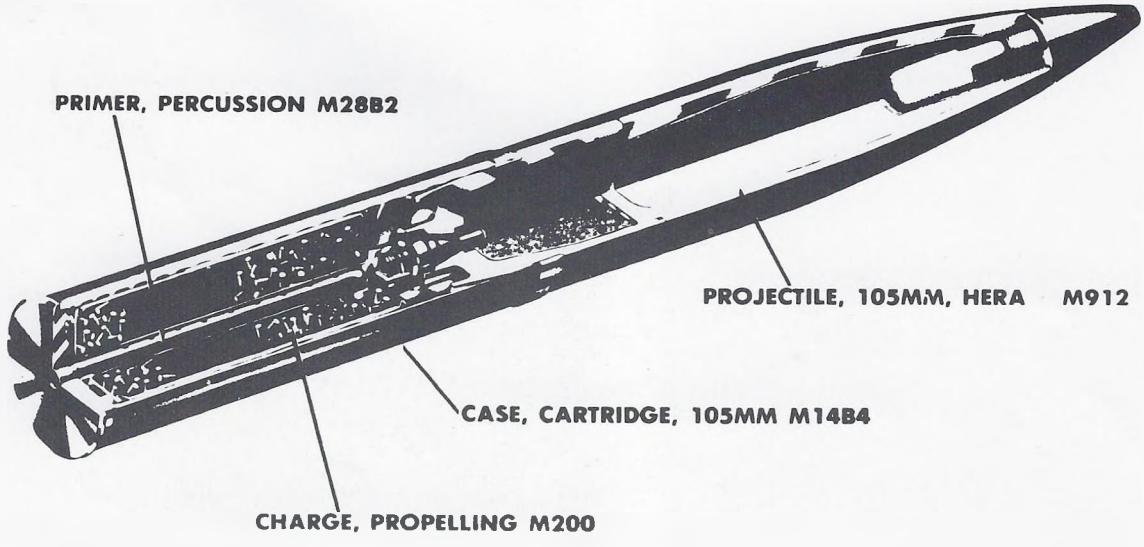
CARTRIDGE, 105MM: HERA, M913

1. SYSTEM DESCRIPTION: The M913, 105mm Cartridge consists of the M913 High Explosive, Rocket Assisted (HERA) Projectile mated with a standard cartridge case containing the M229 Propelling Charge. The charge is similar to the M200 Propelling Charge but contains an extra bag with 3 ounces of M30 propellant and 1.5 ounces of potassium sulfate. The combination of the M229 Charge with the M913 Rocket Assisted Projectile has the effect of increasing the range capability of the M119 Howitzer to 19.5 kilometers.

2. USE: The M913 has been developed exclusively for use in the M119 Howitzer to support the Light Infantry and Airborne/Airmobile Divisions with requisite range and lethality.

3. STATUS: Type Classification-Standard occurred for the M913 HERA Cartridge and the M229 Propelling Charge in November 1990. Solicitations for production are expected to be distributed early in calendar year 1991.

CARTRIDGE, 105MM, HERA, M913



FUZES, ARTILLERY, ELECTRONIC TIME (ET): M762/767

1. SYSTEM DESCRIPTION: The M762/M767 ET Fuze is an accurate, reliable and mass producible low-cost time fuze which can be set by manual method (hand set) or by an automated technique (auto set). Auto setting provides the capability for a direct, automatic data link between the fuze and the fire control system. It will permit the incorporation of rapid automated projectile handling techniques in future artillery weapon systems. An increased fire rate, reduced response time and simplified operation will be obtainable. Auto setting will also reduce the potential for fuze setting errors found in the hand setting technique. The fuze has a hand set capability for manual setting without the need for an external setter or special tools.

2. USE: The fuzes interface with all fielded and developmental, 105mm, 155mm, and 8 inch projectiles. The M767 is used for explosive projectiles, and the M762 is used for cargo-carrying projectiles. They meet the NATO standardization and interoperability requirement. The fuzes will ultimately replace the mechanical time fuzes presently in the field.

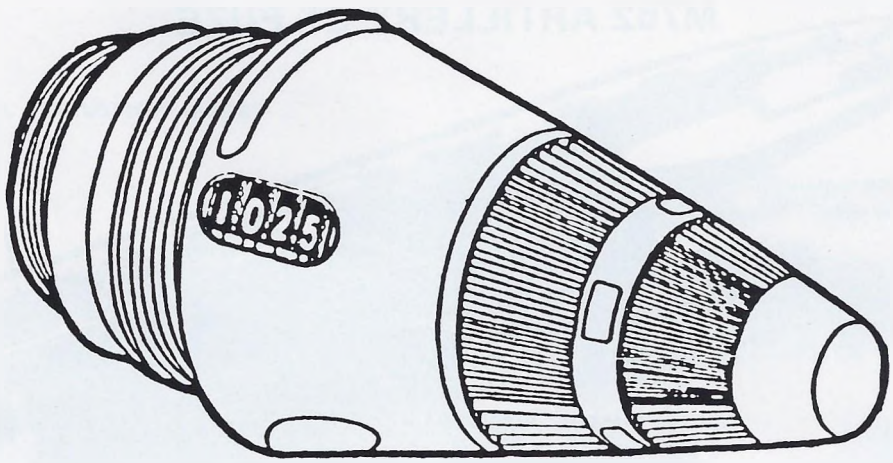
3. STATUS: The fuzes were Type Classified-Standard in September 1988. Production contracts were awarded to two contractors during 1st Quarter FY 90. First delivery of hardware is scheduled for 4th Quarter FY 91.

FUZE, MULTIOPTION FOR ARTILLERY (MOFA), XM773

1. SYSTEM DESCRIPTION: The MOFA is a single fuze for bursting type projectiles providing both an autoset (through use of an electronic fuze setter) and a hand-set feature under all climatic and illumination conditions. It is capable of being set for superquick point detonating (PD), delay, electronic time and proximity functions. Time settings of 0.5 to 199.9 seconds and proximity height of burst of 9 meters will be achievable. Introduction of the MOFA will permit the incorporation of rapid automated projectile handling techniques for future artillery weapon systems such as the Advanced Field Artillery System (AFAS); thus obtaining increased rate-of-fire, reduced response time and simplified operations. Auto setting will eliminate fuze setting errors currently found in hand setting techniques. Fielding of the MOFA will eventually enable 155mm fuze inventory to be reduced from 18 to 4 fuzes (the MOFA, the M762 ET, the M739 series PD, and the MK399 MOD1 MOUT fuze) thus simplifying logistics.

2. USE: The MOFA is being developed for all current (105mm, 155mm and 8-inch) and developmental artillery weapon systems. The fuze will be employed with projectiles having a bursting-type cargo (such as high explosive, white phosphorous, and chemical).

3. STATUS: The MOFA has successfully transitioned from technology base to advanced development. The program, under management of PM AFAS, will demonstrate during advanced development its capability to perform all stated functioning modes and its maturity to enter Full Scale Development in FY 92. It is anticipated that the MOFA will be Type Classified Limited Procurement in FY 96.



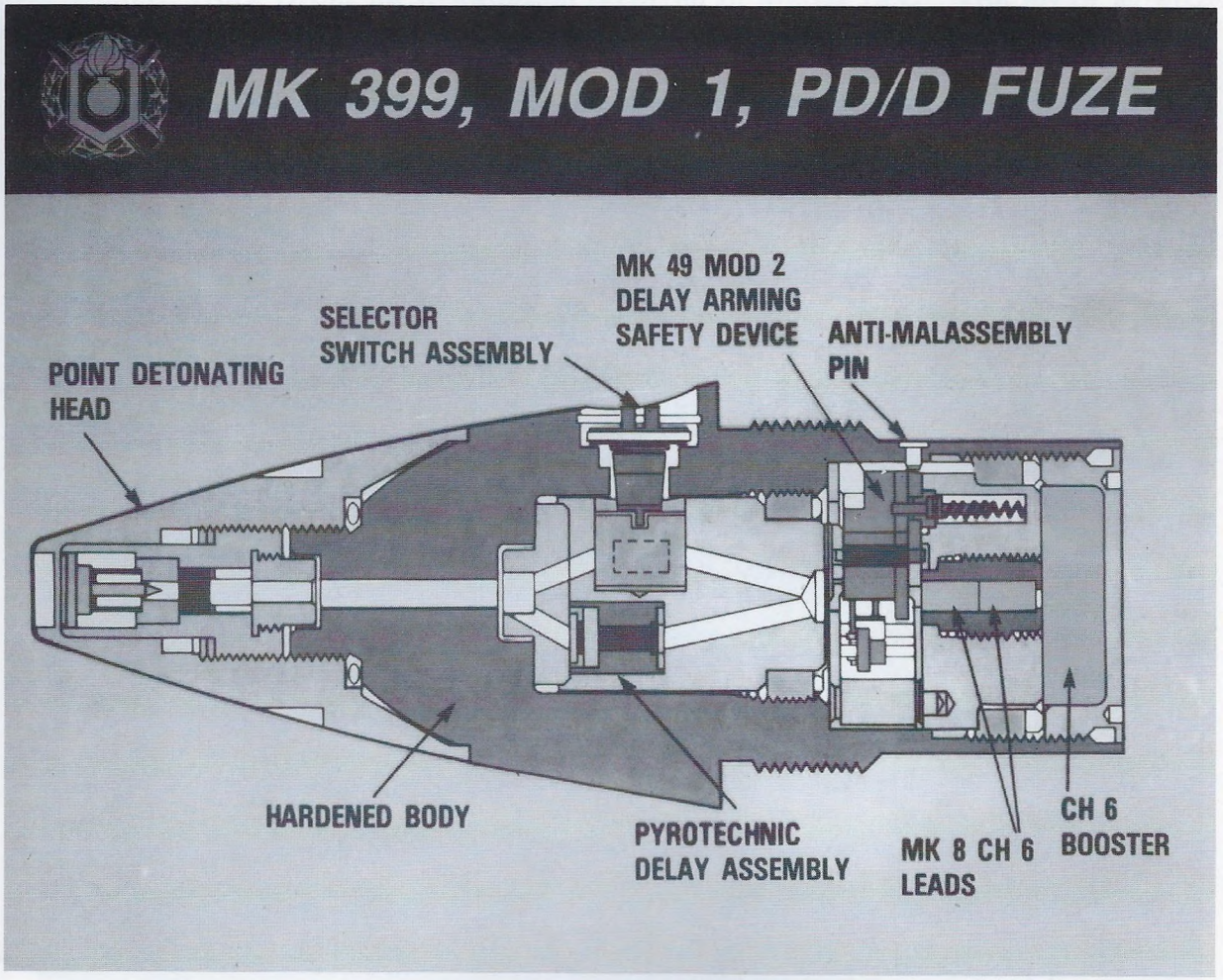
MULTIOPTION FUZE, ARTILLERY (MOFA), XM773

FUZE, POINT DETONATING (PD) DELAY MK399 MOD1

1. SYSTEM DESCRIPTION: The MK399 MOD1 Fuze consists of a hardened steel body for penetrating concrete and brick wall targets. The fuze contains a delay element to function the projectile immediately after target penetration to achieve maximum combat effectiveness. The MK399 MOD1 meets MIL-STD-1316 fuze safety design criteria.

2. USE: The MK399 MOD1 PD/Delay Fuze for Military Operations in Urban Terrain is the Army's new hard target fuze. This will replace the aging M78 series concrete piercing fuze which does not meet todays safety and operational requirements. The new fuze will provide improved reliability and effectiveness at increased angles of penetration (to 60 degrees obliquity) against targets as severe as 12 inches of brick or 8 inches of reinforced concrete.

3. STATUS: The MK399 MOD1 PD/Delay Fuze was Type Classified-Standard in January 1990. It is expected that first production and Materiel Release will occur in 1991.



FUZE, ARTILLERY, PROXIMITY: M732A2

1. SYSTEM DESCRIPTION: The M732A2 is a short intrusion, frequency modulated, continuous wave, radio doppler, proximity fuze. It consists of four modules assembled into a steel fuze sleeve: a proximity detector, a timer and setting ring assembly, a power supply assembly, and a safety and arming assembly with explosive train. Arming is initiated by setback and completed by the spinning of the projectile. The fuze features a backup point detonation mode which is factory set. It can be hand set for proximity operation for projectile times of flight between 4 and 156 seconds in 2 second increments. The M732A2 resulted from a Product Improvement Program applied to the formerly Type Classified M732 Fuze.

2. USE: The M732A2 was designed for use on standard and rocket assisted high explosive projectiles for 105mm, 155mm, and 8 inch artillery and 4.2 mortar rounds. It greatly improves the lethality of the HE and HERA projectiles against personnel and soft targets. The updated electronics improves control over height of burst and countermeasure resistance.

3. STATUS: The M732A2 Artillery Proximity Fuze was Type Classified-Standard in January 1990. Procurement is scheduled for FY 1991.

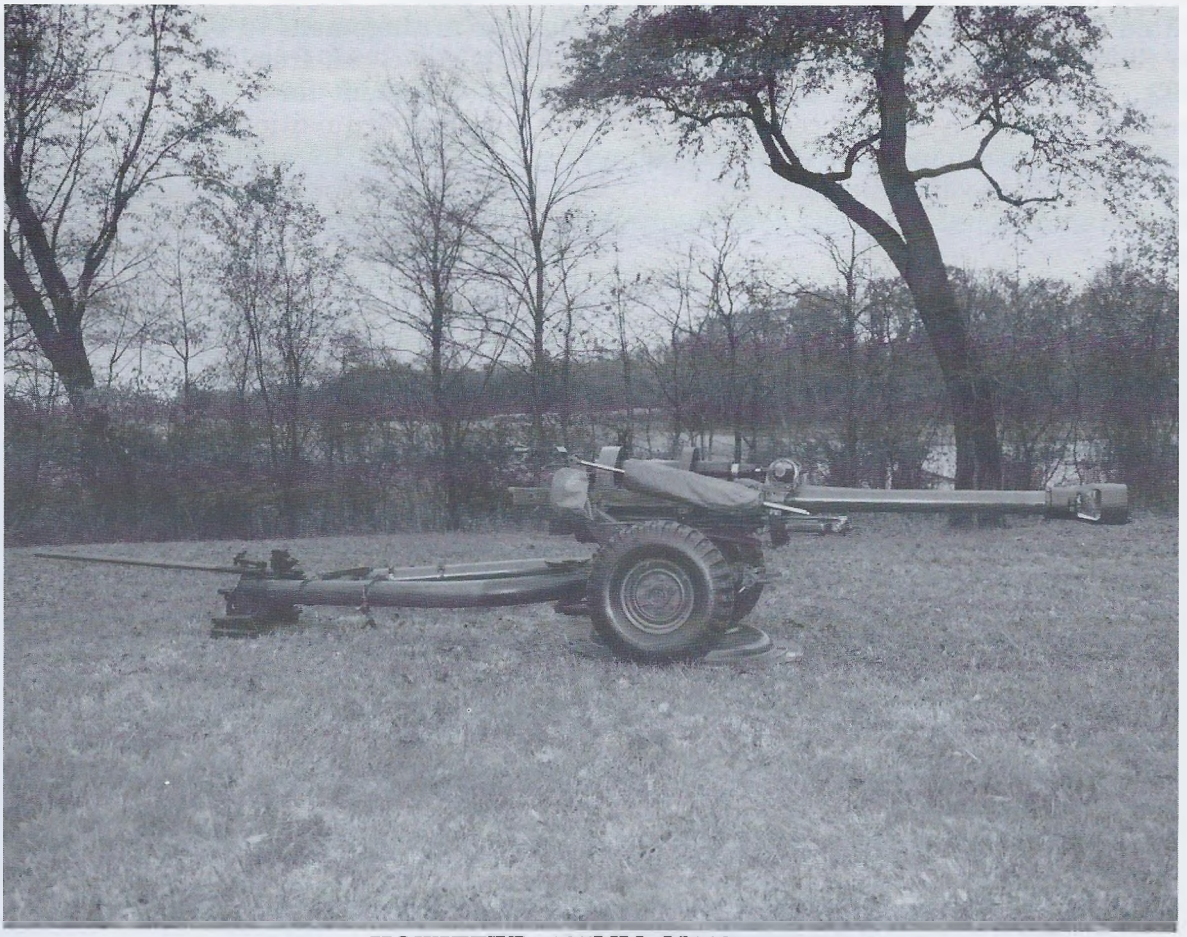
FUZE, ARTILLERY PROXIMITY, M732A2

HOWITZER, TOWED, LIGHT,105MM: M119/M119A1

1. SYSTEM DESCRIPTION: The M119 Howitzer is a light weight, towed 105mm artillery weapon which has been developed by the United Kingdom and was evaluated for use by the U.S. Army as a Non-Developmental Item. When firing the M760 Cartridge, the M119 achieves a maximum range of 14,000 meters compared to the maximum range of 11,500 meters for the Army's earlier M102 Towed Howitzer. The fire control system has been modified in response to the user's request to incorporate a system which is more familiar to U.S. Army personnel. A digital readout panoramic telescope and quadrant were incorporated, and provision has been made to incorporate the alignment device into the howitzer. The system was configured to maintain one man one sight operation. The M913 HERA Cartridge was developed to further extend the maximum range to 19,500 meters.

2. USE: The system is used to support the Light Infantry and Airborne/Airmobile Divisions with requisite range, lethality and strategic/tactical mobility.

3. STATUS: Type Classification-Standard was accomplished in December 1985 for the howitzer. Type Classification-Standard of the U.S. fire control system occurred in June 1989. Full Material Release of the fire control component kit together with the Maintenance Work Order for installation occurred in March 1991. The M119 Howitzer, with the U.S. fire control installed, is designated M119A1.



HOWITZER, 105MM, M119

HOWITZER, LIGHTWEIGHT, INDIRECT FIRE WEAPON SYSTEM: 155MM

1. SYSTEM DESCRIPTION: The lightweight 155mm towed howitzer is a 9000 lb. weapon with performance capabilities equivalent to the presently fielded 16000 lb. M198 system. Weight reduction is accomplished through the use of "non-standard" materials such as titanium and organic composites while firing stability is maintained by the introduction of unique weapon configuration and novel recoil attenuation techniques.

2. USE: The reduced weight of this system allows transportation by a wider range of helicopters and prime movers than the M198 and may permit transport by the light divisions' air assets. In addition, the United States Marine Corps (USMC) has initiated a unilateral development program for a next generation 9000 lb. towed howitzer with an Initial Operational Capability (IOC) of FY 99.

3. STATUS: In 1987, Vickers Shipbuilding and Engineering Ltd. (VSEL) of the United Kingdom contacted U.S. Army Armament Research, Development and Engineering Center (ARDEC) and proposed to build a lightweight weapon using private venture capital. The United States Government agreed to test and evaluate VSEL's weapon and share test data. This evaluation is presently being conducted by ARDEC and the USMC. Testing began in March 1990 at Yuma Proving Ground and consisted of firing, mobility and helicopter transportability testing. In addition, the weapon underwent an Early Operational Assessment with USMC troops at Camp Lejeune, N.C. during July/August 1990. To date the results of testing have been favorable, indicating this technology is mature enough to support continuing development efforts. Royal Ordnance, also of the United Kingdom, has proposed to ARDEC a similar arrangement to VSEL's. Testing of the Royal Ordnance prototype is tentatively scheduled to run from May 1991 to March 1992. The USMC has an approved requirements document for a 155mm lightweight howitzer and is in the process of approving a program/acquisition strategy. Current plans call for a competitive shoot-off beginning in January 1992 followed by a four year Full Scale Engineering Development, with IOC in September 1999. An Army Operational and Organizational Plan has been approved and forwarded to TRADOC for final review and approval.

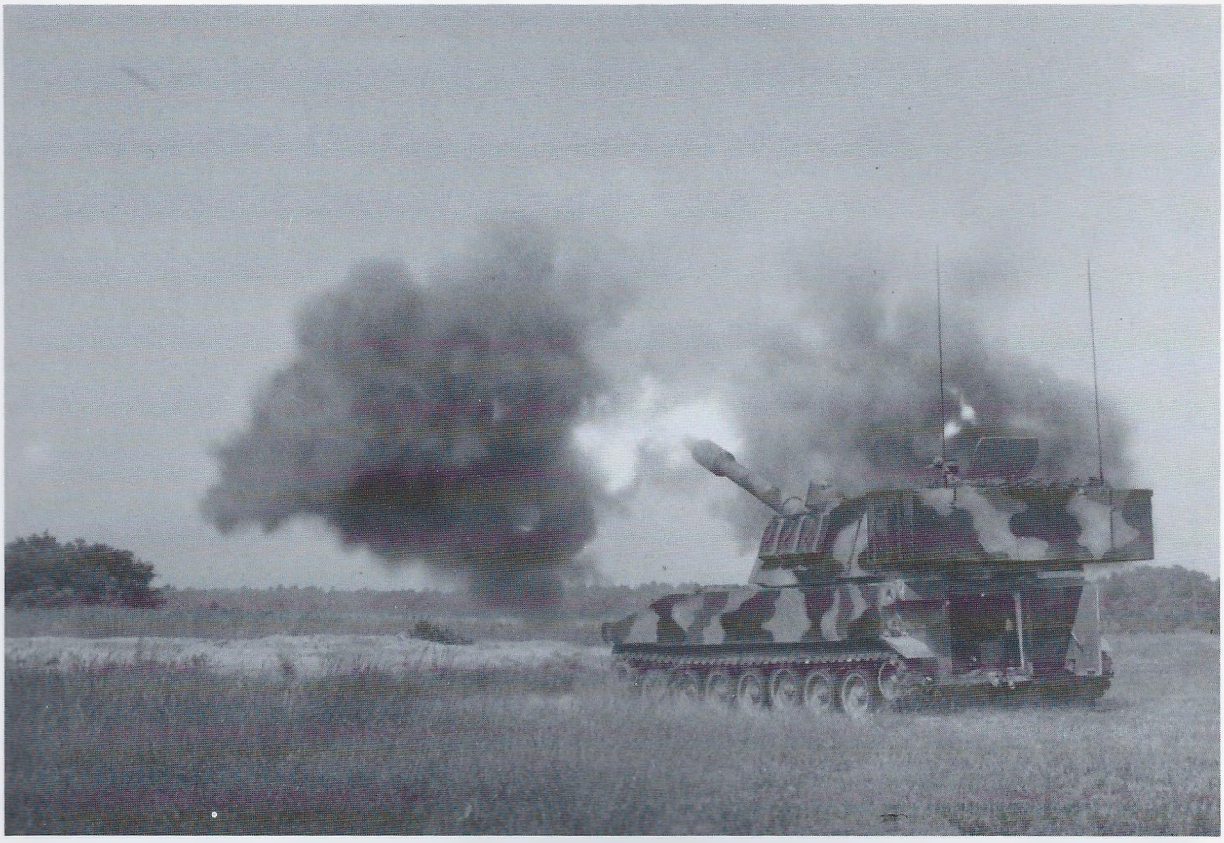
LIGHTWEIGHT INDIRECT FIRE WEAPON SYSTEM (155MM)

HOWITZER, PALADIN, 155MM: M109A6 (HIP)

1. SYSTEM DESCRIPTION: The M109A6 PALADIN/Howitzer Improvement Program is a product improvement of the M109A2/A3 series 155mm Self-Propelled Howitzer. The major objective is to improve responsiveness, terminal effects, reliability, availability, maintainability, and survivability of the systems. These objectives are being accomplished by upgrading the fire control, hydraulic, electrical, and armament systems. The improved vehicles will include semi-autonomous operation, servo actuated automatic gun positioning, ballistic computation, diagnostic-prognostics, secure digital and voice communications and better protection for the crew and critical components. The armament system will include the M182A1 Gun Mount and M284 Cannon which can fire the M203A1 Propelling Charge.

2. USE: The howitzer is used principally as an artillery weapon for armored and mechanized divisions and armored cavalry regiments. The improved howitzer will enhance the accomplishments of this mission through an extended range, improved survivability, and on-board land navigation and automatic fire control systems. In addition, a micro-climatic conditioning system provides cooled and Nuclear, Biological, and Chemical filtered air to each crewman's individual chemical protective clothing to permit the four-man crew to operate in nuclear, biological and chemical environments.

3. STATUS: Full Scale Development and Initial Operational Test and Evaluation are completed. The Army System Acquisition Review Council met in 4th Quarter FY 90 and a letter contract for Limited Production (LP) was awarded in September 1990 for 44 units. First Unit Equipped is scheduled for 3d Quarter FY 93. The Milestone III Full Production Decision is scheduled for 2d Quarter FY 93. Total production quantities, including LP are 824 units to be completed in FY 96.



M109A6 PALADIN

LIQUID PROPELLANT REGENERATIVE GUN

1. SYSTEM DESCRIPTION: Studies on liquid propellant gun systems consistently show substantial benefits in weapon system performance, logistics, system integration, and propellant cost over bagged propellant gun systems. The design approach adopted for development is regenerative injection which utilizes the gas pressure in the combustion chamber to inject propellant from the reservoir. A differential area injection piston is used to maintain the liquid pressure in the reservoir above the combustion chamber pressure.

2. USE: The technology has multi service application and can be employed in all caliber guns ranging from anti-aircraft to artillery. Applications in artillery are currently being investigated.

3. STATUS: More than 3,000 rounds have been fired from 30mm guns including a successful burst fire test in 1st Quarter FY 90 which demonstrated 10 rounds in 90 seconds (6 rounds per minute). A 105mm gun has fired 125 rounds and demonstrated repeatable ballistic performance and control. The first generation 155mm gun (Gun 1) has completed firing trials on a test bed at Wright Malta, NY. This gun was first fired in July 1988 and successfully fired more than 235 rounds. It has demonstrated range capability from 4 to 30 kilometers velocity repeatability of 0.25 percent, and propellant fill accuracy of better than 0.1 percent. A second generation 155mm gun (Gun 2) was designed in FY 89 and fabricated in early FY 90. Testing was initiated on a test bed at Wright Malta, NY in July 1990. Gun 2 will be integrated into a modified M109 Self Propelled Howitzer in mid FY 91. It will then be used for system trials to demonstrate the practical application of a liquid propellant gun to meet the Advanced Field Artillery System requirements for the remainder of FY 91.

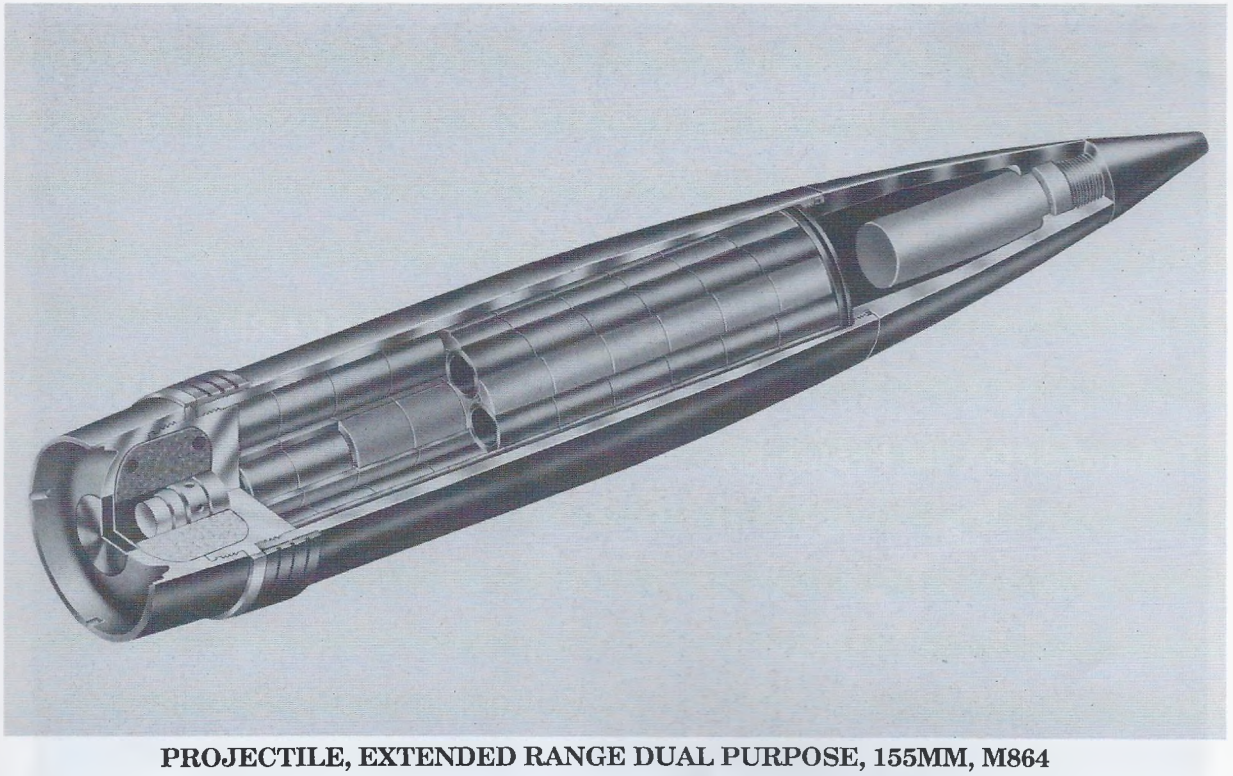
GUN 2 IN MODIFIED M109 VEHICLE (MODEL)

PROJECTILE, EXTENDED RANGE DUAL PURPOSE: 155MM, M864

1. SYSTEM DESCRIPTION: The M864 projectile complements the 155mm M483A1 projectile by providing significantly greater range capability. The projectile exterior is comprised of a steel body, ogive, and base assembly. The payload consists of twenty-four M46 and forty-eight M42 high explosive, dual purpose, anti-materiel/anti-personnel grenades which are scattered by an expelling charge ignited by a time fuze. The base assembly metal parts are loaded with a gas generating composite propellant grain and redundant igniter assembly comprising the base burner assembly. This assembly is ignited in-bore by the hot gun propellant gases and continues to burn for approximately 30-seconds, injecting hot gases into the wake of the projectile reducing drag and substantially increasing range.

2. USE: This projectile enhances the overall effectiveness of the 155mm field artillery weapon system by providing direct support to infantry, mechanized and armored forces at extended ranges. The spin stabilized projectile is compatible with all currently fielded 155mm howitzers and transported in the same manner as the M483A1. It requires no additional training or manpower. The M864 is also compatible with NATO propelling charges L8A1 and L20A1, and can be fired from the 155mm FM-70 howitzer.

3. STATUS: Type Classification-Limited Procurement was accomplished in May 1987, with Type Classification-Standard occurring in December 1987. Production is underway. First Unit Equipped is also expected to occur during 4th Quarter FY 91.



PROJECTILE, EXTENDED RANGE DUAL PURPOSE, 155MM, M864

SENSE AND DESTROY ARMOR MUNITION (SADARM)

1. SYSTEM DESCRIPTION: The SADARM is a target-sensing submunition payload for both the 155mm XM898 Projectiles and the rockets of the Multiple Launch Rocket System (MLRS). After firing of the projectile or rocket and upon reaching the target area, the submunitions are ejected. A vortex ring parachute imparts a constant spin and descent to the tilted submunition body. Dual sensors (millimeter wave and infrared) scan a decreasing spiral footprint on the ground, locate the target, and trigger a firing pulse timed to launch an explosively-formed penetrator to impact the top of the target at high velocity.

2. USE: The SADARM will provide a smart munitions counterfire capability for MLRS and the 155mm howitzer that will be truly fire and forget. It will be operable in both benign and countermeasure environments, in all weather conditions, both day and night, up to the system maximum range. It will be a force multiplier, reducing the levels of ammunition expended per mission and the associated logistic support requirements.

3. STATUS: The SADARM entered Full Scale Engineering Development in FY 86. The XM898, 155mm Projectile is scheduled for Type Classification (TC)-Low Rate Production during the 2d Quarter FY93 and TC-Standard during 3d Quarter FY94. The MLRS SADARM is also scheduled for TC-Standard during 3d Quarter FY94. The SADARM proposes a two block Pre-Planned Product Improvement Program to meet the ever changing threat into the 21st century. The program would extend the range of the 155mm SADARM and improve the counterfire role to include moving artillery targets.

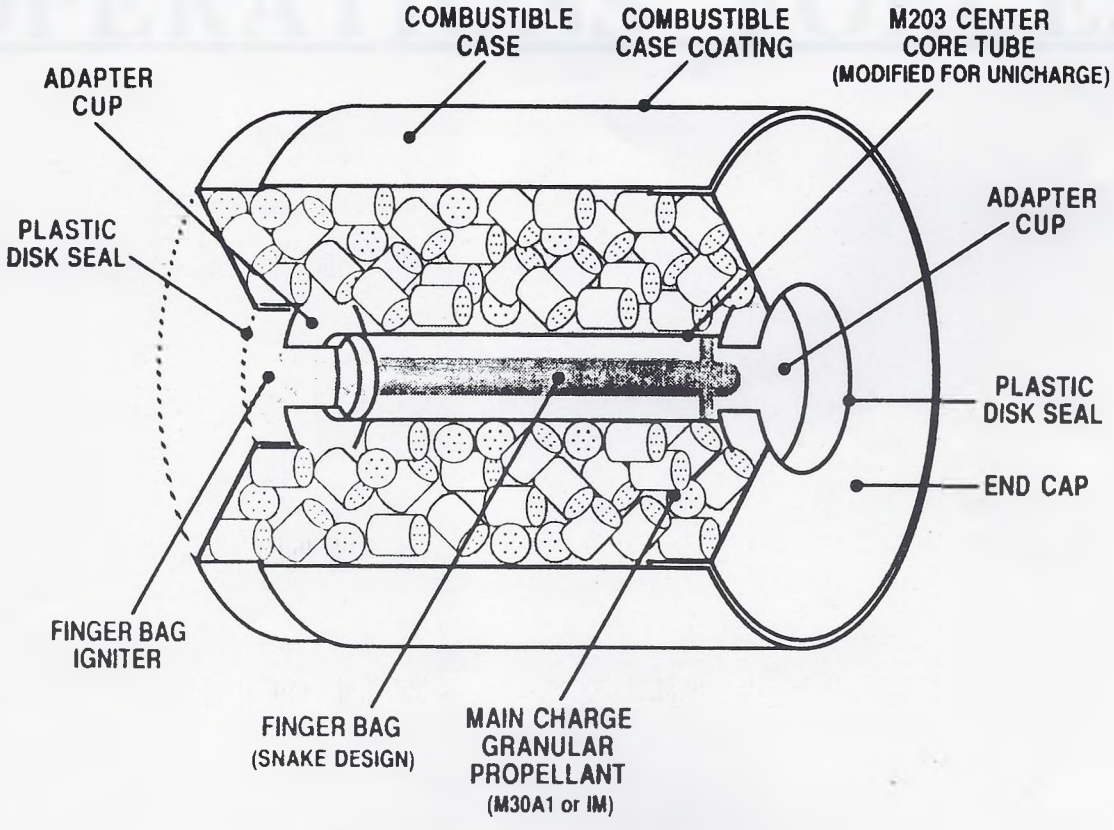
The SADARM System

UNICHARGE FOR 155MM ARTILLERY

1. SYSTEM DESCRIPTION: The Unicharge is a modular increment which can provide a complete zoning solution for 155mm artillery applications by using multiples of a single module. Each unit is identical in all aspects and contains the required additives for wear, flash and coppering reduction. It features a nitrocellulose combustible case, a granular solid propellant main charge, and a black powder center core ignitor.

2. USE: The Unicharge will be capable of being fired from all currently fielded 155mm howitzers, as well as the 1400 cubic inch chamber/52 caliber length cannon being developed for Advanced Field Artillery System/Extended Range Ordnance applications. It will be compatible with all 155mm ammunition in stock and in development. It will also feature NATO interoperability under the auspices of the Joint Ballistic Working Group Memorandum of Understanding for Extended Range Ordnance.

3. STATUS: The Unicharge is currently in 6.3A, Advanced Development, and is scheduled to enter 6.3B in 1st Quarter FY 92 if selected as the propellant for the Advanced Field Artillery System. Type Classification in the standard 1150 cubic inch chamber/39 caliber tube length cannon is scheduled for 4th Quarter FY 95.



Unicharge Increment for 155mm Artillery

SPECIAL OPERATIONS FORCES

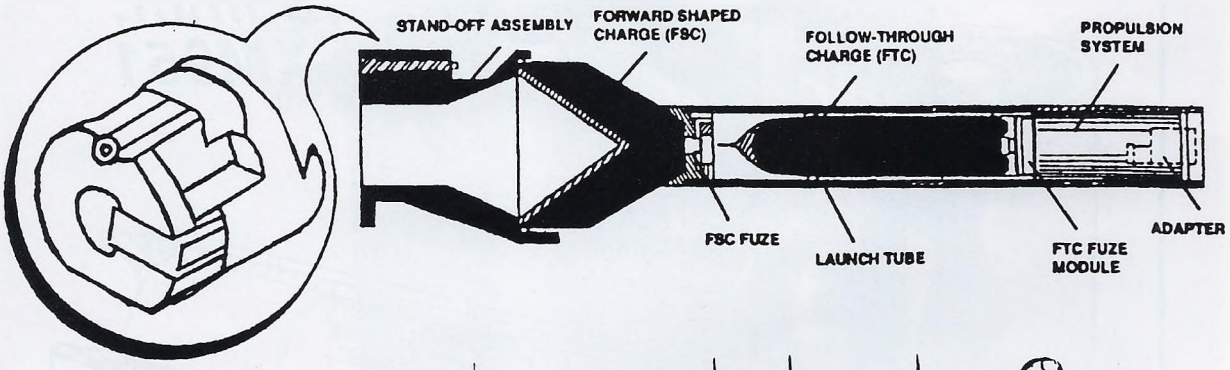
PENETRATION AUGMENTED MUNITION (PAM)

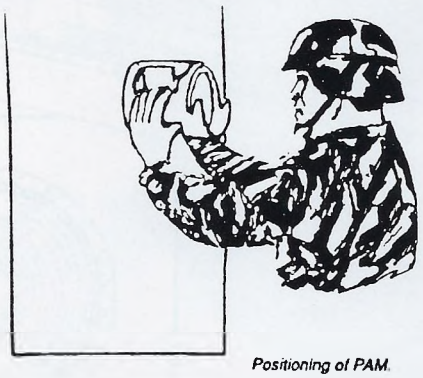
1. SYSTEM DESCRIPTION: The PAM is a one-step, two staged explosive munition which will be used to defeat the substructure of road and railroad bridges by destroying the piers and/or abutments. The PAM will weigh no more than 30 pounds, and it will be man portable and operable by one person. The PAM comes with a "rebar locater" enabling the PAM to be centered and fired between reinforcing bars. Once centered, the locater device becomes the attachment device that holds PAM against the target. A forward shaped charge produces a pilot hole in the target and a main cratering charge follows and is initiated at the optimum depth to destroy the target.

2. USE: This munition will be used primarily by Special Operations Forces. The PAM will also be employed by Light Combat Engineers, and Rangers for interdiction and conventional missions, attacking intermediate supports, piers, and abutments. The PAM should also find a variety of uses in military operations in urban terrain.

3. STATUS: The PAM entered Full Scale Engineering Development in 4th Quarter FY 90. Type Classification is projected for 4th Quarter FY 93.

PENETRATION AUGMENTED MUNITION (PAM)





Positioning of PAM.

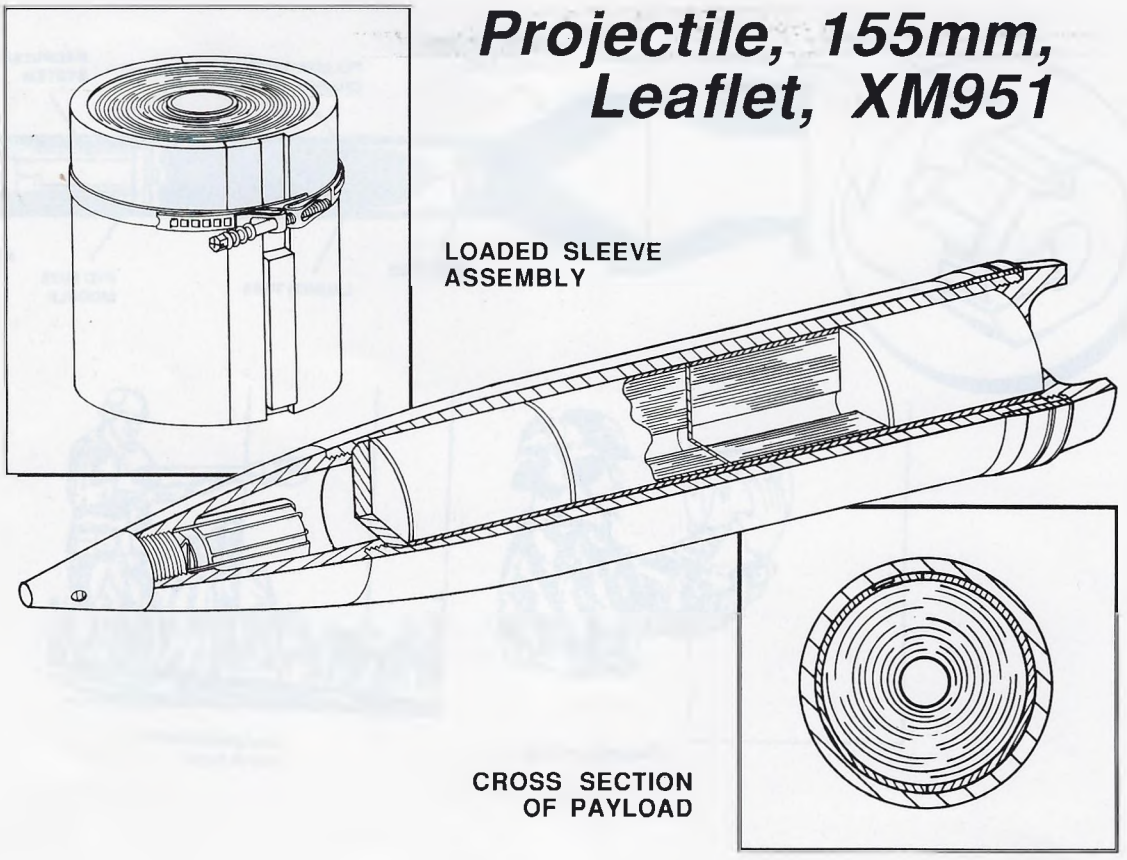
Final attachment of PAM to target.

PROJECTILE, 155MM: LEAFLET, XM951

1. SYSTEM DESCRIPTION: The XM951 is a 155mm artillery projectile designed to carry printed leaflets to a target audience by aerial ejection. Maximum use has been made of M483A1 projectile metal parts as the carrier. Hardware has been designed to contain and protect leaflets during launch of the projectile and ejection of the cargo. Cargo configuration helps to maintain ballistic similitude with the M483A1 projectile.

2. USE: The XM951 is required by the Special Operations Forces, Psychological Operations, to support their mission of influencing the opinions, emotions, attitudes and behavior of enemy forces.

3. STATUS: The projectile has been designed and experimental hardware has been manufactured and tested. Experimental test firings have been conducted at Dugway Proving Ground. The program is currently in the Proof of Principle Phase with Milestone I/II In-Process Review tentatively planned for June 1991. The round was Type Classified-Limited Procurement (Urgent) to support a current requirement. A small quantity was produced to support that requirement. Type Classification of the final configuration is scheduled for 3d Quarter FY 92 to be followed by production in FY 93.

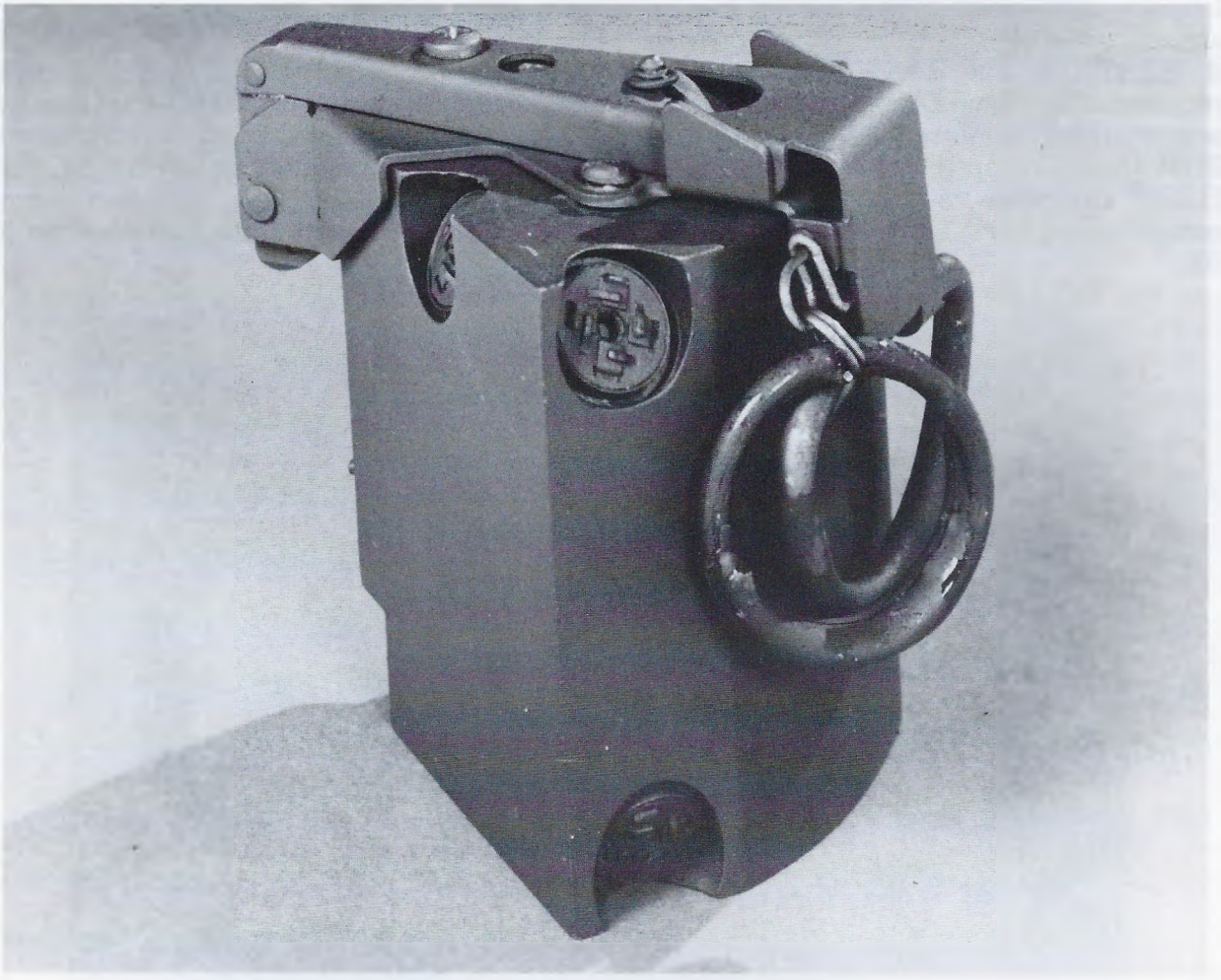


PURSUIT DETERRENT MUNITION (PDM) M86

1. SYSTEM DESCRIPTION: The PDM is one of the Family of Scatterable Mines. The M86 is a hand-emplaced adaptation of the Area Denial Artillery Munition (ADAM). It uses an arming mechanism which activates a battery and fractures a shorting bar. A pull ring and pin provide initial safety by locking the arming strap. The PDM functions when any of the following occurs: (1) One of the triplines is pulled, (2) the mine is disturbed, (3) on time out, (4) or on low voltage from the battery.

2. USE: This munition will be used primarily by Special Operations Forces. It will be used to support hit-and-run, ambush, harassing, and urban warfare missions. The PDM will also be employed by Infantry, light Combat Engineers, and Rangers where the mission warrants the use of this device.

3. STATUS: The PDM was Type Classified-Standard during 4th Quarter FY 87. Full Materiel Release occurred during 2d Quarter FY 91 immediately followed by First Unit Equipped of the Special Operations Forces.



PURSUIT DETERRENT MUNITION (PDM), M86

RANGER ANTI-ARMOR, ANTI-PERSONNEL WEAPON SYSTEM (RAAWS)

1. SYSTEM DESCRIPTION: The RAAWS consists of a lightweight 84mm recoilless rifle (M3), a family of 84mm ammunition (high explosive anti-tank, high explosive, target practice, illumination, smoke, and high explosive dual purpose (HEDP)) 7.62mm subcaliber adapter with ammunition, and associated items of equipment (AT-4 Jump Pack, AN/PVS-4 Night Vision Device). The M3 is a reusable breech loaded and transverse percussion fired 84mm recoilless rifle (part of the propellant gases escape through the venturi, equalizing the recoil pressure). The weight of the weapon unloaded is 22 pounds, with an overall length of 41.9 inches. The present telescopic sight for the M3 has a field of view of 12 degrees with a magnification of 3x, fitted with temperature correction scales.

2. USE: The primary purpose of RAAWS is to defeat lightly armored targets, personnel, and field fortifications. Secondary missions include marking threat targets with smoke for supporting weapons, obscuring threat weapons and illuminating threat targets. The system is being procured specifically for the 75th Ranger Regiment as a Non-Developmental Item directly from FFV Ordnance, Sweden. The RAAWS will replace the M67, 90mm recoilless rifle weapon system currently in use by the Rangers. It provides increased operational capability and lethality using a lower weight and shorter weapon, enhancing airborne and airmobile operations with a larger more versatile family of lower weight ammunition having longer range and increased performance.

3. STATUS: The RAAWS program was initiated in July 1988 with a HQDA directed requirement. Type Classification-Limited Procurement (Urgent) of the basic system was accomplished in March 1990. Full Materiel Release was approved in August 1990 with First Unit Equipped in September 1990. All units are fully trained and equipped. The HEDP cartridge is currently undergoing the final preproduction prove-out to be completed in April 1991. Materiel Release for the cartridge is planned for 2d Quarter FY 92.

SELECTABLE LIGHTWEIGHT ATTACK MUNITION (SLAM) XM94

1. SYSTEM DESCRIPTION: The SLAM is a 2.2 pound, 35 cubic inch, multi-purpose, one-shot anti-materiel and/or demolition munition. It is a target activated device (magnetic influence fuzing, tripline, time activated, or command detonated). The warhead, an explosively formed penetrator, will defeat the target up to a 25 foot standoff from a side or bottom attack.

2. USE: The SLAM will be used primarily by Special Operations Forces but may also be employed by Infantry, Light Combat Engineers, and Rangers where the mission warrants it. It is intended for use against armored personnel carriers, parked aircraft, wheeled or tracked support vehicles, and stationary targets, such as electrical transformers, oil, lubricant, and ammunition sites.

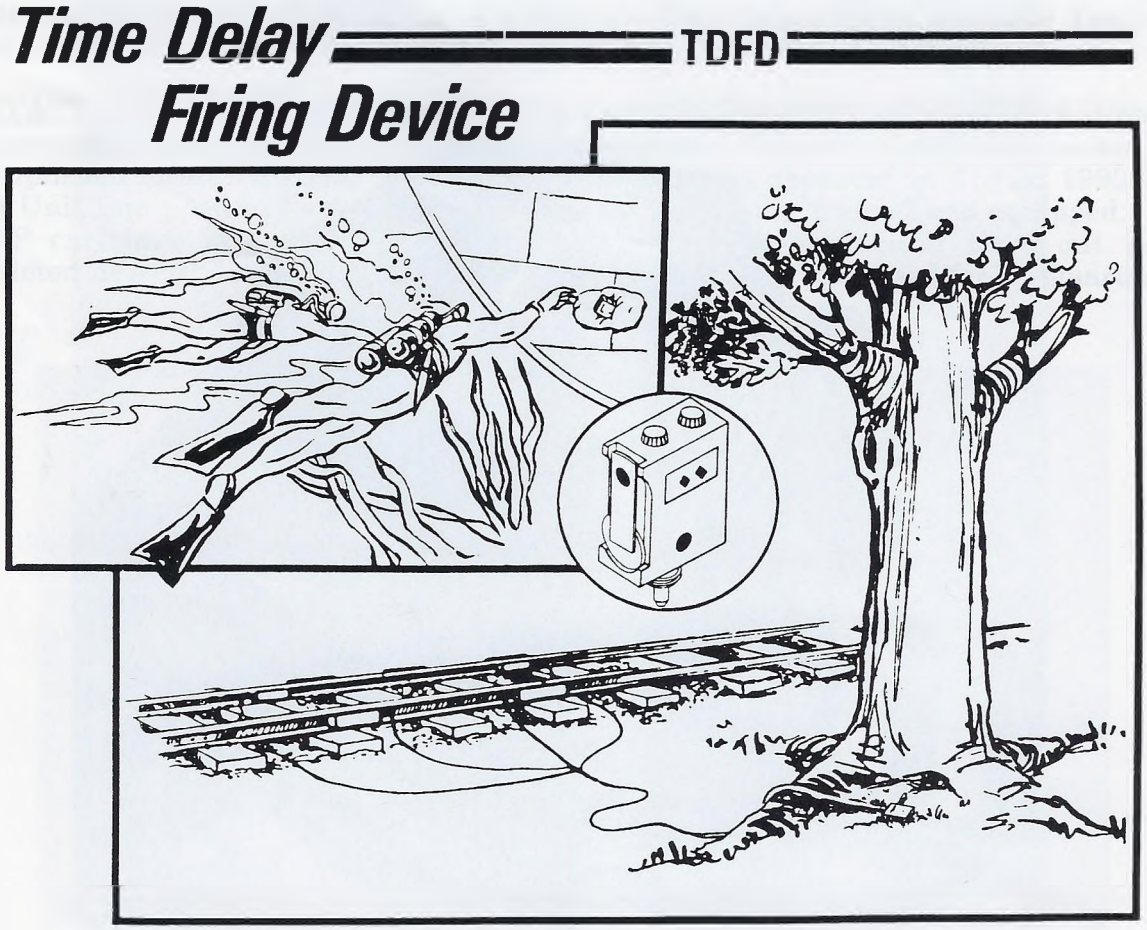
3. STATUS: The Required Operational Capability was approved in February 1990 at which time Full Scale Engineering Development was initiated.

TIME DELAY FIRING DEVICE (TDFD): XM147

1. SYSTEM DESCRIPTION: The XM147 TDFD is an electronic, single function, one-shot demolition firing device. It is field programmable for use in a combat environment. The time delay is adjustable in minutes, hours, and days, from a minimum of 5 minutes to a maximum of 30 days. It will operate in severe environments and under water to depths of 30 feet.

2. USE: The TDFD will be used primarily by Special Operations Forces. It will also be employed by Combat Engineers, and Rangers for a variety of conventional missions.

3. STATUS: The TDFD is in Full Scale Development. Type Classification is scheduled for 4th Quarter FY 91 and First Unit Equipped is scheduled for 2d Quarter FY 93.



AVIATION

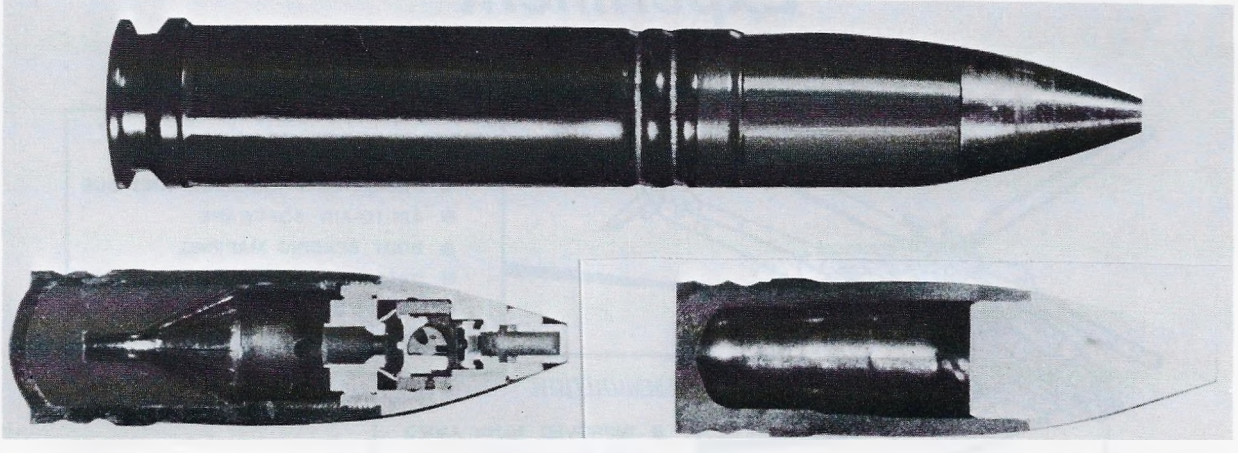
AMMUNITION FOR 30MM AIRCRAFT GUN SYSTEM

1. SYSTEM DESCRIPTION: The present system 30mm ammunition for aircraft includes the electric primed M788 TP (target practice), M789 HEDP (high explosive dual purpose), and M883 HPT (high pressure test) cartridges. They are used in the "Electric Action" M230 Chain Gun on the AH-64 Helicopter and are interoperable with the 30mm Aden Mk IV and Defa 552/553 aircraft cannons. The XM977 is a Target Practice-Tracer (TP-T) round intended to give the AH-64A crew the ability to visually confirm projectile flight path while firing during training exercises. This is both for safety reasons as well as to improve accuracy (the ability to follow projectile to impact). A 30mm air-to-air cartridge is currently being studied in order to give the AH-64A improved capability against aerial type targets.

2. USE: Given above under SYSTEM DESCRIPTION.

3. STATUS: The 30mm cartridges M788 TP, M789 HEDP, M848 Dummy and M883 HPT are all in production. Cartridge XM977 TP-T is presently undergoing Government Qualification Tests at Yuma Proving Ground and Fort Rucker, AL. The air-to-air program is currently investigating the benefits of streamlining the projectile and controlling the fragment size, mass and distribution.

30MM CARTRIDGES



High Explosive
Dual Purpose - M789

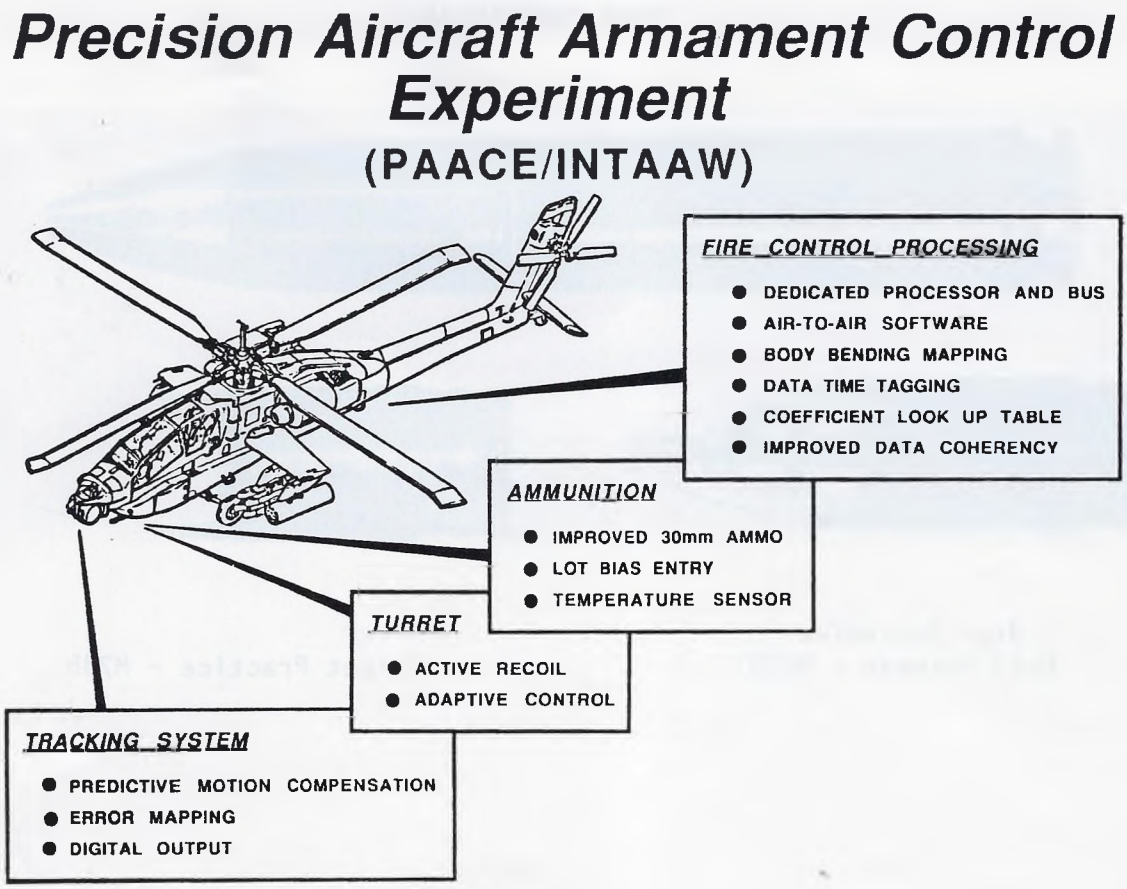
Target Practice - M788

PRECISION AIRCRAFT ARMAMENT CONTROL EXPERIMENT (PAACE)

1. SYSTEM DESCRIPTION: THE PAACE is part of the AVSCOM managed Integrated Air-to-Air Weapons program. It integrates active recoil, adaptive turret control, and other technologies into the current attack helicopter for precision armament control. Active recoil is a microprocessor controlled system which accelerates the 30mm gun forward so that the product of its mass and velocity equals one half of the impulse of the M789 round. The round then fires, and its impulse counters the initial forward velocity, and returns the gun to the proper position prior to firing the next round. Adaptive Control is a state-of-the-art digital turret control system which will point the AH-64 Apache gun turret within an angle of 0 degrees, 2.4 minutes (0.7 mil) of the commanded line of sight.

2. USE: The program is a technology demonstration with the AH-64 used as the test bed aircraft. The technology will be applicable and available for upgrading of the AH-64 Apache, for the next generation Light Helicopter, and for future systems.

3. STATUS: Contractor and Government laboratory testing of the active recoil and the adaptive controller have been completed. The McDonnell Douglas Helicopter Company's Mission Equipment Development Laboratory is integrating and checking out these items together with the gun and turret. Subsequent to the checkout the entire system will be integrated into a test aircraft for flight testing scheduled for August 1991.



AIR DEFENSE

CARTRIDGE, 20MM: MPT-SD, M940

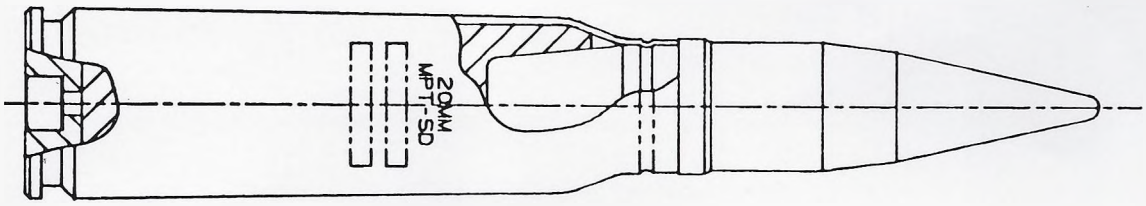
1. SYSTEM DESCRIPTION: The M940 is an improved fuzeless, pyrotechnically initiated 20mm High Explosive Incendiary (HEI) cartridge. The projectile consists of a hardened, heavy walled steel body charged with a high explosive mix and an incendiary mix. An aluminum nose is charged with another incendiary mix. The projectile also has safing and arming (S&A), tracer, and self-destruct mechanisms. The self-destruct is initiated by heat from combustion of the tracer composition. A chemical S&A achieves muzzle safe requirements. The lack of a fuze permits an enhanced aerodynamic ogive shape which results in a 32 percent reduction in drag factor and reduced time of flight, thereby extending the range of the Vulcan Air Defense System (VADS) from 1800 meters to 2400 meters against aircraft targets. Upon target impact, the nose incendiary initiates, transferring to the body incendiary and main charge. This provides a delay in functioning which allows the projectile to penetrate and detonate within the target, resulting in increased probability of kill.

2. USE: The M940 will replace the 20mm M246 HEI-T-SD as the primary air defense cartridge for the VADS and any of its product improved versions. The cartridge is interoperable in all standard M61/M197 gun systems.

3. STATUS: Type Classification-Standard occurred in March 1989. A Low Rate Initial Production contract has been awarded, and deliveries are scheduled for 3d Quarter FY 91. Material Release is scheduled in 2d Quarter FY 92.

20mm
MPT-SD, M940

CARTRIDGE ASSEMBLY



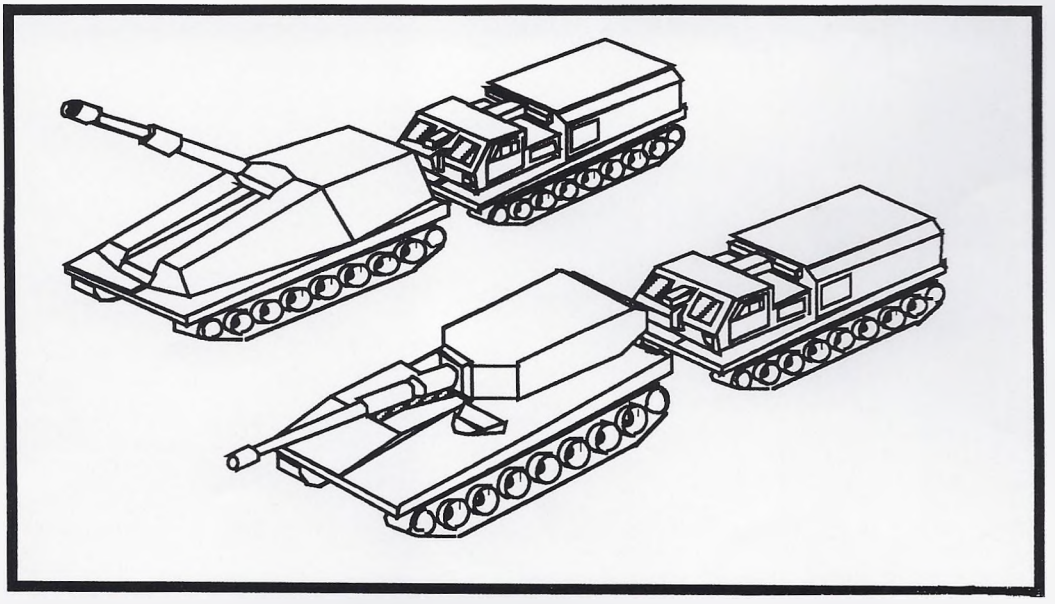
COMBAT SERVICE SUPPORT

FUTURE ARMORED RESUPPLY VEHICLE - AMMUNITION (FARV-A)

1. SYSTEM_DESCRIPTION: The FARV-A is a medium protection level armored, tracked resupply vehicle which will provide the foundation for resupply of ammunition and fuel for the armored force in the forward area.

2. USE: Existing resupply vehicles cannot support the future autonomous operations of the AFAS Howitzer. The FARV-A supports the need in Armor, Artillery, Mechanized Infantry, Combat Engineer, and Air Defense for a resupply vehicle with the survivability, mobility, and materials handling/transfer capability necessary to sustain supported forces and survive in the forward battle area. The FARV-A supports increased rates of fire for artillery and armor, reduces time consuming and dangerous crew operations that expose crew and vehicle to battlefield contamination and indirect fire during rearm. The ability to mass fire from dispersed locations through combined autonomous operations of the howitzer and resupply vehicle is also enhanced .

3. STATUS: The FARV-A Program has scheduled an Advanced Technology Transition Demonstration (ATTD)/Prototype Phase with a Milestone I decision in the 2d Quarter FY 94. The program is intended to develop and demonstrate operational integration with the AFAS while meeting the AFAS development schedule. Joint testing with AFAS is scheduled prior to start of the Full Scale Development program in FY 98. Prior to the start of the ATTD/Prototype phase, the FARV-A program will be oriented toward reducing risk and cost later in the life cycle.



FUTURE ARMORED RESUPPLY VEHICLE - AMMUNITION (FARV-A)

ENGINEERING AND MINE WARFARE

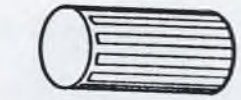
ANTI-HELICOPTER MINE PROGRAM

1. SYSTEM DESCRIPTION: The goal of the Anti-Helicopter Mine Program is to develop an autonomous munition with equivalent form and fit to the Wide Area Mine (to match Army delivery systems and requirements) with a minimum attack volume of a 100 meter hemisphere. The system will have a relatively high degree of passive classification of target. It will include the controllable mine system features, three dimensional acoustic tracking, and it will utilize multiple Explosively Formed Penetrator warhead technology in order to match sensor characteristics and defeat projected armor.

2. USE: The system will provide classic mine warfare characteristics of attrition, delay, and deny against attack helicopters as well as the important characteristic of forcing higher altitude operation and significantly increasing vehicle vulnerability/visibility to conventional air defense systems. The system is expected to provide the Army with a new and significant capability of providing barriers against the emerging threat of large numbers of highly mobile attack helicopters. The threat of such barriers could significantly impact the tactics and operation of threat forces.

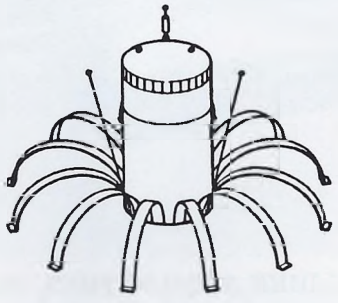
3. STATUS: The program is currently in a breadboard demonstration phase with three competing contractors. The approaches represent a range of available technology options and their associated trade offs. These include shoot from ground to launching a sub-munition with associated terminal sensor and therefore increased range of effectiveness. Field demonstrations are being conducted for various helicopter targets, including multiple formations and various terrain sites to evaluate performance and reliability. Prior subsystem tests have demonstrated close in acoustic tracking and effective warhead patterns against range targets. The breadboard phase will be followed by a prototype selection phase and full demonstration with transition to an Army program scheduled for FY 94.

ANTI-HELICOPTER MINE



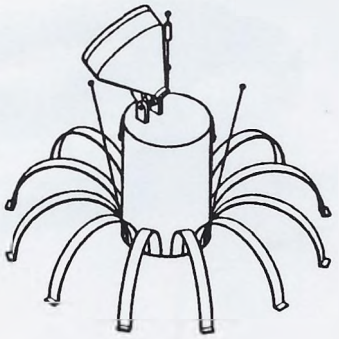
STORAGE, TRANSPORT & DELIVERY

HAND EMPLACEMENT
GND/AIR VOLCANO
MLRS
ATACMS
AIR DROPPED DISPENSER



SELF UPRIGHTING & SYSTEM ACTIVATION

DETECTION
IFF
TRACK



THREAT DESTRUCTION

TRACK
OPTIMAL AIM PT
WARHEAD POINTING
WARHEAD FIRING

CARTRIDGE, SUBCALIBER AMMUNITION, TRAINING: M970

1. SYSTEM DESCRIPTION: The M623 Target Practice (TP) ammunition (165mm) normally used for gunnery training in the Combat Engineer Vehicle (CEV) main gun is extremely costly, in short supply, requires a large range area, and destroys targets. The M970 is a reusable subcaliber training device which simulates the 165mm training round in size, shape, weight, and center of gravity. The device will be fielded with M918 40mm TP ammunition packaged unlinked. A range comparator card will be used by the tank commander to compensate for slight differences in ballistic trajectories between the 165mm and 40mm rounds. Upon initiation, the 40mm projectile is launched and the 165mm device remains in the main gun chamber. It is then removed and reloaded with a new 40mm cartridge.

Realization of yearly savings ($353 for M623 versus $10 for M918 multiplied by the 25,000 rounds yearly training requirement) will be substantial until the CEV is obsoleted.

2. USE: The M970 will supplement use of M623 165mm rounds worldwide during CEV gunnery sustainment training for Engineer Tracked Vehicle Crewmen. This system enables the soldier to use the same procedures used to supply, prepare, load and engage as used with the main gun and standard training ammunition as closely as possible.

3. STATUS: The M970 was Type Classified-Standard in May 1990. Full Materiel Release occurred in December 1990. First Unit Equipped was the 1st Engineering Brigade, Fort Leonard Wood, MO, also in December 1990. Fielding will be completed in FY 92.

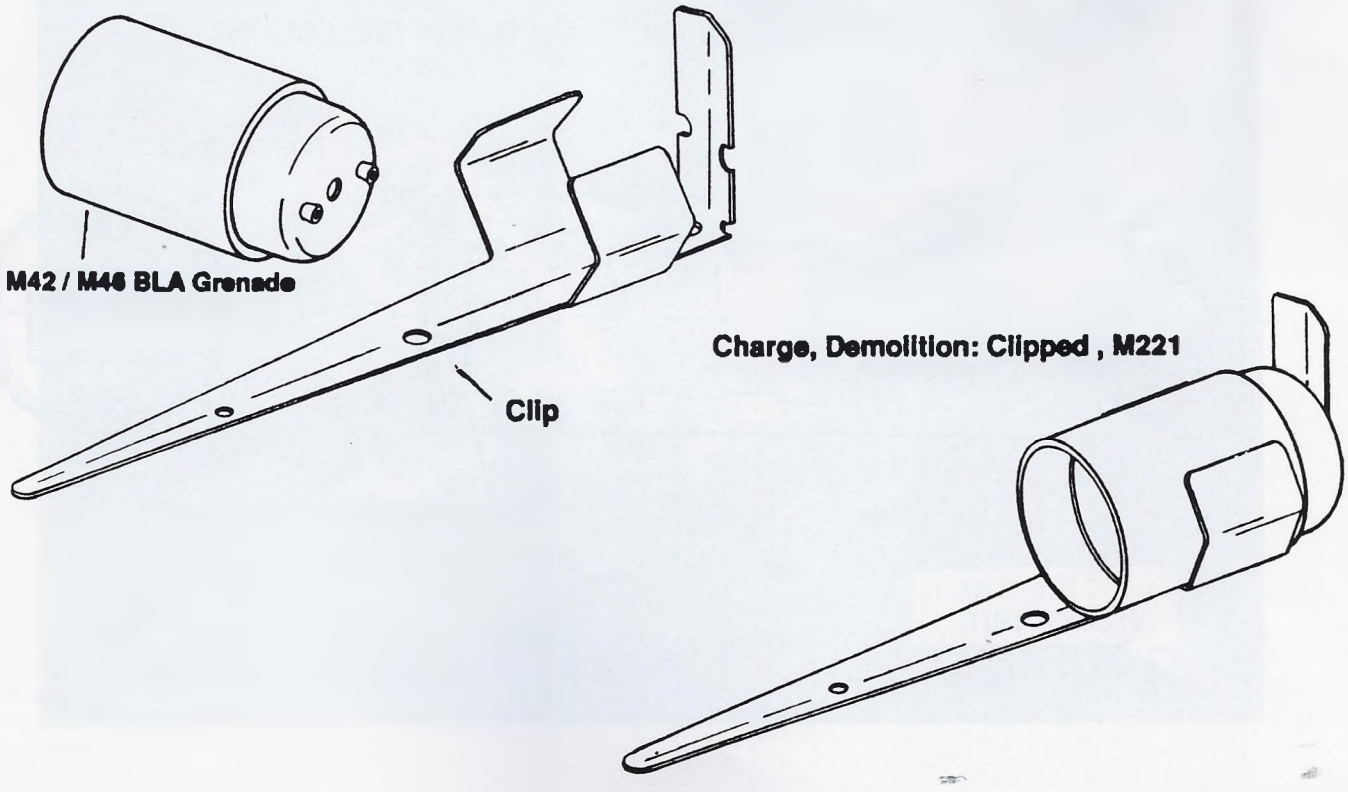
CARTRIDGE, SUBCALIBER AMMUNITION, TRAINING, M970

CHARGE, DEMOLITION: CLIPPED, M221

1. SYSTEM DESCRIPTION: The Charge, Demolition: Clipped, M221, is a lightweight, easily emplaced, two-piece assembly, consisting of an unfuzed M42 or M46 Body Loading Assembly (BLA) Grenade and a Clip. The Clip is stamped from mild steel and is formed in such a manner as to snap on to the Grenade and to hold detonating cord or blasting cap in contact with the explosive lead. The Clip is also used to position the charge relative to the item to be destroyed. The BLA Grenade consists of a body, cone, explosive charge (shaped), rivets, and a lead cup assembly. The explosive charge is Comp A-5 and the lead contains RDX. The M42/M46 Grenades are standard submunitions that can be manufactured, without the fuze, from existing facilities.

2. USE: The M221 is used in the neutralization/disposal of explosive loaded munitions such as Projectiles, Mines, Bombs, Grenades, etc. This item is an extremely effective lighten-the-load force multiplier. It is an easy-to-use alternate to Comp C4 and is capable of being initiated by electric/nonelectric blasting caps or detonating cord. The M221 is primarily for use by Explosive Ordnance Disposal personnel and Explosive Ordnance Reconaissance Agents.

3. STATUS: In January 1991, a DA DCSOPS memorandum granted a Type Classification Limited Production-Urgent and directed the procurement of the M221 for use in Operation Desert Storm (ODS). A production contract was awarded on 22 Feb 91 to Lone Star Army Ammunition Plant to satisfy the ODS requirement. Production Qualification Tests and Initial Operational Test and Evaluation are planned to be conducted 1st Quarter and 2d Quarter FY 92. Type Classification-Standard is scheduled for 3d Quarter FY 92.



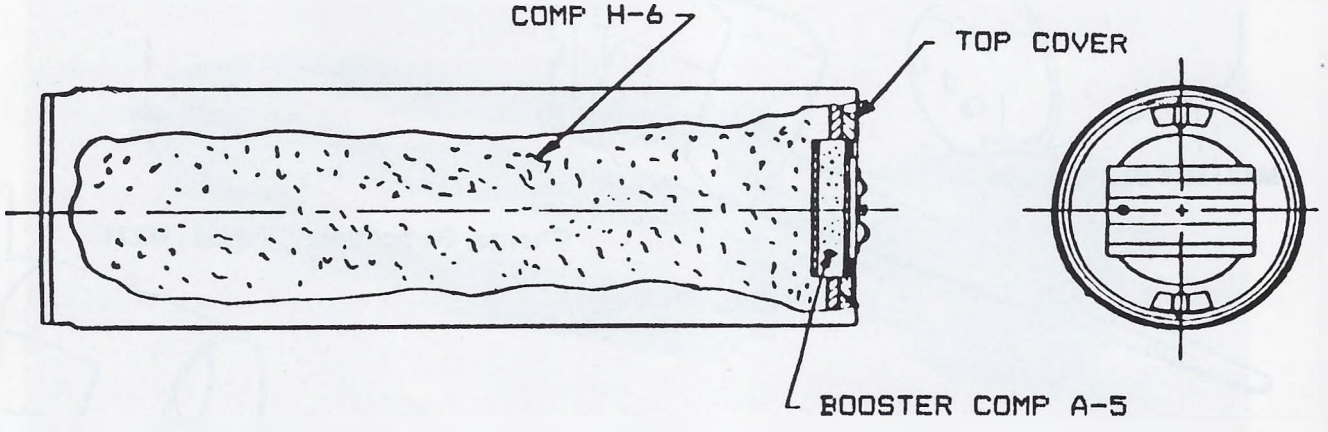
CHARGE, DEMOLITION: 40 POUND, CRATERING

1. SYSTEM DESCRIPTION: The 40 Pound Demolition Cratering Charge consists of a cylindrical water tight metal container filled with 40 pounds of Comp H-6 explosive and 195 grams of Comp A-5 booster located on top of the charge. Two primary tunnels are attached to the top cover at the end of the charge. One tunnel serves as a cap well for priming the demolition charge with an electric or non-electric military blasting cap. The other tunnel is for priming with detonating cord knotted at the end. A metal handle on the top of the container attached to the top cover is provided for lowering the charge into a hole. The 40 Pound Demolition Cratering Charge will be packaged in the M18A2 Propellant Charge Container.

2. USE: The 40 Pound Cratering Charge is used for cratering and ditching operations, destroying buildings, fortifications and bridge abutments. It will provide an alternate item for the Standard 43 pound Cratering Demolition Charge.

3. STATUS: The need for the 40 Pound Demolition Cratering Charge was dictated by an outstanding procurement requirement for the Standard 43 Pound Cratering Demolition Charge, which is no longer procurable. The current 43 Pound Cratering Charge was procured from DuPont as a commercial off-the-shelf item and was last procured in 1969. DuPont as sole-source manufacturer, had dismantled their facility and dispersed their personnel for the old Cratering Charge and had no Technical Data Package (TDP) available. In order to satisfy the current outstanding procurement requirements, a TDP was developed. The 40 Pound Demolition Cratering Charge was subjected to TECOM qualification tests which were satisfactorily completed in February 1990.

CHARGE, DEMOLITION: 40 POUND, CRATERING

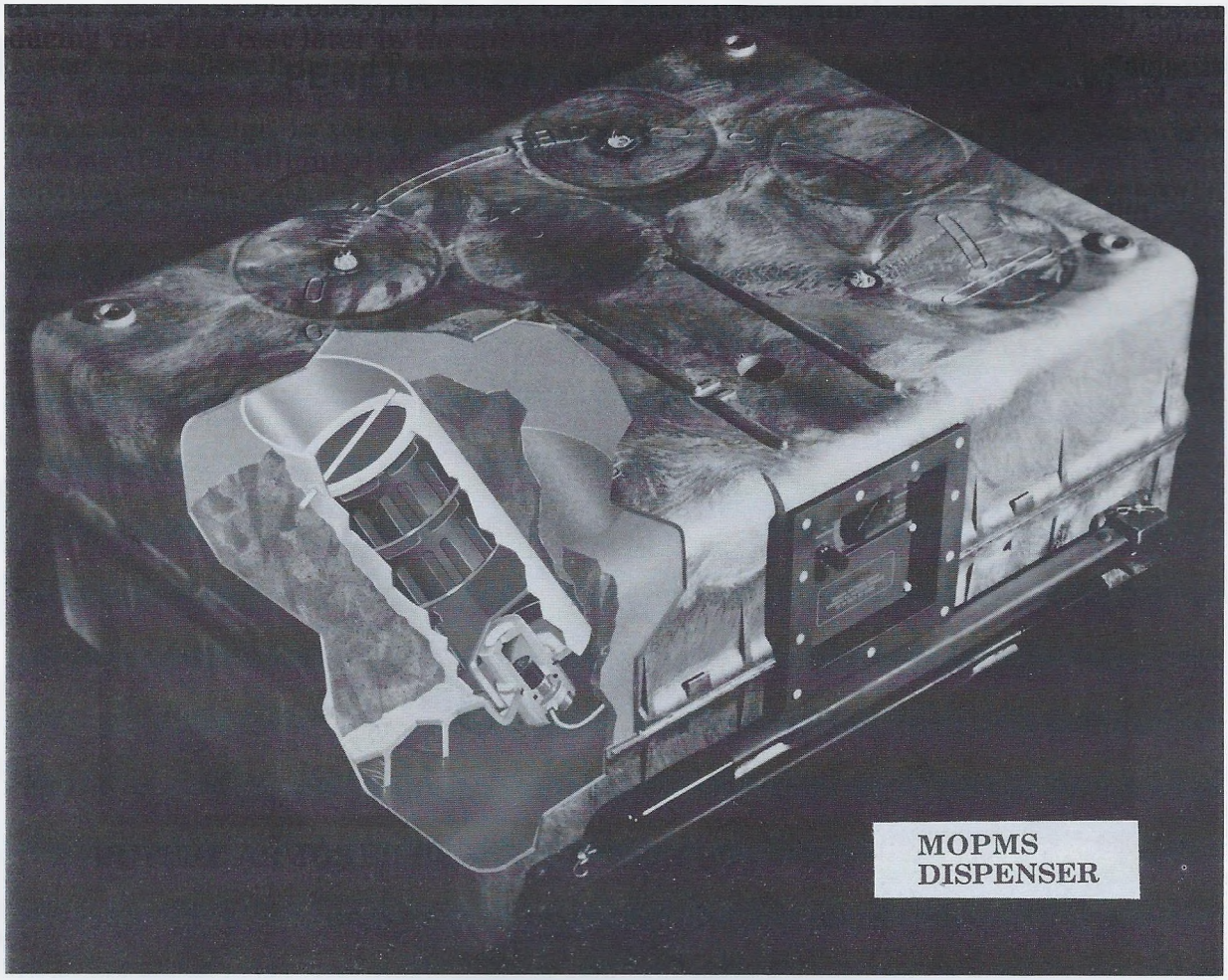


MODULAR PACK MINE SYSTEM (MOPMS)

1. SYSTEM DESCRIPTION: The first mine system which can be remotely controlled after emplacement in the field, MOPMS, consists of 4 Anti-Personnel (AP) and 17 Anti-Tank (AT) mines in a man portable dispenser (M131) and an M71 Remote Control Unit (RCU). The mines are expelled from the dispenser by a coded radio signal from the RCU or by wire signal using a standard blasting device. A commander can communicate directly with the mines to recycle the self-destruct time or destroy the field. If the mines are not expelled, the sealed dispenser can be moved intact to a new location, significantly reducing the logistic burden associated with conventional mines. The system includes the M136 training device, an inert practice dispenser identical to the M131, with a light to indicate receipt of a fire signal.

2. USE: Ground units will use MOPMS to fill minefield gaps, reinforce obstacles, provide perimeter defense, etc., rapidly and be able to extend the life of mines or clear the field by remote control.

3. STATUS: The MOPMS was Type Classified-Standard in June 1986. It is currently in production. First Unit Equipped is scheduled for 1st Quarter FY 92.



VOLCANO, MULTIPLE DELIVERY MINE SYSTEM: M139

1. SYSTEM DESCRIPTION: The VOLCANO is a rapid deployment system for launching a mix of anti-tank (AT) and anti-personnel (AP) mines from the UH60A Blackhawk helicopter, the 5 ton dump and cargo truck series, and the 6 ton Tracked Cargo Carrier. The VOLCANO consists of a dispenser control unit, four racks that hold the M87 canisters, plus the addition of either a ground or air mounting kit. Each M87 canister contains six mines, five AT and one AP. One hundred sixty canisters make up a full mission load. The system uses M88 practice mine canisters, which utilize six dummy mines each. The M89 canister is an electronic dummy load for training.

2. USE: The VOLCANO will be employed offensively and defensively to inflict delay, isolate the battlefield, and reinforce friendly fires. The VOLCANO will be the principal scatterable mine delivery for light forces and will ultimately replace the Ground Emplaced Mine Scattering System in heavy forces. The system has a capacity of 960 mines and is capable of mining an area approximately 1150 meters x 125 meters. The ground VOLCANO responsiveness is limited only by the crew's ability to dispense (approximately 20 minutes) and the vehicle speed in traveling to and transversing the area. Air VOLCANO dispenses its full payload in 17 seconds at 120 knots.

3. STATUS: The ground VOLCANO for trucks is currently in production. The ground system will be fielded in the 3d Quarter FY 91. The air system and the ground Volcano for the tracked cargo carrier are scheduled for Type Classification late in FY 91.

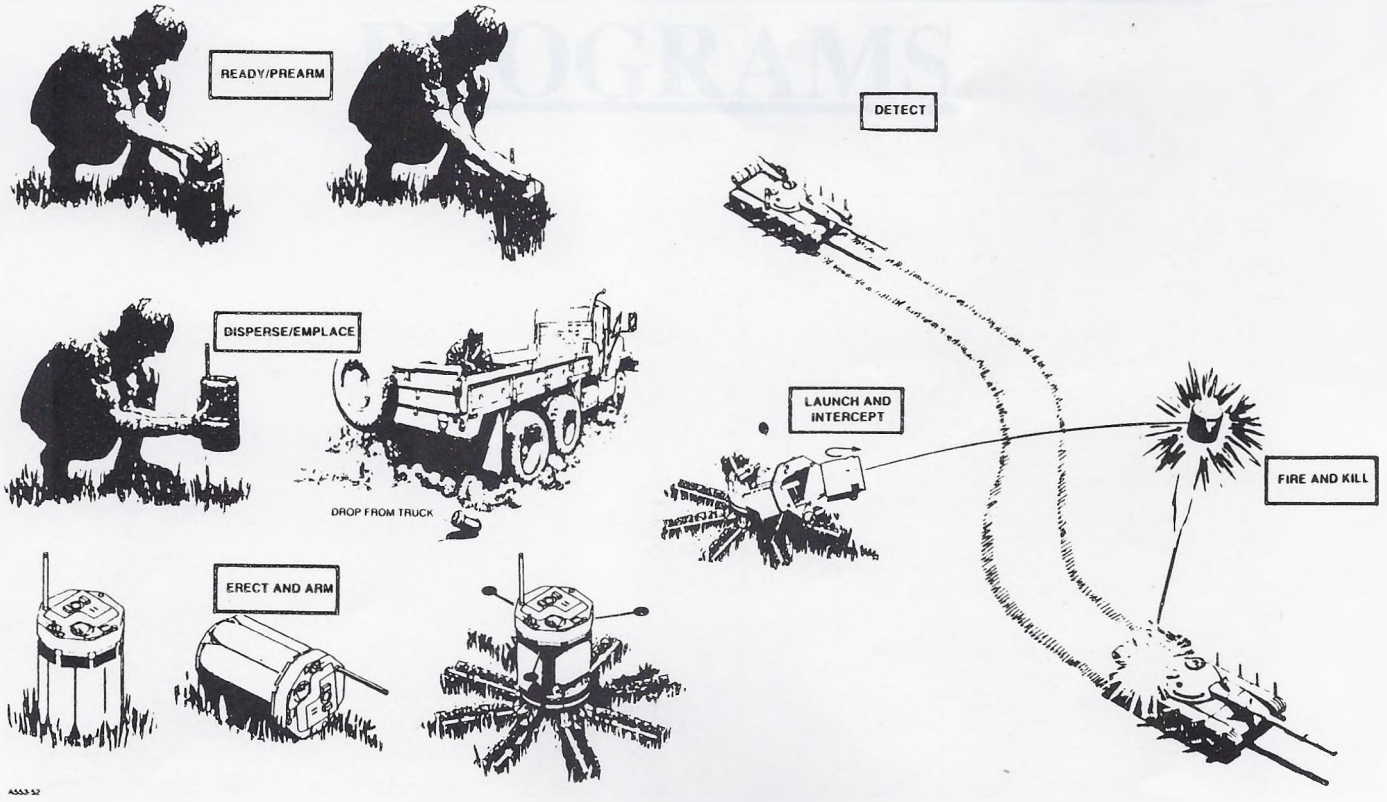
WIDE AREA MINE (WAM): XM93

1. SYSTEM DESCRIPTION: The WAM is a one man portable anti-tank/anti-vehicle mine designed to detect and defeat a target at a distance. The primary method of deployment is by hand emplacement with potential deployment by Volcano, ATACMS, or MLRS. The WAM is capable of being commanded to "turn on" and "self destruct" via interface commands from the M71 Remote Control Unit. Upon deployment on the ground, the mine self-erects (uprights itself automatically) and autonomously searches for target vehicles. It then launches a smart submunition toward a target vehicle which is 100 meters or less distant. The launched submunition attacks the top of the target vehicle with an explosively formed penetrator to defeat it.

2. USE: The WAM can be used stand alone to attack armored vehicles and heavy trucks on designated routes. When used in conjunction with conventional and/or Family of Scatterable Mines minefields, WAM will destroy breaching vehicles.

3. STATUS: The WAM entered Full Scale Engineering Development in April 1990. Type Classification is scheduled for 4th Quarter FY 94.

WAM Is Easily Carried and Deployed By The Solider – Meets Operational Requirements



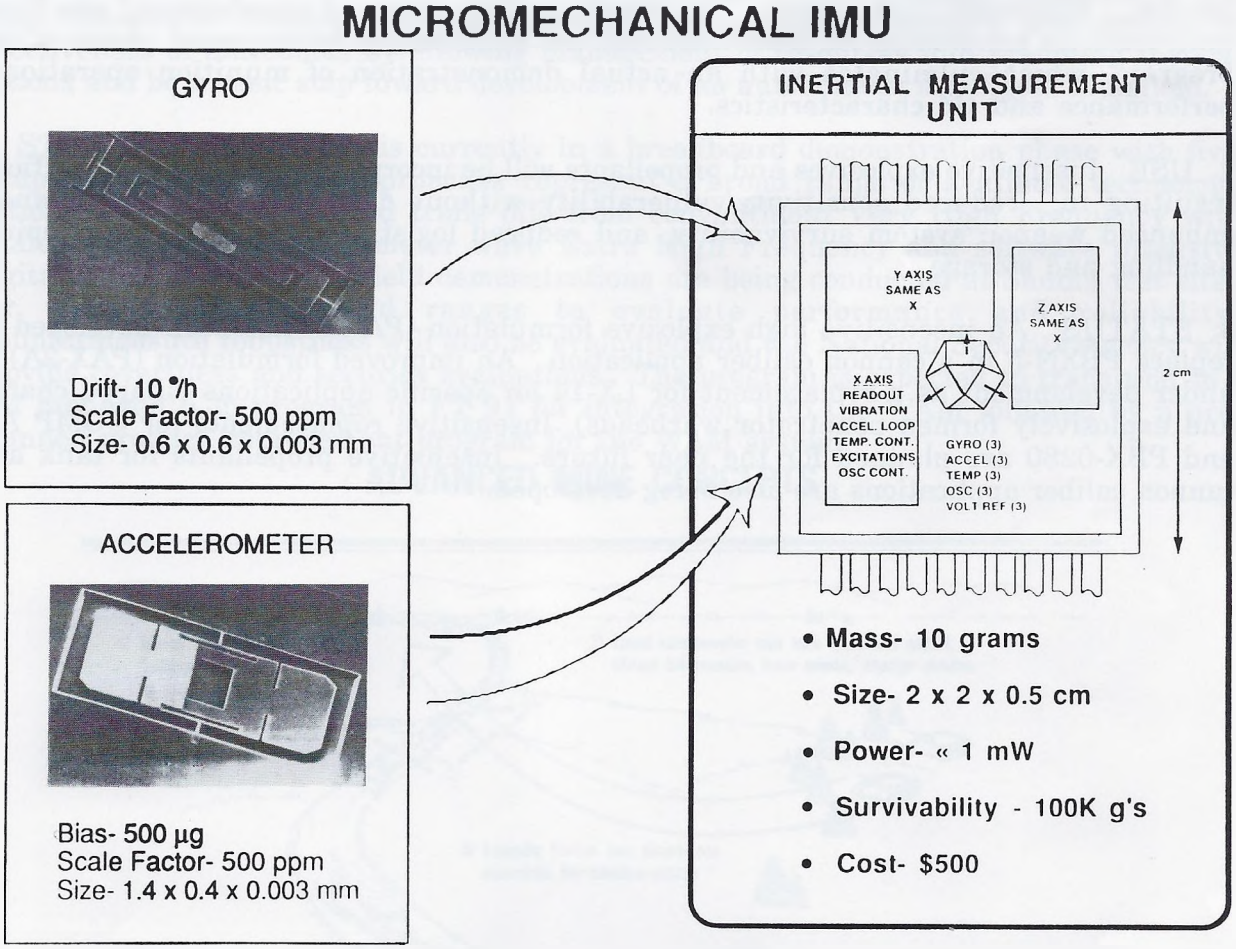
SIGNIFICANT TECHNOLOGY BASE PROGRAMS

ADVANCED TECHNOLOGY FOR SELF CONTAINED MUNITIONS

1. SYSTEM DESCRIPTION: The objective of this Technology Base program is to explore emerging technologies for direct application and integration into both current and future precision munitions. These technologies include ladar (laser radar) and acoustic sensors, millimeter wave electronic steerable antennas, g-hardened Inertial Measurement Units, solid state rate sensors and micro mechanical device technology.

2. USE: To provide significant reductions in cost and improvements in performance including accuracy and lethality at nominal and extended ranges for cannon launched direct and indirect fire precision guided munitions.

3. STATUS: The above technologies are currently undergoing exploration for future integration into precision guided weapons systems, such that items advance to 6.3 as the technology matures. It is anticipated that significant advancement in the sensor technology mentioned above may be applied as a Pre-Planned Product Improvement to the Search and Destroy Armor (SADARM) Program in FY 92.



INSENSITIVE MUNITIONS

1. SYSTEM DESCRIPTION: Insensitive Munitions (IM) are being developed to improve the combat survivability of weapon systems. In 1987 the Army adopted the Joint Services Requirements for Insensitive Munitions (JSRIM). In order to comply with the JSRIM, the Army drafted a "Master Plan" that outlines goals and policies for the implementation of IM into its weapon systems. An analysis of all Army munitions has been conducted, and a priority list for IM implementation has been established. High priority munition systems are based on the highest potential benefit to the Army and include: Anti-Armor Missile Systems, Light Armored Vehicle Ammunition, Artillery Submunitions, and Tank Munitions. The overall objective of these IM development programs is to achieve IM classification without sacrificing operational performance. The approach being followed is to demonstrate feasibility of insensitive formulations on a laboratory scale. Primary screening of formulations is based on sensitivity and performance tests which include: thermodynamic performance calculations, impact sensitivity, and differential thermal analysis. New formulations are compared against a current formulation as a baseline in order to directly compare differences in explosive sensitivity and energy output. Promising formulations identified at the laboratory scale, are scaled up and fabricated on a bench scale to be tested for performance and vulnerability. These tests include: detonation velocity, cylinder expansion, and small scale sympathetic detonation testing. Materials that successfully complete this phase of development are then considered as candidates for transition into the engineering development phase of the program, which culminates with an actual demonstration of munition operational performance and IM characteristics.

2. USE: Insensitive explosives and propellants will be incorporated into Army munitions resulting in: reduced sensitivity/vulnerability without degradation to performance, enhanced weapon system survivability, and reduced logistic vulnerability in shipping, handling and storage.

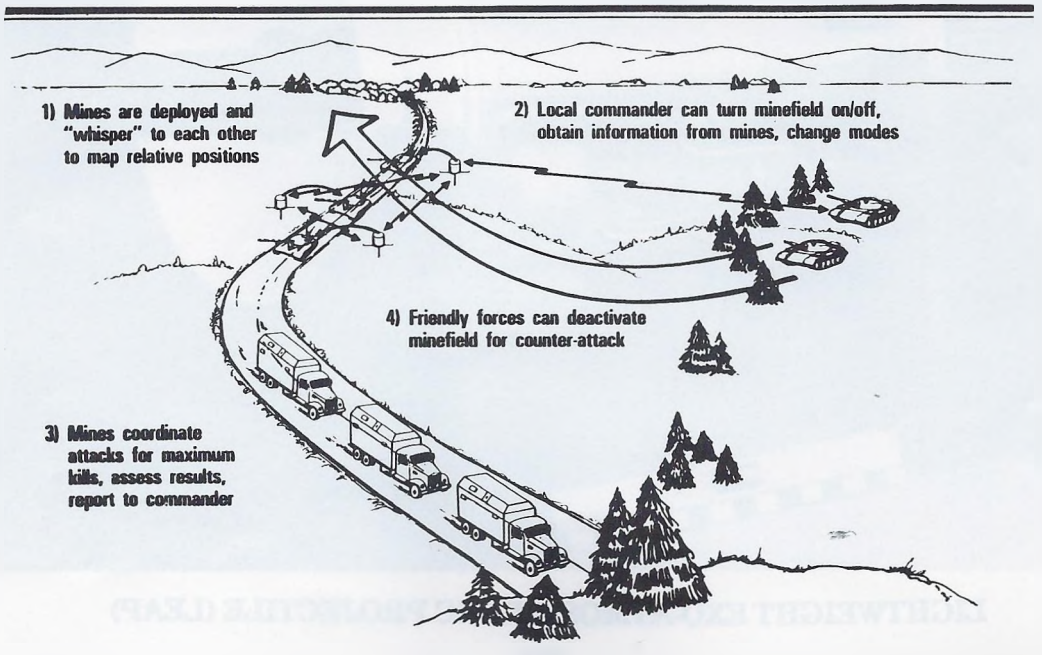
3. STATUS: An insensitive high explosive formulation (PAX-2) has been developed to replace PBXN-5 in a cannon caliber application. An improved formulation (PAX-2A) is under development as a replacement for LX-14 for specific applications (shaped charge and explosively formed penetrator warheads). Insensitive replacements for COMP A-3 and PBX-0280 are planned for the near future. Insensitive propellants for tank and cannon caliber applications are also being developed.

1. SYSTEM DESCRIPTION: Controllable Minefield is a joint development program with the Defense Advanced Research Projects Agency. The goal is to develop a digital radio frequency communication link to smart mines. The system is to have a minimum range of 3km. Size and power requirements are to be compatible with the Wide Area Mine (WAM) program, using a volume of 25 cubic inches or less and an overall requirement of 10 ampere-hours or less for the proposed life of the WAM. The system will be a two-way, self-organizing network, which establishes a link through multiple paths and independent operation from a control station. The system will include features of Transmission Security, Communication Security, and low probability of intercept for anti-jam and covertness hardening. Wherever possible and appropriate, Army common communication devices will be incorporated into system design; i.e., combat radios, fill devices, terminals, laptop PCs, etc., to minimize cost and logistics impact of fielding.

2. USE: The system will provide the basic capability to provide the user requested operational functions of; remote arming, active/inactive command cycling, recycle of self destruct times, reporting of minefield target activity, coordinated attack options, status of individual mines and potential capability for self mapping of mine locations. The system is expected to provide the Army with a unique and significant capability of providing real time maneuver freedom through friendly smart mine barriers and enhanced effectiveness of minefields by allowing management of resources and providing tactical options and be a basic step toward development of an autonomous intelligent minefield.

3. STATUS: The program is currently in a breadboard demonstration phase with five competing contractors. Approaches represent a broad range of available technology options and their associated trade offs from conventional Very High Frequency with analog components to millimeter wave Extra High Frequency and software intensive digital signal processing. Field demonstrations are being conducted at Sandia test sites for various terrains and ranges to evaluate performance and reliability. Countermeasure robustness will also be evaluated and the National Security Agency will provide covertness and security evaluations. The program is expected to transition to a PM managed 6.3b program in FY 91 for integration into the WAM followed by a pre-planned product improvement program for the WAM system.

ADVANCED MINE CONCEPTS

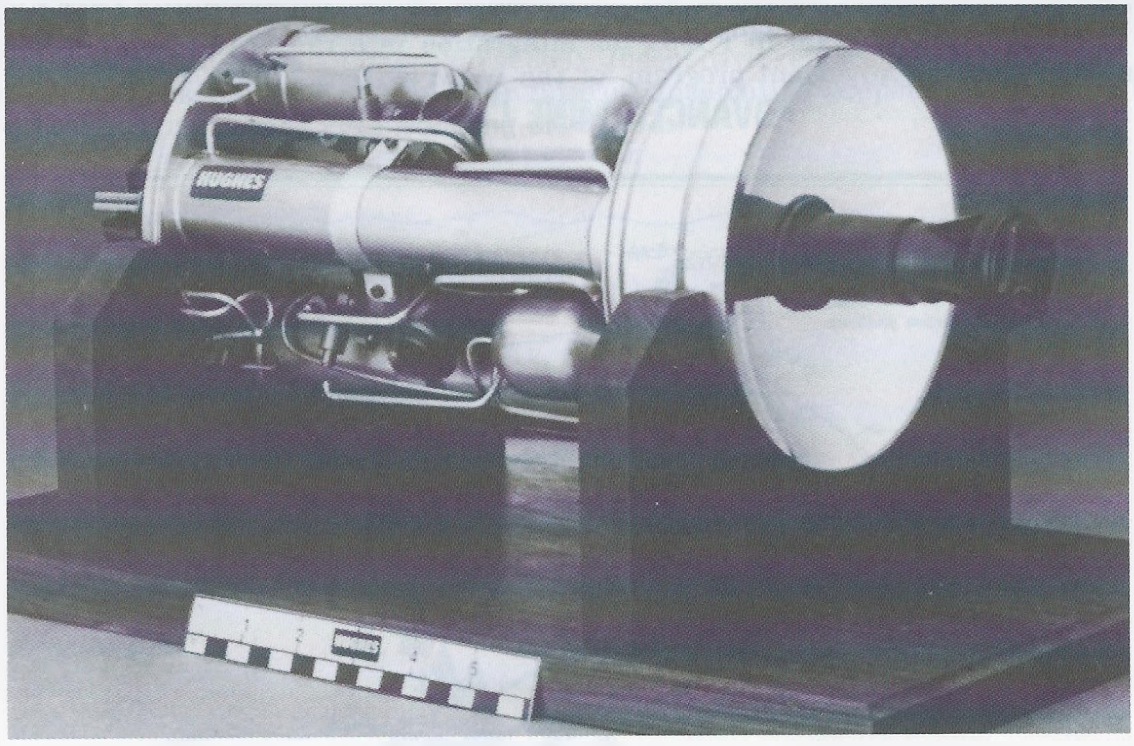


LIGHTWEIGHT EXO-ATMOSPHERIC PROJECTILE (LEAP)

1. SYSTEM DESCRIPTION: The Army LEAP is the smallest and lightest weight interceptor technology demonstrator being developed today. The overall dimensions of the LEAP projectile are fifteen centimeters (6 inches) in diameter by 43 centimeters (17 inches) in length with an overall weight of three to five kilograms depending upon the configuration. The front end of the LEAP, the guidance unit, consists of the seeker and wafer scale integration electronics unit. The actual guidance unit weighs 860 grams (1.9 pounds). The other major subassembly of the LEAP projectile is the propulsion system. Lateral propulsion is supplied by the light weight, liquid hypergolic divert system through four thrusters. Attitude control is provided by eight warm gas attitude control system (ACS) thrusters located on the aft bulkhead of the projectile. Each ACS thruster weighs only 3.6 grams (0.1 ounce). Mounted on the aft bulkhead are an Inertial Measurement Unit, thermal battery, umbilical connector, and telemetry system.

2. USE: The Army LEAP Program is a joint Strategic Defense Initiative Organization/Army program to develop a lightweight kinetic energy kill vehicle technology demonstrator designed to intercept ballistic missiles and re-entry vehicles. The projectile is command guided to an acquisition basket and then homes in on the target autonomously, using the strapdown seeker. The technologies validated in the LEAP program will be used to support the interceptor development efforts for approved systems such as Brilliant Pebbles and Ground Based Interceptor.

3. STATUS: The component level testing on the program is essentially complete and has confirmed the ability of the components to perform according to the design specification. These components have now been integrated to the subsystem and system level. Each of the major LEAP subassemblies, the guidance unit and propulsion system, have completed a successful test series. Efforts are now focused on the integration of these two assemblies to form full LEAP projectiles. Free flight testing of these projectiles will be conducted within the next year, both on the ground and in space.



LIGHTWEIGHT EXO-ATMOSPHERIC PROJECTILE (LEAP)

LIQUID PROPELLANTS (LP)

1. SYSTEM DESCRIPTION: The 6.1 LP Program provides LP technology to support the development of regenerative liquid propellant guns (RLPG) for cannon caliber, armor systems and the artillery RLPG demonstration. Approaches include investigation of LP droplet ignition and combustion, examination of new ignition systems, spectroscopic study of LP thermal decomposition and burning, modeling LP combustion kinetics, and 2-D hydrodynamic modeling of RLPG. An effort will also begin to provide higher energy LP candidates for RLPG artillery and direct fire applications.

2. USE: The RLPG will provide a high rate of fire, greater muzzle velocity, automated loading and improved logistics. Also provided is an innovative system for cannon armor, cannon caliber weapons, and insensitive munitions.

3. STATUS: The LP combustor kinetic model and the 2-D hydrodynamic model of RLPG have been completed. It is planned to compare outputs from the two models with experimental data (both actual gun firings and closed chamber testings) for model validation. New high energy LP candidates are being formulated. Plans to synthesize high energy density LP fuel candidates, the nitro derivatives of ammonium adamantyl nitrate salts (Ammonium tetranitro adamantyl nitrate; Diammonium tetranitro adamantyl dinitrate and Tetraammonium tetranitro adamantyl tetranitrate have been initiated.

LOW VULNERABILITY HIGH PERFORMANCE SOLID PROPELLANTS

1. SYSTEM DESCRIPTION: The overall objective of this program is to support the Army's Insensitive Munitions initiative. Specific goals include the determination of the mechanisms by which the threat and propellant interact. These interactions are modeled on a computer and strategies are developed by which existing energetic materials can be modified or new molecules can be synthesized which will be more resistant to attack. Since these new materials will be specifically designed to be difficult to initiate, a complementary study will be conducted to determine ignition and combustion properties of these materials using sophisticated spectroscopic techniques. These needs are being addressed through a broad synthesis and characterization program. The process is viewed as an iterative approach in which new molecules are synthesized based on current knowledge. The materials are evaluated and compared with theoretical predictions. The theory is then refined and predictions are made for the synthesis of new materials, and a complementary study is being conducted to determine ignition and combustion properties of these materials using laser spectroscopies.

2. USE: New energetic materials produced will be used to fabricate low vulnerability munitions.

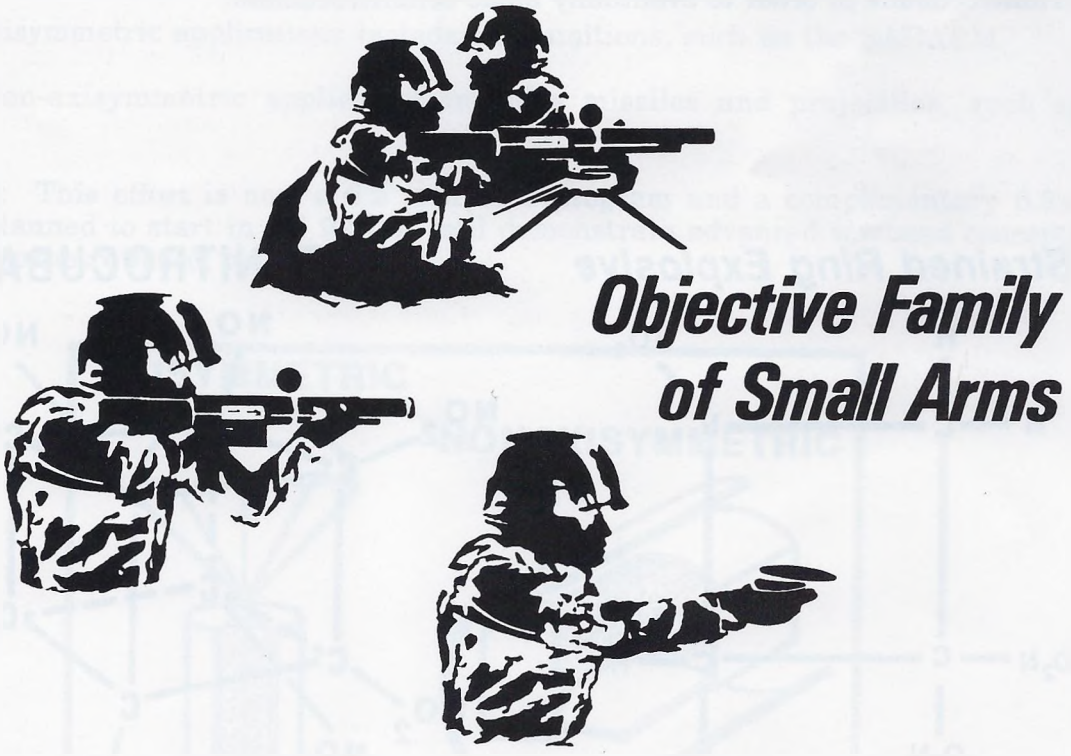
3. STATUS: One of the concepts that is currently being explored in the study of the stability and vulnerability of energetic materials is the approximation of a molecular system by a mechanical system. The basic idea is to envision a molecule as a collection of masses connected by springs. Physical models could actually be built but it turns out to be easier to solve the equations which describe this mechanical system on a computer. Two cases can be considered. The system can simply be allowed to relax. The result of this process is that the molecular shape or structure can be computed. Other properties such as energy, dipole moment and strain energy can also be calculated. The dynamics of the system can also be studied. One of the springs can be stretched and the flow of energy in the molecule can be observed. If the springs are designed to break when they reach a certain length then it is possible to predict how an energetic material will decompose as a result of an input of energy. This basic approach has been applied to nitromethane and RDX in the gas phase. Condensed materials will be modeled next. Preliminary calculations have shown trinitrodiaminopyridine to be an attractive material for insensitive propellant. Effort directed toward the synthesis of this molecule is currently underway.

OBJECTIVE FAMILY OF SMALL ARMS

1. SYSTEM DESCRIPTION: The Objective Family of Small Arms seeks to provide revolutionary improvement in capability over the current systems. The family includes an individual combat weapon, a crew served weapon and a personal defense weapon. Weapons are expected to have violent, decisive target effects, high kill probabilities, and utilize lightweight materials and ammunition. The goals are currently documented in the Army's Small Arms Master Plan.

2. USE: The Objective Family will replace all the current individual combat weapons, crew served weapons and personal defense weapons.

3. STATUS: Investigations are currently being conducted into nonconventional lethality mechanisms, such as relativistic electron beams, and pulsed laser systems. Other efforts include bursting munition concepts, inductively set fuzes, and full solution fire control systems with heads up displays. Technology demonstrations of the individual weapons will occur in FY 95 and of the crew served system in FY 97.



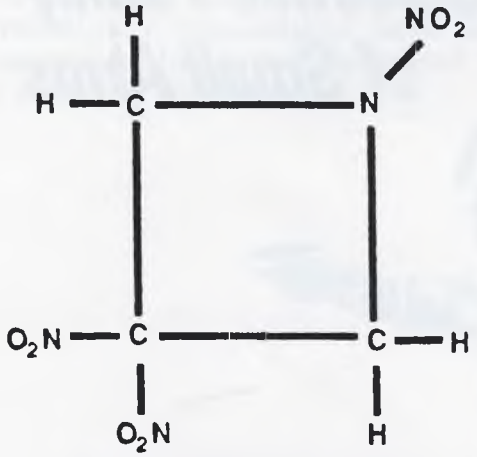
SYNTHESIS OF MORE POWERFUL EXPLOSIVES

1. SYSTEM DESCRIPTION: The purpose of this 6.2 program is to develop new, more powerful explosives as well as to find new, affordable methods to manufacture HMX. New classes of high density strained-ring and cage explosives which promise up to 30 percent power enhancement over HMX have been conceived and are currently being researched in the laboratory.

2. USE: These new explosives are needed for anti-armor applications and, when available, will be tested in shaped charge and Explosively Formed Penetrator warheads. The new GARDEC HMX process has shown potential to produce HMX at the present cost of RDX and thus provides opportunity to replace RDX by HMX in munitions at no additional cost.

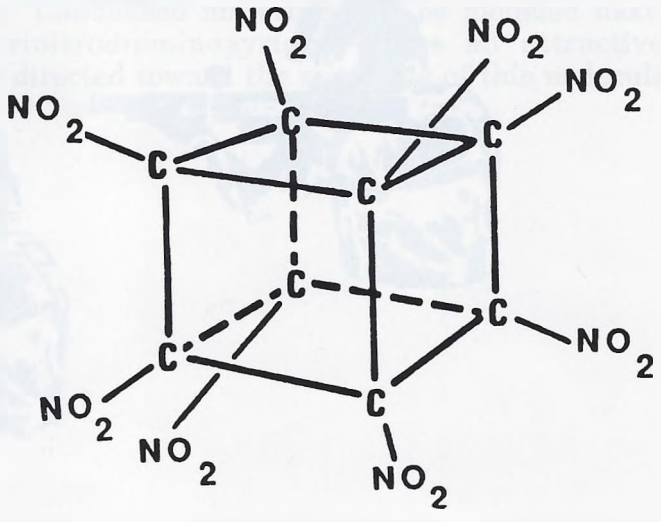
3. STATUS: The new GARDEC HMX process using cost-effective materials at near ambient temperature has shown considerable promise toward cost savings. A pilot plant study for high rate HMX production is planned. Breakthroughs have been made in strained-ring explosive research. Trinitroazetidine (TNAZ), a superior steam meltcastable explosive compound 80 percent more powerful than TNT, has been synthesized. Tetranitrocubane, a precursor to octanitrocubane, which is a target cubane cage explosive, anticipated to be about 30 percent more powerful than HMX, has been successfully prepared. Efforts are currently focused toward adding more nitro groups to tetranitrocubane in order to eventually make octanitrocubane.

Strained Ring Explosive



Trinitro Azetidine (TNAZ)

OCTANITROCUBANE



WARHEAD TECHNOLOGY

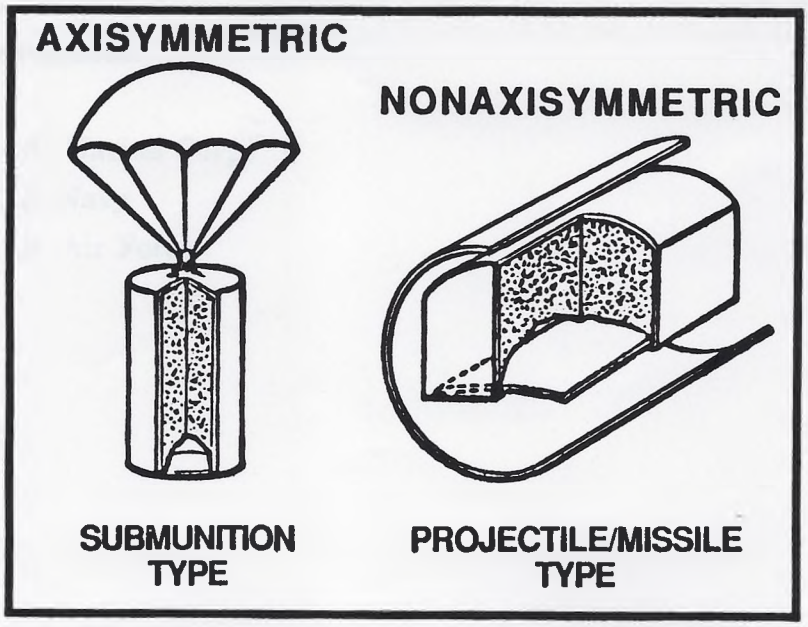
1. SYSTEM DESCRIPTION: More effective antiarmor warheads are needed to combat the future threat and the sophisticated armors; e.g., reactive armor, that are constantly being improved. The shaped charge (SC) warhead work is focused toward defeating the near term armor threat. A key portion of this SC effort is the evaluation of alternative liner materials and the processes required to produce these liners. In explosively formed penetrator (EFP) warheads a metal liner is accelerated and formed into a stable penetrator by means of an explosive charge. The penetrator is well suited to long standoff applications such as top attack smart munitions. The major technical effort is devoted to developing enhanced EFP warheads of two types: (l) axisymmetric and (2) non-axisymmetric. In the axisymmetric configuration the warhead is axially symmetric about the direction in which the penetrator is fired. In the non-axisymmetric configuration, the penetrator fires at right angles to the axis of the projectile; this warhead fires "sideways" and is well suited to top-attack systems such as Smart Target Activated Fire and Forget (STAFF) munition. Important design parameters are liner configuration and material selection, initiation method, and type of explosive utilized.

2. USE: The improved performance SC warhead is applicable to the TOW Weapon System and other similar anti-tank weapons. The new EFP warheads developed will provide higher penetration capability against enemy armor than the current EFP warheads.

a. Axisymmetric applications include submunitions, such as the SADARM.

b. Non-axisymmetric application includes missiles and projectiles, such as STAFF.

3. STATUS: This effort is now a 6.2 tech base program and a complimentary 6.3A program is planned to start in FY 92 that will demonstrate advanced warhead concepts for enhanced penetration of enemy armor.



Explosively Formed Penetrators

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