Modeling Artillery and Mortar Systems

By JW Dirkse

It broke my heart to drive friends or family by our field artillery motorpool and have them ask what type of tank we operated. It took time, but I was finally able to train my wife to recognize the difference between our M-109A5 howitzers and the armor battalion's tanks. While they may look similar, a howitzer has a completely different purpose than a tank and that purpose is to suppress, neutralize or destroy the enemy using indirect fire, not direct fire. Unlike the individual tank whose gunner visually observes and engages a target, indirect fire systems engage targets which they cannot see. Yes there are exceptions to almost every rule. US tanks have trained and conducted indirect fire using a gunner's quadrant and howitzers have employed direct fire against the enemy, but both situations are not typical or desired employment methods.

Understanding how the howitzer, field gun or mortar unit is organized and equipped and how the individual system operates will help the modeler produce a more accurate model or diorama. Artillery and mortars are part of a larger team that consists of forward observers, fire support elements, fire direction centers and firing platoons or batteries that operate over a broad area. The guns are located in the firing batteries whose composition varies depending on the weapon system and modified table of organization and equipment (MTOE). Some equipment that is

generally found in the firing unit includes the fire direction center vehicle and equipment, guns, prime movers if not self-propelled and ammunition carriers. Prior to the fielding of on-board inertial navigation systems and GPS, artillery was fired from a prepared firing position. The modeler, especially in 1/35 scale, is most likely focusing on a single artillery piece and possibly its prime mover. The item that will add realism to an artillery position, but is often missing is artillery ammunition. The massive volume of artillery ammunition and the associated packing material (dunnage) is an ever present sight in a firing position.

The 105mm round is semi-fixed, meaning the projectile is set on a shell casing that contains the primer and propellant, but the projectile can be removed to change the propellant charge. During WWII, The complete round was shipped in a black fiber tube (Figure 1). Originally the entire round, including the fuse, was shipped in one tube. A mission requiring HE with a point detonating action and another mission requiring HE mechanical time airburst meant the unit needed two separate types of ammunition on hand. As WWII progressed, the deep fuse well round was shipped with a shipping plug. Fuses, including the new proximity fuse, were shipped separately and meant the unit could keep a single type of HE projectile which was capable of accepting multiple fuse types. The fiber tube was sealed with a strip of colored tape that identified the type of round in the tube (Table 1). The most common types of rounds found in a firing position would be HE, Illumination and HC or WP smoke. White phosphorus (WP) melted at higher temperatures and therefore, WP rounds were required to be shipped and stored upright.

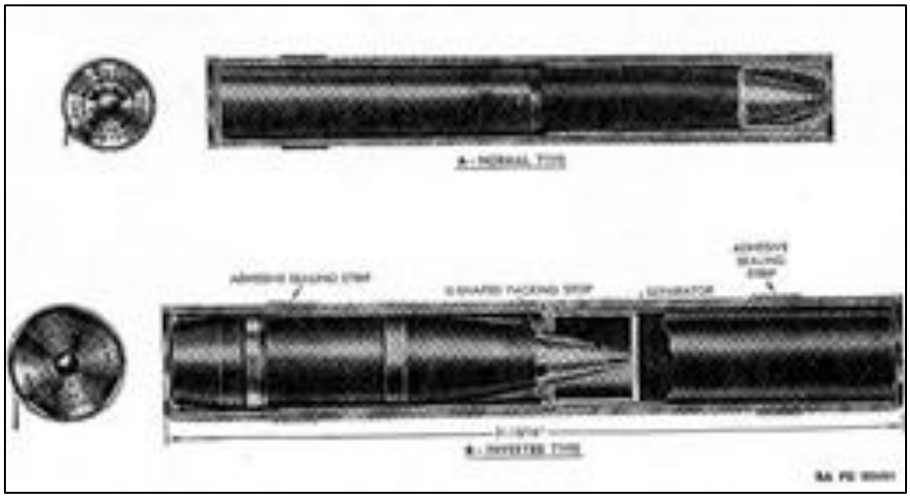

Figure 1, 105mm Projectile in Fiber Tube

Table 1, Fiber Tape Colors

Ammunition	Projectile Model	Fiber Container Tape Colors
Gas (H)	M60	Divided into three stripes: green, gray, green
Gas (CNS)	M60	Divided into three stripes: gray, red, gray

Ammunition	Projectile Model	Fiber Container Tape Colors
HE	M1	Yellow
HE, AT	M67	Yellow
Smoke (FS, HC, and WP)	M60 and M84	Divided into three stripes: gray, yellow, gray
Illumination	T16	White
Canister	T18	Black

Two fiber tubes were shipped in a wooden box (Figure 2). You'll notice the stenciling on each box. The modeler should ensure the ammunition codes, types, lot numbers and general stencil configuration matches the ammunition type and historical period being modeled. In addition to the two-round box, a three-round clover leaf configuration (Figure 3) was used for a short period of time during WWII, but the fiber tube alone did not provide sufficient protection for the round. At over 150 pounds, the weight of three round bundles was also too heavy for normal handling so the configuration was discontinued.

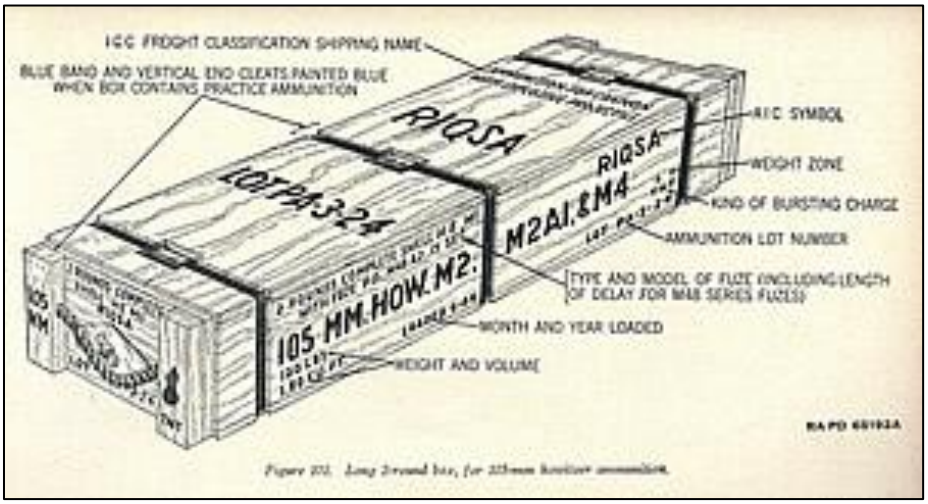

Figure 2, Two-Round Box

Figure 3, Three-Round Cloverleaf Configuration

Artillery sections usually kept ammunition in the original packing material as far forward as possible. As a result, ammunition on the ammunition carrier would most likely still be in wooden boxes, ammunition at the gun would remain in the fiber tubes and only rounds for immediate use would be prepared for use. Keeping the rounds in their protective packing as long as possible resulted in large amounts of dunnage littering the firing positions. In some positions the dunnage was filled with earth and used to provide protection.

The 105mm projectiles are painted and marked according to type (Figure 4). The squares below the fuse well indicate the weight of the projectile. The propellant case was originally brass and later changed to green painted steel. The propellant in the case consists of 7 numbered bags joined sequentially by a string (Figure 5). Rounds were prepared for firing by removing the tape from the fiber tube, pulling off the end cap and placing it on the ground open end up, upending the fiber tube until the round is placed in the end cap, remove the shipping plug from the fuse well and install the fuse, separate the projectile from the propellant case and cut the charge then reinstall the projectile on the case and load the round. Excess powder increments were stored in a safe place in the firing position until they could be disposed of or burned.

Figure 4, 105mm Projectile Colors and Markings

Figure 5, 105mm Propellant Increments

The 105mm howitzer ammunition has changed very little from WWII to today. The stenciling data has obviously changed and there are some variations to the materials used for the boxes, but the basics remain the same. The following website provides additional details and information about 105mm ammunition.
http://www.usarmymodels.com/ARTICLES/105mm%20Ordnance/1%20105mmOverview.html

Larger US systems including 155mm, 175mm and 203mm systems use separate loading ammunition where the primer, propellant, projectile and fuse are individual components that are packaged and shipped separately. The 155mm components shown in Figure 6 include three

types of propellants with their shipping canisters and a fused HE projectile. The brass primers which are not shown are individually packaged in a foil paper wrapper and resemble a .410 shotgun shell in size and shape. Fuses are currently shipped in a metal ammo can, but were previously shipped in wooden boxes. The green protective cover on the bottom of the powder increments is removed before firing and protects the igniter pad on the base increment.

Figure 6, 155mm Ammunition Components

The shipping containers and ammunition components for US separate loading ammunition have changed very little since WWII. Propellant was shipped on wooden pallets that were held together with steel banding Figures 7 & 8. Recently the propellant canisters have been modified slightly with octagonal end caps to prevent them from rolling are now painted in a sand color.

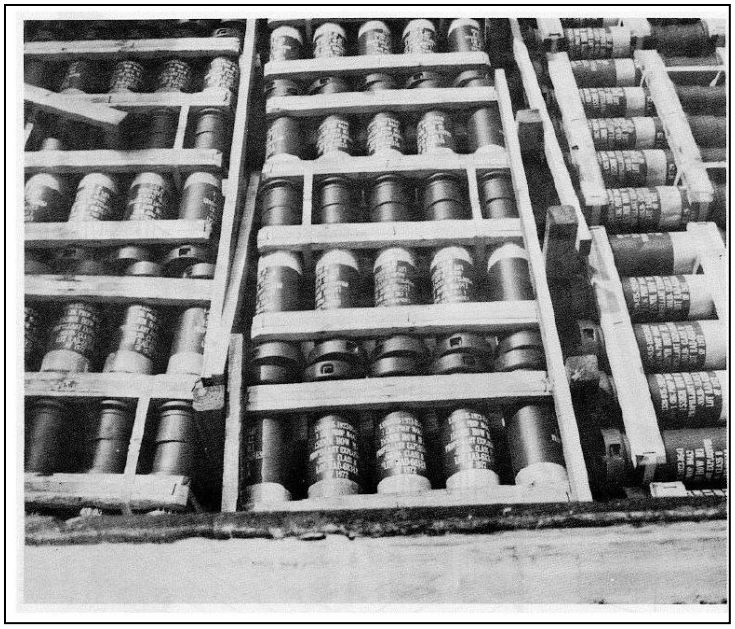

Figure 7, Propellant Canisters

Projectiles are shipped on eight round wooden pallets (Figure 8) that are again banded with steel banding. The projectile rotating band is made of soft copper and is protected by a cover or grommet. During WWII the grommet was made of rope, but over the years it has changes to a metal ring and then a fiberglass split-ring.

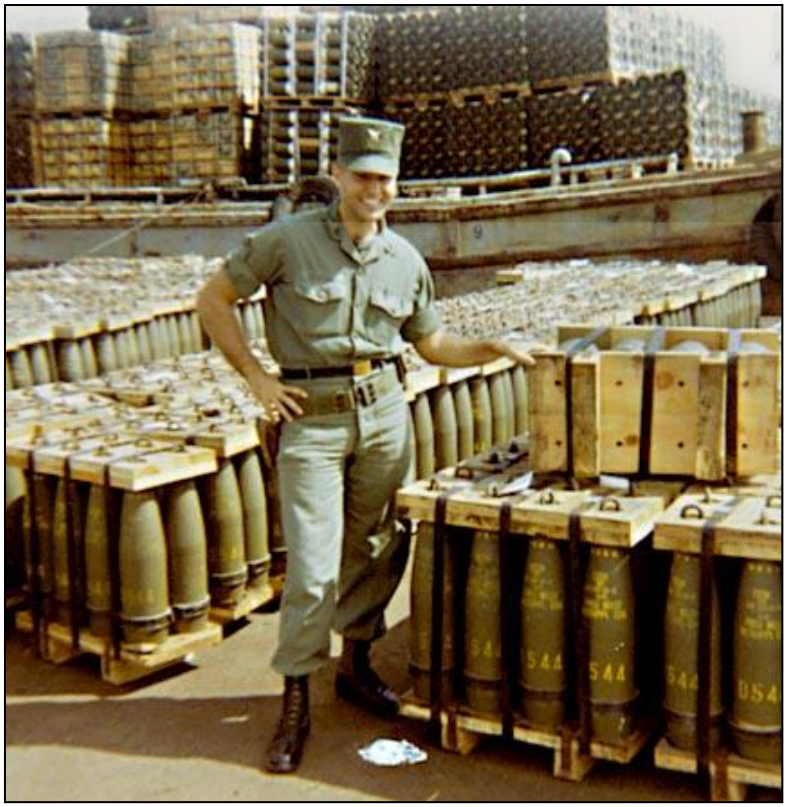

Figure 8, Projectile Pallets

Artillery units kept ammunition in the original packaging as long as possible in the supply chain. Material handling equipment at the depots and Ammunition Supply Points made it possible to load pallets of propellant and projectiles on ammunition trucks and transport them forward. The steel bands on the pallets were only broken when necessary, because once the pallet was broken open, ammunition was moved by hand. Current ammunition vehicles use Roll-on / Roll-off truck beds and on-board cranes to keep ammunition on shipping pallets, deliver it at ground level and move it as far forward as possible on the battlefield. Once in the firing position, the ammunition is usually stored off the ground on dunnage and covered when possible. You can expect to see ammunition residue in the position if the firing unit has spent any time in the position.

Mortar ammunition is packaged in fiber tubes similar to 105mm ammunition. The propellant increments are attached to the rear of the mortar round and removed as necessary to meet the announced charge.

Figure 9, Mortar Rounds

Figures 10 and 11 provide examples of the way in which a mortar crew stored and protected their ammunition. You'll notice in Figure 11 that even after the fiber tube is opened and the round is prepared, it is put back in the tube to keep it as clean as possible.

Figure 10

Figure 11

When modeling artillery or mortar systems there are several things to keep in mind to add the final level of realism. Some of these areas include:

1. Gun crews are composed of teams with assigned positions and responsibilities based on the weapon system. Typical positions include the Section Chief, Gunner, Assistant Gunner, #1 Cannoneer and additional numbered cannoneers who serve as ammunition handlers and vehicle drivers. If you are modeling a specific weapon system and its crew, the action of the crewmember and his position on the piece should be consistent with published crew drill. Examples of Army Technical Manuals (TMs) which contain examples of crew drill are http://www.scribd.com/doc/57977084/75mm-Pack-Howitzer-Manual and http://www.scribd.com/doc/33256295/Tm-9-350-155-MM-Gun-M2-Carriage-M1-and-M1A1-Gun-Mount-M13-Heavy-Carriage-Limber-M2-and-M5-and-Firing-Platform-M1-1945
2. The primary method of communications in a firing platoon or battery was accomplished using telephone wire until 15 years ago. A hot loop was established between the aiming circle, guns and the FDC. Fire missions were passed from the FDC to the guns by voice or digitally to a gun display unit which also required a separate wire line. Someone at the gun will be on the telephone and recording the firing data to a paper record.
3. Artillery and mortars are configured differently when moving vs. in a firing position. In a moving Configuration spades are up, sights are stowed, protective covers are in place, ammo is repacked or strapped in place, travel locks are in place, auxiliary equipment is stowed, and aiming stakes are in the travel position. In a firing configuration spades are down, sights are mounted, protective covers removed, ammo is prepared, the travel lock is stowed, auxiliary equipment is out, aiming stakes are out, the collimator is emplaced, and the field of view from gunner's sight to the aiming point is not obstructed.

4. Ammunition is generally not unpacked until needed with the exception of a small number of immediately ready rounds. Depending on the weapon system, mission and threat, crews have a choice of firing ammunition off the weapon system, ammunition carrier or from ammunition prepositioned on the ground. If the system has been in position and firing, packing material will be present in the position. Consider a diorama with ammunition in various states of preparation. It would be normal in a 155mm position to see projectiles with the nose plug still in place while others are fused and ready to fire.
5. Understand indirect vs. direct fire. Howitzers require aiming reference points for accurate deflection. The modern collimator (Figure 12) provides an aiming reference point and is located to the left front of the piece. Primary aiming stakes are emplaced to the left front of the piece and secondary aiming stakes to the rear. The gunner requires an unobstructed view from his site to the aiming point so equipment and personal gear will not be in front of the sites.
6. Auxiliary equipment is laid out in the firing position according to the TM. Depending on the weapon system you might see a loading tray, ramming staff, water bucket and mop, and fuse setters at the firing point.
7. Know the historical context of the system you are modeling. The unit MTOE will provide some information about the prime mover for towed systems and the ammunition resupply vehicles. This information could add additional detail to a diorama.

Figure 12, Emplaced Collimator

The firing position is a busy place during training missions or combat. Figure 13 provides an example of a towed artillery piece in action. You can see the crew manning their positions, equipment and ammunition laid out, and a fused round in the lower left on the projectile tray ready to be rammed. In this scene the artillery piece may be the focus of attention, but the

manner in which the equipment and ammunition is laid out tells a story. I hope this article helped explain some of the details of modeling artillery and I look forward to seeing your next artillery diorama.

Figure 13, Towed Howitzer Position