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Prepositioning and Rapid Deployment
New Challanges in Ammunition Storage

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Prepositioning of ammunition in OCONUS locations and storage of ammunition for rapid deployment represents a significant departure from traditional storage configurations within the continental limits of the United States and overseas as well.

Traditional storage facilities and procedures are contrasted with recent requirements resulting from prepositioning and rapid deployment.

Good Afternoon. I am Tom Lighthiser, a Logistics Management Specialist employed at the U.S. Army Defense Ammunition Center and School, Savanna, Illinois. For the next 20 minutes I will briefly describe relatively recent changes that have occurred in ammunition storage in the Army throughout the world.

No country in the world, the United States included, can possibly produce, ship, and store all material required to support a conflict at all potential locations. Although conflicts have prompted us to position significant force structure in Europe and Korea, the success of the United States in the future may well rest upon the prepositioning of materiel and the ability to rapidly deploy our fighting forces.

In order to establish a baseline understanding of the more traditional ammunition storage, I will first describe and depict wholesale and retail ammunition storage in the United States followed by a brief discussion of storage overseas. I will then briefly discuss prepositioning of ammunition and storage for rapid deployment.

Army ammunition is stored within the continental limits of the United States at 12 DESCOM depots and depot activities, and numerous AMCCOM plants and arsenals at which the ammunition/explosives are produced. We refer to this as wholesale storage, as the ammunition accountability is maintained by the respective NICP, AMCCOM, OR MICOM, or remains in the industrial base. There are exceptions to certain depots storing retail ammunition designated for rapid deployment. The ammunition stored in depots and plants is characterized by large lot sizes and standard storage facilities are used. Within the depot complex, we have in excess of 10,300 storage facilities while the ammunition plants have

approximately the same number. Over 2,000,000 S/T of ammunition is presently stored in the wholesale storage base. The slides that follow depict typical depot/plant ammunition facilities and storage:

Stradley Magazine
Above-ground Magazine
Navy 5" Gun Ammunition In An Army Igloo Magazine
AF MK84 2000# Bombs In An Army Stradley Magazine
Palletized Boxed Ammunition In An Army Igloo Magazine
155MM Projectiles in Navy-Type Earth-covered Magazine

Additional ammunition is stored at the posts, camps, and stations subordinate to FORSCOM and TRADOC where it is used for training purposes, and to a limited extent, consists of storage of unit basic load (UBL) ammunition, some of which is rigged for aerial delivery and/or airlift. This ammunition is referred to as retail in that the unit having custody of the ammunition is also accountable for it. As you might expect, this ammunition represents much smaller quantities, and generally consists of a greater mix. The training ammunition is tailored to the specific training requirements while the UBL is based upon specific weapons, densities, rates, mission, etc. Ammunition storage facilities in the posts, camps, and stations vary in size and construction from wooden and metal magazines built prior to World War II to the latest magazine design. The ammunition stored is generally limited to several hundred short tons representing the annual training requirement and UBL. The following slides depict typical facilities and storage in the posts, camps, and stations:

Non-Standard Earth-covered Magazine
Non-Standard Earth-covered Magazine
Underground Magazine Previously Used For Special Weapons
Boxed Ammunition In Wooden Magazine
Small Lots/Light Boxes
Unit Basic Load

The U.S. Army stores significant quantities of ammunition outside the continental limits in depots in Germany, England, Italy, Belgium, Japan, and Korea. Although not wholesale stock, per se, the Army has wholesale-like ammunition identical to the stocks stored in the CONUS depots and plants, and it is characterized by large quantities and large lots. Unlike the uniformity in storage structures that exists within the United States, storage facilities in overseas areas were often built by the host country according to their specifications and are as varied as there are countries involved. The variety of storage structures utilized in overseas depots is shown in the following slides:

Type 16 Magazine - Germany
Aerial View Of CADA And U.S. Constructed AGM - United Kingdom
AGM CADA - United Kingdom
155MM Projectile Storage In British Box Magazine
AGM - Italy
U.S. Stradley Magazine - Italy
Prop Charges - Italy
Boxed Ammunition In German Stradley - Belgium

Hillside - Korea
ECM - Korea
1950 Vintage Quonset Hut - Korea, most of which are rapidly disappearing
New Stradley-Type Magazine - Korea
Cave - Japan
Cave - Japan

The ammunition overseas comparable to the retail level stock within the CONUS at the posts, camps, and stations is stored in Ammunition Supply Points (ASPs), Prestock Points (PSPs), Reserve Ammunition Supply Points (RASPs), Basic Load Storage Areas (BLSAs), Ammunition Holding Areas (AHAs), Quick Reaction Sites (QRSs), Forward Storage Sites (FSTs), etc., located at the various overseas locations. This ammunition is very similar to the retail stock within the CONUS except that much of it is UBL that is positioned at, or in close proximity to, its potential point of use along the border in eastern Germany or along the DMZ in South Korea.

As indicated earlier, a great variety of structures exist in the overseas theaters. In recent years, the United States has constructed numerous standard magazines overseas and has even developed specially designed facilities to permit rapid re-supply in a forward area. The QRSs in Germany are representative of specially designed structures compatible with specific weapons systems. A self-propelled M109 155mm Howitzer is shown returning to a QRS. The QRS consists of earth-covered magazines having a common headwall and doors on both ends, whereas the smaller shed-type buildings were designed to store specific unit loads of tank and artillery ammunition. The dock heights are compatible with specific tracked vehicles and/or tanks.

The next series of slides will depict storage conditions for UBLs in Korea and Germany. The UBL storage depicted are the same types of ammunition and configurations that you will see later in rapid deployment UBL stocks stored at various installations, both posts, camps, stations, and depots within the continental limits. The primary difference, of course, lies in the geography as the UBL ammunition overeseas is positioned near its anticipated point of use, whereas the UBL in the CONUS is configured for rapid movement to any location in the world where it may be required.

The slides that follow depict typical AHAs in Korea:

Tank Park
M113 APC AHA
Trailer Mounted UBL
Engineer Battalion UBL Trailer Mounted
155MM Howitzer AHA
155MM Howitzer AHA
ADA UBL AHA
Aerial View AHA
Aerial View AHA

The next series of slides depict tank parks and BLSAs in Germany:

Tank Park
Artillery BLSA UBL
Artillery Trailer Mounted
Artillery BLSA
Artillery BLSA
Bulk Storage
Open Storage UBL In Winter

The Explosive Safety Standards that govern ammunition/explosive storage throughout the Army evolve from the DOD 6055.9 STD as shown in the slide. The DOD standard is prescribed within the Army by AR 385-64 which is further implemented by TM 9-1300-206, and AMC-R 385-100. In some areas, additional criteria is used when required by the host nation, e.g., the NATO standards are used in Germany. In recent years, the storage requirements at the retail level, particularly as they apply to UBL storage, have been changed to reflect criteria that is more permissive when operational considerations violate the prescribed standard.

The pre-positioning of United States equipment in Europe began in the 60s in response to United States and European concerns that forces in the theater were inadequate to meet the WARSAW Pack Threat. The Army has met the threat with heavy equipment for four divisions and supporting units and is currently pre-positioning more materiel in the European area. The levels of pre-positioned munitions, however, continue to fall short of objectives. The United States' goal is to possess sufficient war reserve stocks to sustain wartime activity until industrial production can provide the required support. The long-range goal is to correct the NATO-WARSAW Pack sustainability imbalance by the 1990s.

The Soviet invasion of Afghanistan and the revolutionary Iranian government's seizure of American hostages in late 1979 called attention to the lack of United States conventional military capability in the Indian Ocean area. This situation contrasted with Europe in that there was no mainland base to pre-position materiel.

The Island of Diego Garcia offered a secure base of operations, but fell short of needed storage area to stockpile materiel. Accordingly, the following year the Department of Defense established a pre-positioning force of merchant-type ships to carry equipment, weapons, and provisions to support a marine-amphibious brigade. The troops themselves would be flown out to the area and "married" with the equipment in a friendly port area.

Initially, seven ships (contract-manned and under charter to the Military Sealift Command (MSC)), comprised what was to be called Near Term Pre-Positioning Force (NTPF) and were located off the Island of Diego Garcia in July 1980. The force consisted of three RO/RO vehicle ships, two commercial breakbulk cargo ships, and two commercial medium-sized tankers. NTPF was established as a quick and efficient means of achieving dedicated sealift in the Indian Ocean, a region without mainland staging site for military units. Similar to the European pre-positioning plan, the Near Term Pre-Positioning

Ships Program (PREPO) was designed to augment our reinforcement in the Indian Ocean regions while minimizing the impact upon our strategic mobility capability.

As PREPO, formerly referred to as the NTPF, gained momentum as an effective means to reduce sealift response time and provide increased presence in the area, the number of ships and scope of the mission increased. The slow loading/unloading breakbulk ship was replaced with the LASH vessel.

Included under MSC long-term charter are 25 ships of the Afloat Pre-Positioning Ships (APS) Program. The program consists of two parts: The Maritime Pre-Positioning Ships (MPS) Program and the Pre-Positioning (PREPO) Ships Program (formerly Near Term Pre-Positioning Force) discussed previously.

The MPS Program is designed to combine the responsiveness of airlifted troops with sealift delivery of pre-positioned materiel. The 13 ships involved in the program will be organized into 3 MPS Squadrons that can carry equipment and supplies for Marine-amphibious brigades.

The 12 PREPO ships are assigned to Commander, MPS Squadron Two and consist of those pre-positioned cargo ships and tankers loaded with Army and Air Force equipment, POL, and supplies.

The Army has ammunition stowed on three ships in the PREPO Ships Program. Due to the requirement that the ships undergo maintenance at prescribed intervals, it is necessary to return the ship to a port on a scheduled basis to permit offloading of the ammunition prior to ships maintenance. During this period, all ammunition is subjected to rigorous inspection to determine its condition, and inventories are accomplished to verify the accountable records. Maintenance, P&P, exchange of stock, etc., are also accomplished at the same time. This fact, coupled with the need to provide safe and secure storage and adequate space for staging for backloading, restricts the number of installations at which the operation can be conducted. Most have been conducted at the U.S. Navy Magazine, Subic Bay. The slides that follow depict some highlights of the NTPF operations from August 1980 to date.

Aerial view of Military Ocean Terminal Sunny Point, NC site of 1980 onload of first ship with Army ammunition:

First ammo onload of NTPF breakbulk ship SS American Champion.

Onload complete, the Champion is ready to deploy.

The Champion arrives at NAVMAG Subic Bay January 1982 for first Army ammunition maintenance cycle which was the third NTPS maintenance cycle.

This slide shows the considerable cargo lay-down area available at Subic.

Download of ammo completed in nine days of around-the-clock operations.

With mission complete, SS American Champion departs Subic on 2 February 1982.

Inventory, inspection, P&P completed in 17 days. SS American Spartan relieves the Champion on 19 February 1982.

Backload of the Spartan took 11 days.

During the fifth maintenance cycle, NTPF transitioned from breakbulk to Lighter Aboard Ship (LASH). Here the SS Gulf Shipper and

The USNS Southern Cross discharge ammo at Subic Bay in March through April 1984.

LASH vessel SS American Veteran arrives with 63 lighters and 21 MSC vans.

Inventory, inspection, P&P, and maintenance complete, backloading to LASH barges begins.

Typical LASH barge with cargo stowed in breakbulk fashion.

LASH barge with general supplies cargo mixture.

Aerial view of Camayan Pier, Subic Bay, showing 12 LASH barges and the expanse of operations.

The previous slides depicted NTPF operations conducted at the U.S. Navy Magazine, Subic Bay R.P. as indicated earlier. The ammunition ships in the NTPF are based at Diego Garcia.

This is Diego Garcia, located in the Chagos Archipellago in the Indian Ocean. It is a 20 square mile island, forming part of the British Indian Ocean Territory (B.I.O.T.), and serves as a base for the U.S. Air Force, Navy, and MPS Fleet serving the Indian Ocean area.

This slide shows the part of Diego Garcia. The air strip is in the center and the pier is at right, extending into the harbor.

This is Central Gulf Lines' SS Green Harbour. This ship carries approximately 48 (LASH) barges. Each barge containing Army preposition stock on this vessel is 15 feet high, 30 feet wide, and 60 feet long. Each barge is stowed in breakbulk fashion and can be on/off loaded by the ship with a gantry crane. The maximum stacking on the weather deck is two barges high and up to four barges below deck.

Ammunition stored in the above-deck barges is exposed to a temperature range of 75°F to 95°F with humidity levels seldom going below 80%. All above-deck barges and barges stored in the hold are individually connected to a dehumidification system.

In order to obtain storage environmental data, five LASH barges on the Green Harbour were instrumented at Subic Bay in November, 1985. Each barge was gridded with a temperature and humidity sensor placed in each corner, mid-sidewall and center, in three layers from bottom, middle, to top. Airflow and temperature-humidity probes were placed at the barge dehumidifier inlet and exhaust. The probes are connected to a datalogger which digitally stores data from all probes every half hour. Data storage modules are changed out on a 30-day basis. Data is being collected as of 1 December 1985 and is an on-going process until the next ship's maintenance cycle. At this time, an assessment of the ammunition quality will be made to assess the effects of the storage environment.

This slide shows a combination temperature-humidity probe (the silver cylindrical housing mounted below the cross member), a hot wire anemometer (pencil-like probe) mounted at an inlet air duct of a LASH barge. The wires at right connect to a datalogger.

These dataloggers were chosen because they operated from standard "D" size flashlight batteries for a period over 30 days.

Each probe is read and the data recorded in the storage module mounted on the water-tight enclosure cover (at left).

This slide shows a datalogger installation in the hold on the Green Harbour.

This is a partially loaded LASH barge.

Our organization, USADACS, has been tasked by HQ, U.S. Marine Corps to investigate the effectiveness of vented containers in a controlled environment in MPS Squadron 2. Eight MILVANs were instrumented on the MV Bonnyman stationed at Diego Garcia. Temperature and humidity are being monitored in each MILVAN with selected ammunition items. This slide shows the probe in a small arms MILVAN.

And this one shows prop charges. Probes are placed as close to the geometrical center of the container as possible.

The dataloggers for this application operate on a five-minute interval and record the average value every half hour. Four recording instruments are used in a 60-day data recording cycle. Data recorded in storage modules are transmitted to USADACS for processing.

The ability to rapidly deploy ready forces anywhere in the world has resulted in the necessity to store UBL in configurations that violate normal compatibility standards for storage of ammunition. Due to the overriding mission requirements for centralized storage of UBLs, compatibility requirements have been somewhat relaxed.

Rapid deployment scenarios envision the need for providing all classes of supply as one package. This slide shows a contingency plan package pre-rigged for air drop to support an airborne corps. This points out not only the incompatibility among the Class V items but the obvious incompatibility with other classes of supply. Operational requirements are overriding considerations.

For OCONUS units, relaxation of normal requirements has been formalized in Chapter 10 of DOD 6055.9-STD. Use of this criteria allows the responsible major commands to fulfill their missions when requirements dictate the need to keep their UBL ammunition within the boundaries of their barracks or in the immediate vicinity thereof in trucks, trailers, tanks, structures, etc. This involves acceptance of greater-than-normal risks to unit personnel, facilities, and equipment when permitted by host nation laws and/or status of forces agreements. Essentially, this allows commanders to store up to 4,000 KG Net Explosive Quantity (NEQ) in a BLAHA, disregarding normal storage compatibility requirements, while excluding propelling charges in Class/Division 1.2 and the quantity of explosives in Class/Division 1.3 when determining NEQ for quantity-distance (QD) purposes. QD relationships in a BLAHA are prescribed by a separate QD table applicable only to basic load storage areas.

Rapid deployment of ready forces stationed in the CONUS presents another situation requiring pre-configured UBL for aerial delivery. Pre-rigged UBL, trailer mounted for airlift, also presents compatibility problems. Normal storage compatibility requirements cannot be met when storage in a central location is essential to meet rapid deployment time-workload constraints.

The following slides illustrate a typical magazine at a CONUS depot and pre-rigged loads stored:

CONUS Stradley Igloo Magazine
Anti-Personnel Mines
Small Arms Ammo
Small Arms Ammo
Mixed Loads in Storage
Small Arms in Storage
Pre-Rigged Load

A point of interest is that compatibility within vehicles and on pre-rigged pallets is consistent with requirements of TM 38-250 for air shipment and DOT compatibility requirements, but storage compatibility requirements are not met.

The next two slides are typical of UBL mixes in storage for rapid deployment.

The first slide represents UBL pre-rigged on AF 463L pallets, stored in earthcovered magazines. Note that Magazine A has a large quantity of explosives with 25,590 pounds. Incompatibility is due to the presence of 190 pounds net explosive weight (NEW) of storage compatibility group (SCG) "G" smoke grenades. These grenades are dispersed among several pre-rigged pallets due to mission signalling requirements. The SCG "D" material is permissible for storage with SCG "C" under Category Z. The incompatible SCGs are shown in red.

The next slide represents a typical UBL for a 155mm ready battery, palletized and trailer mounted. In this case, the SCG "G" primers are not compatible with SCG "D" items. Storage of SCG "C" and "D" is permissible under Category Z. This storage configuration is similar to the complete round concept. While not compatible for storage, this mix of SCGs is compatible for military air shipment in accordance with TM 38-250.

The following slides show examples of UBL pre-rigged for airdrop and trailer-mounted loads of ammunition palletized on AF 463L pallets for airlift.

Pre-Rigged for Airlift
Pre-Rigged for Airlift
Pre-Rigged for Airlift
Pre-Rigged for Airlift
Pre-Rigged for Airlift
Pre-Configured Load
Loaded Trailer
Loaded Trailer (Inside)
Loaded Trailer
Loaded Trailer

During the previous discussion, I have attempted to describe the traditional ammunition storage environment, both wholesale and retail, in the United States and overseas. I then talked about the PREPO Program and storage of ammunition for the rapid deployment force. As was evidenced during the discussion, and slides that were reviewed, the pre-positioning of ammunition and its storage for rapid deployment represent many new challenges in ammunition storage.