APPENDIX A

THE EVOLUTION OF AMMUNITION DISTRIBUTION

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Today, Army combat units face extended travel, long loading times and long queues when trying to replenish their ammunition. Ammunition transfer operations are time-consuming and labor-intensive. This article provides a "snapshot" of the transition from the current ammunition distribution system to the maneuver-oriented ammunition distribution system (MOADS) designed to support future requirements as envisioned on the AirLand Battlefield.

Current Distribution

The extensive US commercial surface transportation industry moves Army ammunition from its origin at a production plant or depot to the air or sea port of embarkation. The US rail system transports the majority of the Army ammunition tonnages, supplemented by the commercial trucking industry. The ability of rail transportation to continuously move large tonnages makes it highly effective and efficient. The responsiveness and flexibility of truck transport makes it more suitable for moving small shipments to seaports and high-priority shipments to airports. The current capacity of the US commercial surface transportation system is adequate to meet known emergency or military mobilization needs.

There are 880 principal rail routes used to transport munitions, which handle 98 percent of the military munitions traffic. The routes are generally chosen to avoid, when possible, large urban areas and reduce general population exposure to explosive hazards.

The link between the Army shipper (ammunition depot or plant) and the commercial transportation industry is the Military Traffic Management Command (MTMC), Falls Church, Virginia, which is the Department of Defense's (DOD's) traffic manager in the continental United States (CONUS). In addition, MTMC serves as the common-user ocean terminal service operator in CONUS and certain overseas ports. Intertheater ammunition resupply by airlift is the exception and is the responsibility of the Air Force's Military Airlift Command (MAC).

We out-load ammunition for overseas shipment at three ammunition ports approved by the DOD Explosive Safety Board. After arriving in the overseas theater, we offload Army ammunition from ships at either military or commercial (host nation) ports and move it by military or civilian contract truck assets and (or) host nation rail system to its destination. We also use inland waterway transportation when advantageous.

Each host nation controls its commercial transportation, and during wartime, the US-host nation agreements determine the allocation of resources to US forces. US unified commanders are responsible for controlling, allocating and managing US military transportation assets and for coordinating host nation civilian transportation assets.

We examine Army requirements and those of the other services from a transportation standpoint in the joint planning process. We use various analytical techniques to test transport capabilities, identify system shortfalls and recommend improvements. The three military transportation operating agencies (MTMC, MAC and Military Sealift Command, Washington, D.C.), in coordination with the Transportation Command (TRANSCOM), Scott Air Force Base, Illinois, and the overseas commanders maintain liaison and coordinate with the commercial carriers and governmental agencies involved in supporting the Army with transportation.

Theater

Material management centers (MMCs) manage the theater ammunition distribution system at the division, corps and theater levels. The division ammunition officer (DAO) prepares ammunition forecasts (48 hours in advance) and submits them to the corps MMC. The corps MMC directs shipments of ammunition from the corps storage areas (CSAs) and ammunition supply points (ASPs) on corps transportation to the ammunition transfer points (ATPs). The theater MMC manages the distribution of ammunition shipments arriving from CONUS and replenishes issues from CSAs and ASPs out of theater storage area (TSA) stocks, as requested by the corps MMC. Ammunition shipments are made by the Armament Munitions and Chemical Command (AMCCOM), Rock Island, Illinois, from the US in response to theater Army requirements.

The organizations, procedures and techniques used to distribute ammunition in peacetime are similar to those used in wartime. Ammunition arrives at the port in containers or as breakbulk. A terminal service transportation company (usually contractors) then transloads these items to either theater truck transportation, rail or inland water modes.

The host nation provides theater rail transportation. In peacetime, we move most ammunition in Europe by rail. The mix of rail, truck or inland waterway distribution is determined by availability within each theater of operations. However, we maintain a minimum essential US military truck transportation capability for all theaters. Transportation medium truck companies (commercial) provide this US military truck transportation capability with M915 truck tractors and M872 stake and platform (S&P) trailers. The M872 is a 40-foot long, 34-ton capacity semi-trailer. These vehicles are a commercial fleet designed to operate only over improved roads.

The medium truck companies (commercial) deliver ammunition to the TSA, CSA and as far forward as the ASP, if road networks permit. General support (GS) ammunition companies operate both the TSAs and CSAs, the former usually holds 30 days of supplies and the latter, 7 to 10 days.

The number of transportation companies available depends on the expected theater ammunition consumption. In Europe, a mix of host-nation and US GS ammunition companies support the theater commander by meeting his storage requirement.

Corps

Figure 1 shows the flow of ammunition in a typical corps sector with four committed divisions. Road or rail networks entering the corps rear area represent the flow from the TSA or ports on corps main supply routes (MSRs). Each CSA usually will not store more than 25,000 short tons of ammunition. Usually three or four GS ammunition companies are required to operate the CSAs for the corps shown in Figure 1.

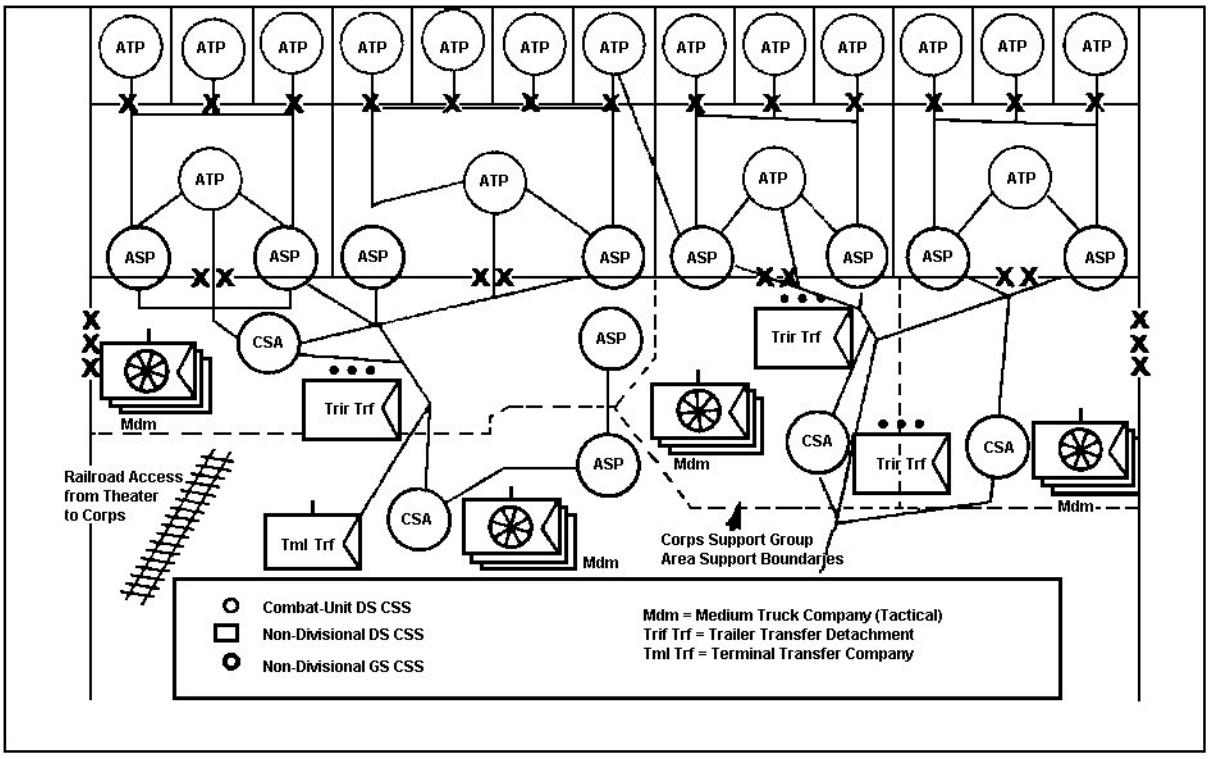

Figure 6. Under the Current Distribution System, the Flow of Ammunition in a Typical Corps with Four Committed Divisions

Stocks received at CSAs arrive directly from ports or from TSAs. We unstuff the containers; unload the items, along with breakbulk ammunition; and put them in warehouses in individual pallet configurations. When we receive a requirement to ship ammunition forward, the ammunition company loads it on line-haul transportation provided by medium truck companies (tactical).

The corps transportation company has a tactical truck fleet composed of M931 5-ton tractors and M871 S&P trailers. These trailers are 30 feet long and have a 22½-ton capacity.

Division

Ammunition is shipped from the CSA to either ASPs or ATPs. There are typically two ASPs per division located in the division area. These two ASPs combined can store three to five days of ammunition for a division and the corps' forces supporting that division, hereafter referred to as a "division slice."

ASPs. A direct support (DS) ammunition company operates the two ASPs. It consists of 233 personnel and has 16 forklifts and eight 7½-ton cranes. When stocks arrive at the ASP on corps or theater transportation, the DS ammunition company offloads and positions the stocks.

Currently, about 50 percent of ammunition is shipped to the division ATPs using corps transportation. The remaining 50 percent is picked up at the ASP by using units (primarily corps 8-inch Field Artillery) because ATPs have limited transfer capabilities. However in recent years, DS companies have augmented ATPs to allow them to handle the 8-inch munitions and reduce resupply time.

ATPs. The ATP is a collection of loaded, corps transportation 2½-ton S&P trailers with high-tonnage, high usage single-item ammunition. An ATP will typically control 10 to 25 trailers of artillery, armor, infantry and other ammunition.

There is a total of four ATPs in support of a division slice, one in each brigade support area (BSA) and one in the division rear. The ATPs in the BSA can transload 350 to 500 short tons of ammunition per day. They're equipped with five forklifts and two cranes and staffed with 10 soldiers (see Figure 2). The rear ATP can transload 200 short tons per day and has three forklifts, three cranes and six soldiers. The entire collection of ATPs can support less than half of the division-slice requirements.

Transportation Distances. Distances between the various nodes in one scenario of the corps portion of a theater ammunition distribution system is two to three kilometers from the service battery to the ATP, 46 kilometers to the ASP and 130 kilometers to the CSA. This typifies a corps ammunition distribution system in a mature theater of operations. It's important to note that a combat unit must travel about 46 kilometers one way to pick up more than half of its required ammunition using its organic 10-ton heavy expanded mobility tactical trucks (HEMTTs) or 5-ton cargo trucks. Combat units comprise the final link in the ammunition distribution system.

Unit

Field Artillery units expend 60 to 80 percent of the division slice's ammunition. A DS 155-mm Field Artillery battalion has 27 10-ton HEMTT trucks to distribute ammunition to its 24 howitzers. An infantry task force with two companies of Abrams tanks and two companies of Bradley fighting vehicles will typically have 20 10-ton HEMTTs and 5-ton cargo trucks to distribute ammunition.

Current System Problems

A force development test and experimentation (FDTE) conducted at Fort Hood, Texas, during October and November 1986, confirmed that the current ammunition distribution system cannot meet the ammunition demands of

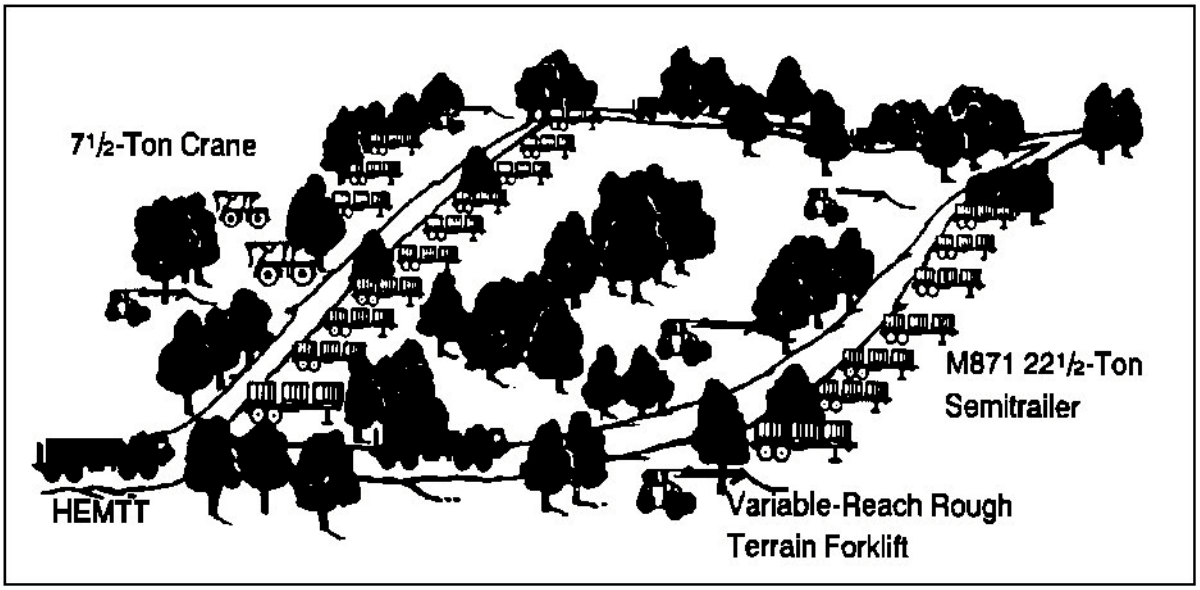

Figure 7. Notional ATP in the BSA under the Current Ammunition Distribution System

intense combat. During the test, queues exceeding 40 user trucks were at the ATP. Combat units ran out of ammunition!

Ammunition distribution at all levels was found to be ponderous. Partially loaded M871 trailers accumulated at the ATP, and corps transporters had to make additional trips to retrieve them.
Today, combat units face extended travel (20- to 100-kilometer round trips), long load times (20 to 40 minutes per truck) and long queues at the ATP and ASP. The result is large targets for the enemy (ammunition and trucks) in very vulnerable locations on the battlefield. The most crucial problem is insufficient ATP capacity.

The current system is not flexible enough to support AirLand Battle doctrine, which requires that support elements rapidly relocate to keep pace with combat forces. The Fort Hood test and subsequent analyses have identified ways we can reorganize the current system to improve its effectiveness without increasing personnel or equipment requirements.

MOADS

A new distribution system--the maneuver-oriented ammunition distribution system (MOADS)--uses a new concept for ammunition requests and delivery. It does not change the wholesale system or the delivery of ammunition to the rear of the CSAs.

Under MOADS, units request combat-configured loads (CCLs) instead of separately ordering each ammunition item. The CCLs are standardized loads of artillery, armor, infantry and other ammunition that fit into an 8 by 30-foot space on an M871 trailer.

Corps

This change has two effects. First, it simplifies ammunition ordering and forecasting in combat (e.g., "three A packs, two E packs" versus "72 pallets, D563; 12 pallets, D541," etc.). Simpler ordering procedures reduce the likelihood of miscommunications and improve the probability the user will get the ammunition he needs. Units currently are using CCLs in III Corps, Fort Hood, and V Corps, West Germany.

Second, the CCL system smooths loading at the CSA and ASP. Using the old procedures, ammunition handlers at these nodes could not load ammunition on trailers until the corps MMC directed an ammunition issue. Unless there is a permanent backlog at the CSA or ASP, there are periods of nonproductive time.

With MOADS, CSA and ASP ammunition handlers can use the time between ammunition issues to preconfigure CCLs and anticipate requirements because they know the approximate demands for each type of CCL. The GS ammunition company at the CSA remains the same as in the current system.

Division

With MOADS, we have three ASPs in support of the division slice instead of two. These ASPs are further forward and smaller than current ASPs. The MOADS allows the DS ammunition company the capability to provide an additional ATP to support corps combat units in the division. The amount of ammunition in the ASPs is reduced from three-to-five days to one-to-three days of supply for the division slice. This is still enough ammunition for short periods of time if communication lines are severed.

More ammunition is shipped directly from the CSA to the ATP, eliminating additional handling by the ASP. Those items routinely shipped from the ASPs to the ATPs (about 25 percent of the combat users' requirements) are shipped in CCLs. The combined effect of the reduced ASP stockage and flow of ammunition through the ASP is that the DS ammunition company remains relatively constant in size.

The ATPs provide 100 percent of combat unit ammunition requirements. (Combat units are Field Artillery, Armor, Infantry, Aviation, Air Defense Artillery and Combat Engineers.)

Unit

Under the current system, the user must pick up stocks from several different trailers at the ATP to make up complete, fireable rounds (e.g., fuze, projectile, propellant charge and primer) and to get the proper mix of components.

With MOADS, a user only needs to go to a single trailer to get the items he needs. The combat units pick up their entire ammunition requirements from the ATP, thereby eliminating the long distances traveled under the current system.

We'll replace the 7½-ton cranes currently at the ATP with 6,000-pound forklifts. During the Fort Hood test, we found them more productive and versatile than cranes at the ATP. Forklifts can transload all ammunition while cranes only can transload top-load pallets (e.g., Field Artillery projectiles) efficiently. Also, the crane's boom creates a dangerous signature at the ATP. Combat-unit ammunition distribution is the same as in the current system.

MOADS Improvements

The MOADS improves ammunition distribution significantly. It orients on the combat user by providing 100 percent of his ammunition at the ATP. The shortened unit resupply loop leaves more ammunition trucks available to resupply combat vehicles for the combat unit commanders.

MOADS enhances the survivability of the ammunition system by making ASPs smaller and more dispersed. It improves flexibility by making CSAs and ASPs more productive and by eliminating unnecessary loading and unloading of ammunition. For example, it reduces the CSA to ASP to ATP loop to CSA to ASP for 25 percent of the division slice's daily demands.

The MOADS puts more forklifts in the divisional ATP, thereby increasing the ATP's ability to meet ammunition requests and reducing queues and the ATP signature on the battlefield. Some commands already have implemented many MOADS elements.

Further Improvements

However, one crucial problem remains: efficiency of moving ammunition. To move ammunition stocks on the battlefield, they must be (1) picked up by a forklift one pallet at a time, (2) placed on a trailer, (3) taken to the new location, (4) picked up by a forklift one pallet at a time and (5) placed on the ground. There is no difference between the current system and MOADS in these most time-consuming and labor intensive activities.

For example, if an ASP with one day's supply of ammunition (assume 2,250 pallets of ammunition) needs to move forward or rearward, it would take five forklifts and two cranes 53 hours of continuous loading at the ASP to move that ammunition. (This assumes five minutes per lift, no equipment breakdowns and unlimited availability of M871 trailers.)

We cannot support the highly mobile warfare envisioned AirLand Battle doctrine without large increases in the number of ammunition handlers and equipment, if we have to continue to use current equipment. To alleviate these requirements, we need to use revolutionary material handling technology.

MOADS-PLS

The palletized loading system (PLS) provides that technological breakthrough--a truck with a demountable cargo bed. It allows one soldier to load or unload from six to 24 pallets of ammunition at one time without a forklift.

The PLS system is a truck and trailer both with a demountable bed and each with a 16.5-ton capacity. The total system capability is two 8 by 20 foot decks with a 33-ton combined capacity.

Theater

The PLS ammunition distribution begins once ammunition has arrived at the TSA or CSA, as directed by the Theater Material Management Center (TMMC). Ammunition is stored on the ground at the TSA. When we ship ammunition from the TSA, PLS flatracks are loaded with a single type of ammunition. The flatracks are lifted onto theater transportation, using rough-terrain container cranes (65 tons) and shipped to the CSA where flatracks (six to 24 pallets) are stored.

The current Transportation medium truck company (commercial) is unchanged. A new GS ammunition company operates the TSA, whose primary missions are to unstuff containerized ammunition and ship prepositioned war reserves. The TSA increases in size because additional incoming ammunition is diverted to the TSA to take advantage of its safer location (far from close combat) and heightened productivity. Approximately 50 percent of the theater's ammunition will flow through the TSA.

Corps

The CSA's primary mission is to build CCLs. Like MOADS, PLS uses CCLs to simplify the ammunition request system. The CSA receives 50 percent of the ammunition already on flatracks; the remainder comes primarily as breakbulk ammunition from the port on either rail or truck, as in the current system.

Ammunition is stored on flatracks in single-item loads or CCLs, as the workload dictates. All Field Artillery ammunition is stored in complete round configurations.

In the current system, each pallet of ammunition requires three or more lifts at the CSA. With PLS, pallets are, on the average, handled only once. All subsequent movement is on flatracks. The decrease in ammunition handling reduces the CSA's equipment and personnel.

Ammunition distribution and management remains as in MOADS. Ammunition shipments are from CSA to ASP or ATP by medium truck company (PLS).

Division

The ASP's mission is the same in PLS as with MOADS: operate three ASPs and one ATP. The ASPs ship approximately 25 percent of the division slice's ammunition needs.

The ASP builds CCLs and stores one half to one day of supply for its combat users. This ammunition is available for emergency pick up or delivery if main supply routes are interrupted. The PLS difference--no waiting for ammunition loading--is a major improvement in the ammunition system's responsiveness. The DS ammunition company and ATP are smaller in their PLS configuration.

Unit

Field Artillery ammunition is delivered directly to self-propelled units. The PLS convey stops at the ATP, determines if the customer can accept the ammunition shipment and follows a unit guide to the service battery location.

Ammunition for all other users arrives at the ATP on PLS flatracks and stays there for customer pickup. Infantry, armor and other users have their trucks loaded by forklifts at the ATP. We can stack PLS flatracks, thereby reducing the number of trips trucks units must make to return empty flatracks to CSA.

The PLS cost and operational effectiveness analysis eliminated all forklifts from ATPs. A subsequent analysis indicates we should retain three forklifts per ATP.

The self-propelled 155-mm and 8-inch Field Artillery units are scheduled to receive PLS trucks by corps sets, starting in 1992. When a PLS convoy arrives, corps trucks will unload full PLS flatracks and pick up empty PLS flatracks. The artillery units will pick up full PLS flatracks, leaving no ammunition on the ground. The Field Artillery School is evaluating the use of PLS trailers. While the trailers diminish the PLS trucks' mobility in rough terrain, they could add at little cost another 190 rounds per truck in the service battery area.

Infantry, armor and other users will continue to distribute ammunition using HEMTTs and 5-ton trucks. However, these branches are evaluating using PLS for resupply.

MOADS-PLS Improvements

The Fort Hood test found the PLS distribution system to be far more effective than the current ammunition system. It moved 42 percent more ammunition using 36 percent fewer vehicles.

The PLS improves distribution by delivering ammunition directly to artillery users, virtually eliminating load time for ammunition supply trucks. It improves support to other users by reducing queue time and enhances system survivability by making ATPs smaller.

The PLS creates flexibility and responsiveness in a system known to be rigid and untimely. For example, if an ASP with one day's supply of ammunition (assume 2,250 pallets) needs to be moved forward or rearward, it requires no forklifts to prepare the ASP to move. As soon as corps PLS trucks arrive, the ASP can begin to move. There is no waiting time for loading.

Our British, German, Canadian and French allies are buying PLS compatible systems. The US signed an interoperability agreement with the United Kingdom and Germany in January 1988, assuring that each nation's PLS trucks can pick up, transport and discharge any other signatory's flatracks.

The PLS lightens the logistical tail by eliminating 3,600 personnel and 3,900 equipment requirements. Studies are under way to determine the cost and effectiveness of using PLS to provide barrier materials, fuel, repair parts, shelter and bridge transportation.

Conclusion

PLS can revolutionize the Army's distribution system. Employing PLS to support previously unsupportable combat operations is what we need on the AirLand Battlefield.

This evolution of ammunition distribution--MOADS and PLS-- gives us the competitive edge to win the first battle and make it the last-- firepower is the key to that victory!