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**COMMERCIAL OVERSEAS TRANSPORTATION OF
CONTAINERIZED AMMUNITION**

by

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March 1999

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**COMMERCIAL OVERSEAS TRANSPORTATION OF CONTAINERIZED
AMMUNITION**

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This thesis examines how DoD has attempted to use the commercial transportation system to move containerized ammunition overseas. It identifies problems encountered during the TURBO CADS exercises, examines commercial business practices and regulations that cause difficulties, and makes recommendations for peacetime overseas movement of containerized ammunition.

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I. INTRODUCTION

A. BACKGROUND

Commercial shipping, whether by rail, truck or ship, can be broadly classified into two categories - breakbulk and container. Breakbulk items are shipped loose or stacked within a truck, ship or rail car, while container cargo is shipped after being loaded into containers.

The most common shipping containers are eight feet wide by eight feet high, with lengths of 20 and 40 feet. Due to the reductions in handling time, damage, and theft, commercial shipping companies have found containerized shipping to be more efficient and cheaper than breakbulk. With the exception of grains, oil, coal, gas, and other large items, the commercial transportation industry has moved almost completely from breakbulk to containerized shipping. [Ref. 1, p.33]

The use of containers has completely changed the transportation industry in the last 40 years, supporting the development of intermodal transportation.

Intermodal transportation is the concept of transporting passengers and freight in such a way

that all the parts of the transportation process are efficiently connected and coordinated, offering flexibility. [Ref. 1, p.1]

Containerized intermodal shipments are common today. The transportation industry now uses truck vans, rail flatcars, and container ships to move freight from truck to rail to ship, allowing efficient and seamless movement between transportation modes. The cost savings of containerized transportation has also interested the Department of Defense (DoD). [Ref. 1, p.23]

The U.S. military is faced with tight budgets in the foreseeable future. At the same time, U.S. forces must be ready to deploy on short notice, to hostile environments, for an unknown duration. This pressure is causing DoD leaders to review military spending, looking for ways to reduce cost without reducing capabilities.

According to the Mobility Requirements Study of 1992, one method to reduce costs is to outsource military jobs to commercial counterparts. To eliminate costly duplication of commercial and DoD infrastructure, the military has been considering outsourcing overseas containerized ammunition transportation requirements to commercial ocean carriers. [Ref. 2]

In November of 1992, the United States Commander-in-Chief, Pacific (USCINCPAC) established a U.S. Pacific (PACOM) munitions containerization working group. This group determined that the current munitions delivery system relied too much on the breakbulk movement of ammunition.

Using the group's recommendations, DoD decided to develop the capacity to transport containerized ammunition. The United States Transportation Command (USTRANSCOM) took the lead on developing and funding joint exercises to develop a containerized ammunition transportation system. USTRANSCOM proposed a 5-year, TURBO (header for all USTRANSCOM exercises) CADS (Containerized Ammunition Distribution System) exercise program. TURBO CADS exercises would stress the use of containerized ammunition transportation from the ammunition depots to overseas destinations. [Ref. 4]

Most ammunition destined for overseas locations is currently shipped from the various ammunition depots to one of three military ammunition ports: Naval Weapons Station Concord, CA., Port Hadlock, WA., and Military Ocean Terminal Sunny Point (MOTSU), NC. From there it is transported by DoD-owned ships to various overseas supply bases. [Ref. 3]

TURBO CADS '94 was the first time the military attempted to move containerized ammunition from the depots to overseas military ports using DoD ships. The purpose of this exercise was to train then test DoD depots and ports in handling containerized ammunition. Overall, this exercise was successful. With DoD now able to handle containerized ammunition, TURBO CADS '95 attempted using commercial transportation companies to move containerized ammunition from depots through military and civilian U.S. ports to military and civilian overseas ports within the Pacific. This exercise was not successful as overseas and U.S. commercial ports could not be used. TURBO CADS '96 was cancelled, and TURBO CADS '97 and '98 used government ships to move containerized ammunition through military ports. The viability of using commercial ocean liners/carriers for peacetime movement of containerized ammunition is in doubt. [Ref. 4,5,6,7]

Commercial truck and train carriers are used for ammunition transportation within the continental U.S. (CONUS). However, commercial overseas movement of containerized ammunition is problematic. [Ref. 4,5,6,7] Five problem areas have been identified.

1. Regulations Governing the Movement of Ammunition

Two regulations governing ammunition are the U.S. Code of Federal Regulations, (CFR) section 49, parts 171 to 177, which list transportation regulations, and DoD Instruction 5100.76M, which gives security requirements for ammunition. For example, the CFR requires explosives to be segregated from other flammable shipboard cargo, while DoD 5100.76M requires pierside security inspections of ammunition containers. These requirements limit shipboard cargo storage options and require more manpower. This adds expense and time to ammunition shipments. Local commercial port regulations also limit the quantity of ammunition allowed within the port at any one time. This protects nearby populations from accidental ammunition explosions, but make ammunition movement through commercial ports very expensive and time consuming.

2. Waivers

Waivers are issued by regulating agencies to allow relaxation of specified parts of ammunition regulations such as those listed above. For example, a port regulation limiting the amount of ammunition within a port may be waived during a national emergency, but during peacetime, a

new waiver must be obtained for each ammunition shipment. This adds expense and time to ammunition shipments.

3. Permits

Coast Guard permits must be issued allowing ammunition into a commercial U.S. port. These permits normally are issued within one day of application, but have to be obtained for each ammunition shipment. This also adds expense and time to ammunition shipments.

4. Shipping Route Profitability

Commercial shippers position their ships on routes which maximize profits. They are very reluctant to move a ship from a normally scheduled profitable route to pick up ammunition from a military port that is less commercially viable.

5. Political Considerations

Moving ammunition through any port tends to alarm people who live nearby. This can cause political pressure to disallow ammunition shipments through the port. For example, just prior to Turbo Cads '95, the Pusan District Maritime Port Authority refused to allow ammunition through

the commercial port of Pusan. They cited the local population's increasing concerns with the transportation infrastructure after the collapse of a local bridge. [Ref. 5, p.37]

These problems notwithstanding, DoD is focused on outsourcing many of its transportation functions. [Ref. 8, p.i] This is shown in the Focused Logistics portion of Joint Vision 2010, where the Joint Chiefs of Staff stated that

outsourcing, privatization and competition offer the prospective of lowering costs and improving performance across a wide range of activities. [Ref 8, p.36]

B. OBJECTIVES

The subject of this thesis is commercial transportation of military ammunition. The goal is to examine how DoD has attempted to use the commercial transportation system to move containerized ammunition overseas, identify problems encountered, and make recommendations for how to better utilize the commercial system. The primary objective is to examine the viability of using commercial

transportation for the peacetime overseas movement of containerized ammunition.

C. RESEARCH QUESTIONS

1. Primary Question

How can commercial ocean carriers be used by DoD to carry containerized ammunition during peacetime operations?

2. Secondary Questions

- What are the commercial options for moving containerized ammunition through military and civilian ports?

- What are the implications of DoD's policy of moving ammunition in 20 foot containers while the commercial industry predominantly uses 40 foot containers?

- What are the compliance, waiver and cargo segregation requirements for DoD and commercial shippers under 49 CFR 171-177?

- What are the Net Explosive Weight requirements for ports?

- What are DoD security and policy requirements for moving ammunition through commercial ports?

- What are the political considerations associated with shipping containerized ammunition through commercial ports?

- Do the problems and regulations make ammunition movement so difficult and unique that it should be done by government vessels?

- What caused TURBO CADS '95 Plan A to fail?

D. SCOPE, LIMITATIONS, METHODOLOGY, ASSUMPTIONS

This thesis will examine DoD's previous attempts at using commercial ocean carriers for shipping containerized ammunition from U.S. military and commercial ports. The study will explore the viability of commercial overseas movement of ammunition. More specifically, the thesis will: (1) review TURBO CADS '94-'97; (2) examine DoD, federal and local regulations regarding the movement of ammunition; (3) look at political considerations associated with moving ammunition through commercial ports; and (4) discuss business considerations involving ammunition transportation. The thesis will then summarize the issues, draw conclusions and make recommendations on commercial overseas transportation options.

The scope of this thesis will be limited to examining containerized ammunition transportation through the ports of Oakland, CA., Concord, CA., and Port Hadlock, WA. to overseas military ports.

Problems dealing with moving ammunition through the foreign commercial ports of Pusan and Chinhae, Republic of Korea (ROK) will also be discussed.

E. SUMMARY

This chapter described how and why DoD has moved towards using commercial carriers to move containerized ammunition overseas. It provided background information on containerized shipping, ammunition movement, TURBO CADS exercises, and DoD's reasons for outsourcing transportation functions. It also identified the major problems involved in shipping containerized ammunition through U.S. ports to overseas locations.

Chapter II will provide specific information about the TURBO CADS exercises including results and recommendations from past exercise reports. Chapter III will examine federal, DoD, Coast Guard, and local regulations concerning ammunition movements through U.S. commercial ports. Chapter IV will look at business concerns including movement options, container sizes, routes, and political considerations.

Finally, Chapter V will provide a summary, conclusions and recommendations.

II. TURBO CADS EXERCISES

A. AMMUNITION DISTRIBUTION SYSTEM

Military ammunition is defined as "ammunition of all types, bombs, explosives, mines, fuses, detonators, pyrotechnics, missiles, rockets, propellants, and other associated items." [Ref. 10, p.A6] Military forces rely on the ammunition distribution system for the production and transportation of ammunition to their locations.

The military's ammunition distribution system consists of the Army Material Command, Industrial Operations Command (IOC), each Service, munitions plants, depots, and USTRANSCOM and its component commands - Military Transportation Management Command (MTMC), Military Sealift Command (MSC), and Air Mobility Command (AMC).

The IOC, under the direction of the Army Material Command, is responsible for managing ammunition for all U.S. military services and is designated the Single Manager for Conventional Ammunition (SMCA). The SMCA is responsible for ammunition procurement, running ammunition depots, life cycle management, and disposal. Within the IOC, ammunition is broken down into different groups with

each group controlled by an item manager. All ammunition is tracked throughout its lifetime with the use of a Department of Defense Identification Code (DODIC). [Ref. 11, p.13]

USTRANSCOM is responsible for providing air, land, and ocean transportation to DoD during peace and war. Under USTRANSCOM, AMC handles air transportation, MSC is responsible for ocean transportation, and MTMC manages land transportation and port management. [Ref. 12, p.4]

Since the end of the Cold War, DoD has been shifting from large stockpiles of conventional ammunition to smaller, safer, and higher quality reserves. Because the major use of ammunition in peacetime is for training, ammunition depots within the continental U.S. were divided into east, west, and central regions. Additionally, they are now being divided into three tiers with at least one depot from each tier per region: (1) Tier I stores training ammunition and the first 30 days of war reserve ammunition; (2) Tier II stores war reserve ammunition for use after the first 30 day of conflict; and (3) Tier III is used as caretaker facilities for storing ammunition in excess of DoD's needs. This new arrangement should be completed by 2001. [Ref. 9]

From the ammunition depots, ammunition is shipped by MTMC, under the direction of IOC, via truck or train to either continental U.S. (CONUS) destinations or ammunition ports. From the ammunition ports, ammunition travels via government ship to overseas destinations. (See Figure 1)

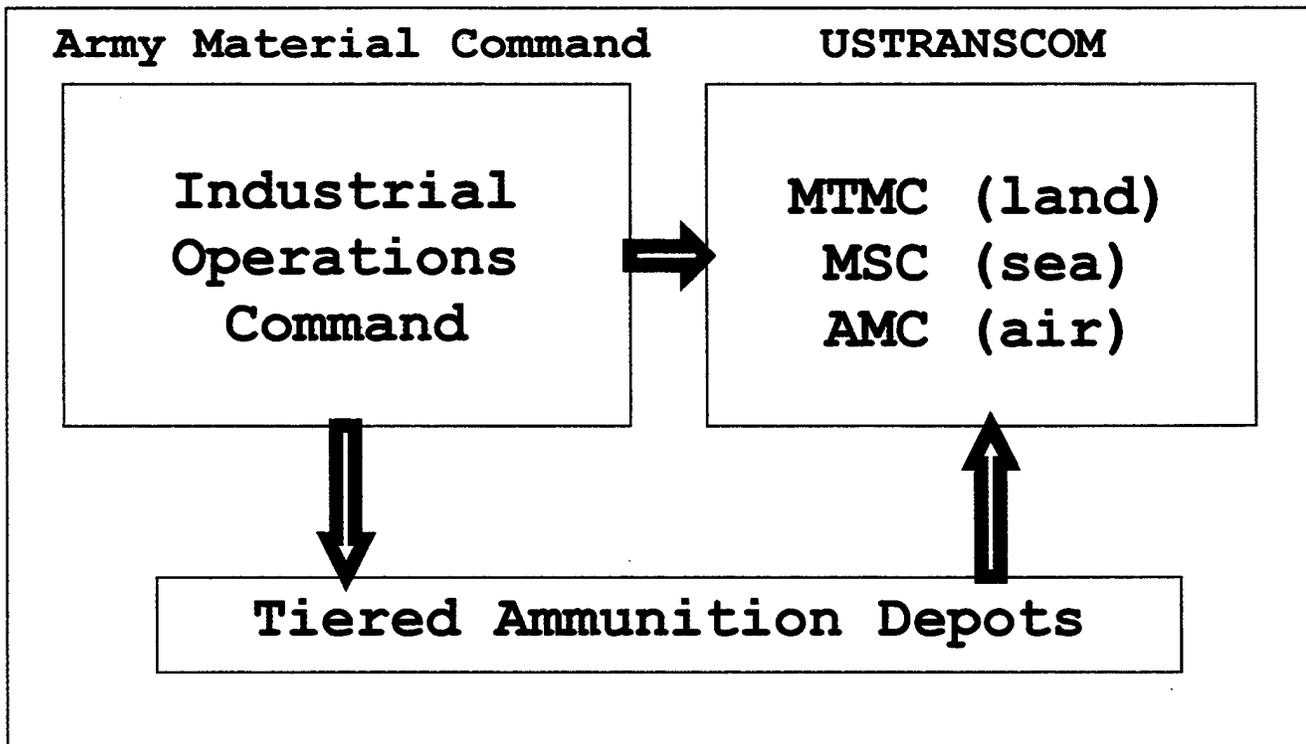


Figure 1. Ammunition Distribution

IOC also ships ammunition to CONUS Naval weapons storage facilities (ammunition magazines). The Navy then resupplies its ships under way, using specialized at sea replenishment ships. Naval ammunition will not be

discussed in the remainder of this thesis since it isn't reliant on ammunition distribution outside of the continental United States. Additionally, Navy at sea replenishment operations are not adaptable to containerized ammunition movement. [Ref. 11, p.25]

B. DEVELOPMENT OF TURBO CADS EXERCISES

As mentioned in Chapter I, DoD had begun thinking about the time and cost efficiencies gained through the use of containerization. This was reinforced by the completion of the Team Spirit 1993 Intermodal Initiative. This exercise successfully used containers to transport military equipment from specific military units. Testing the containerization of ammunition shipments was a logical extension to this policy. [Ref. 4, p.7]

The United States Commander-in-Chief Pacific (USCINCPAC) felt that the best approach was to develop a series of joint service, USTRANSCOM-supported containerized ammunition transportation exercises. In November 1993, USCINCPAC, utilizing the Army's Containerized Ammunition Distribution Executive Group, established a working group to develop exercise details. The group's purpose was to

develop a plan that would lead to institutionalizing containerized ammunition shipments in the Pacific. The plan proposed was a 5-year exercise program stressing a containerized ammunition distribution system (CADS) from ammunition depots to destinations. [Ref. 4, p.8]

During this time, USTRANSCOM noted that ammunition delivery to overseas locations depended almost solely on breakbulk equipment. However, breakbulk shipping continues to decline as the commercial world moves toward the use of containerships. Additionally, government-owned breakbulk ships are reaching the end of their useful life. Realizing DoD's future dependence upon commercial shipping for ammunition transportation, and armed with the success of the Team Spirit unit containerization exercise, USTRANSCOM agreed to assume sponsorship for development and control of the TURBO CADS exercises. [Ref. 4, p.7,8]

C. TURBO CADS '94

1. Concept of Operations

The first TURBO CADS (TC) exercise was conducted from August 1 to November 27, 1994. Its purpose was to train facilities and test CADS capabilities from CONUS ammunition

depots and Alaska to destinations in the Pacific. The secondary purpose was to satisfy yearly ammunition transportation requirements for U.S. forces in the Pacific region. [Ref. 13]

A total of 1387 twenty foot containers or twenty foot equivalent units (TEU) of ammunition were moved from six CONUS depots and two forts in Alaska to three seaports of embarkation (SPOE). The depots were: Crane Army Activity, Indiana; Hawthorne Army Ammunition Plant, Nevada; McAllister Army Ammunition Plant, Oklahoma; Seneca Army Ammunition Depot, New York; and Sierra Army Depot, California. The Alaska forts were Fort Wainwright and Richardson. The SPOEs were Naval Weapons Station (NWS) Concord, CA; Indian Head (Port Hadlock), WA; and Valdez, AK.

From the SPOEs, the ammunition traveled by ship to Apra Harbor, Guam; Tengan, Okinawa; Chinhae, ROK; and Hiro, Japan. From these seaports of debarkation (SPOD) the munitions were moved to their final destinations: Anderson AFB, Guam; Kadena AFB, Okinawa; Suwon, Osan, Chong-ju, and Kunson ASB, ROK. Retrograde (outdated, defective or no longer needed) ammunition was also shipped breakbulk to CONUS from Guam, ROK, and Okinawa.

CONUS transportation from the depots to the SPOE was via commercial rail and truck. From the SPOE, sealift was provided by the SS Gem State and the MV Green Wave. The SS Gem State is a self loading and unloading (self-sustaining) 680 container capacity cargo ship from the Ready Reserve Fleet (RRF); the MV Green Wave is an MSC-chartered, self-sustaining, breakbulk/cargo container ship. From the SPOD, the containers traveled via rail and truck to military facilities.

2. TURBO CADS '94 Objectives

The specific objectives of TC94 as put forth by USTRANSCOM are listed below:

1. Use off-the-shelf commercial and DoD containers.
2. Evaluate on-hand container handling equipment (CHE), and identify shortfalls.
3. Identify transportation system shortfalls that would prevent the routine, continuous use of containerized munitions transportation.
4. Show the usefulness and ease of blocking and bracing improvements compared to breakbulk.
5. Observe inland railroad movement of containerized munitions in the ROK.
6. Observe and evaluate containerized munitions transfer, stuffing, and unstuffing operations.
7. Assist in developing a CADS doctrine.

8. Exercise NWS Concord's container throughput capability. [Ref. 4, p.3]

3. TURBO CADS '94 Problems

There was one major problem that occurred during this exercise. This was the lack of container handling equipment (CHE). Since military depots and bases had been moving ammunition breakbulk, they lacked container handling experience as well as equipment capable of moving containers.

4. TURBO CADS '94 Conclusions

Overall, the exercise was deemed successful. Notable conclusions are listed below:

1. Containerized ammunition transfer, stuffing and unstuffing operations were observed and doctrine was developed. DoD was capable of transporting containerized ammunition using DoD and commercial containers.
2. Operations were slowed by severe shortages of container handling equipment (CHE) from origin to destination. CHE was borrowed from other commands or leased to solve the shortages.
3. Facilities lacked experience handling containerized munitions. This required sending a team of experts to train personnel just prior to the exercise. Ammunition depots were taught how to stuff containers correctly using proper blocking and bracing techniques.

4. Inland railroad movement of containerized munitions was successful within the U.S. and the ROK. NWS Concord successfully handled all container operations.
5. Communication channels between DoD and commercial intermodal companies needed improvement. [Ref. 4]

These conclusions were used to design the next TURBO CADS exercise. Additionally, with the concept of containerized ammunition proven and most of TC94's objectives met, the next step would involve commercial industry further.

D. TURBO CADS '95

1. Concept of Operations

TURBO CADS '95 was conducted from June 1st to August 31, 1995 in the Pacific area of operations. The primary purpose was to ship ammunition, via commercial transportation, from depots, through civilian and military ports, to destinations in the Far East. The secondary purpose was to satisfy yearly ammunition transportation requirements for U.S. forces in the Pacific region. [Ref. 13] Ammunition would be shipped via rail and truck from twelve CONUS depots to SPOEs at NWS Concord, Oakland, CA. and Tacoma, WA. Movement from depot to SPOE was to

maximize the use of rail and be augmented by truck. SPODs would be Pusan, ROK; Hiro, Japan; Okinawa, and Pearl Harbor, Hawaii. [Ref. 14]

2. TURBO CADS '95 Objectives

The specific objectives of TC95 as put forth by USTRANSCOM are listed below:

1. To achieve commercial door-to-door munitions movement utilizing a contract with a commercial carrier.
2. To test Pacific military units' CADS capabilities.
3. To test modern In-Transit-Visibility (ITV) technology systems in tracking containers. This involves the use of radio frequency (RF) tags that are attached to shipping containers. When queried by a source, such as a satellite, the tags respond much like an airplane transponder does to a radar signal. In this way, the location of the containers can be tracked.
4. To improve DoD and commercial industry partnership. [Ref. 5, p.2]

To achieve these objectives, the exercise was divided into two plans. Plan A was to use commercial liners to move 236 TEUs through the commercial ports of Tacoma and Oakland to Pusan, ROK. This commercial contract was restricted to U.S. ocean liner companies. Plan B was to use commercial carriers to move 1536 TEUs through NWS

Concord to military ports in Hawaii, Okinawa, Japan and the ROK. This contract was open to all carriers. [Ref. 14]

3. TURBO CADS '95 Problems

Plan A was unsuccessful. It was cancelled because the ROK disapproved the use of Pusan, a large commercial port, after gas explosions in Taegu, ROK and the earthquake in Kobe, Japan. [Ref. 5, p.5] Plan A's container load was then shifted to Plan B, increasing that load to 1772 TEUs.

Plan B was partially successful. With Pusan now closed, munitions into Korea had to go through Chinhae, ROK. Due to a modernization program, the port was not available at all times. Because of this and the increased number of TEUs, no commercial carrier would agree to meet the required delivery dates. This problem was solved when MSC chartered the MV Corpus Christi to immediately move 594 TEUs from Concord to Chinhae, ROK.

Although the MV Corpus Christi solved the immediate problem, there were still 1178 TEUs waiting in Concord. This problem was solved by Crowley Maritime Services, Inc. The company proposed to transport the remaining ammunition using an ocean-going tug and self-unloading barge. Although the speed was only eight knots, a workable

schedule was devised. [Ref. 14] This proved to be an excellent solution, as the Crowley tug and barge performed all scheduled portcalls including unloading and loading of munitions. Additionally, the tug and barge returned 368 TEUs of retrograde to NWS Concord. [Ref. 5, p.8]

4. Conclusions

Overall, the exercise was a success; however, there were many conclusions. The major ones are listed below.

1. Commercial door-to-door service is not possible without risk assessments and waivers for ports and intermodal transfer facilities. DoD and commercial companies must comply with the U.S. Code of Federal Regulations (CFR), section 49, parts 171-177 when transporting explosives. Current waiver authority is vested with MTMC. USTRANSCOM should have waiver authority.
2. The commercial intermodal system is not effective at using West Coast DoD munitions ports. This is due to low productivity and because commercial carriers are unable to support stops there with normal liner service. Port Hadlock, WA. should be upgraded to support containerized operations and DoD should continue attempting munitions movement through commercial ports.
3. The commercial industry response was below expectations. Ocean carriers' proposals didn't meet required delivery dates for Plan B; there was slow placement of railcars at depots; and the lack of truck backloads caused slow motor carrier support until DoD agreed to pay deadhead (empty return trip) mileage. To achieve better economies of scale, all requirements for a movement should be offered in a single contract,

with truck, rail, and ocean carriers involved in exercise planning meetings.

4. ITV through radio frequency (RF) tags required host nation approval. Japan initially disapproved frequencies; at that time, there were no international standards or authority for RF tags. DoD needed to push for RF standards, and ensure that DoD RF tags are acceptable in countries where cargo is shipped. It should be noted that since then, international RF standards have been developed which DoD now follows.
5. The ocean going tug and barge was a surprising success, providing a viable strategic capability for sustainment and resupply. They are also an excellent intra-theater platform and USTRANSCOM should consider this capability in future OPLANS. [Ref. 5, 14]

Integrating DoD's ammunition transportation system with existing commercial intermodal services was proving to be very challenging. However, the overall results were positive and the recommendation was made to continue.

E. TURBO CADS '96

TC96 was cancelled. Originally, it was to apply the lessons learned and recommendations of TC95 in the U.S. Central Command's (CENTCOM) area of operations. However, the Middle East proved to be an exceptionally difficult, politically sensitive and expensive area for commercial

ammunition shipments. Reasons given for cancellation included difficulties in getting port waivers and permits, host country permissions as well as funding for commercial liners. Turbo Cads '97 was then scheduled for the CENTCOM's area of operations. [Ref. 15]

F. TURBO CADS '97

1. Concept of Operations

Turbo Cads '97 was conducted from 16 July to 7 November 1997 in support of United States Commander-in-Chief Central Command (CINCCENT). The exercise requirements were to transport 777 TEUs of ammunition via rail and truck from various depots to the SPOE at Military Ocean Terminal Sunny Point (MOTSU), N.C. From MOTSU, the munitions would be shipped to Kuwait and Ad Dammam, Saudi Arabia. The Ad Dammam munitions would then be line-hauled by military units to a munitions storage area near Prince Sultan Air Base, Saudi Arabia. Retrograde ammunition would be returned for delivery to NWS Concord (922 TEUs). The secondary purpose was to satisfy yearly ammunition transportation requirements for U.S. forces in the Middle East region. [Ref. 13]

2. TURBO CADS '97 Objectives

The primary objectives were similar to TC96 with one major exception - there would be no commercial ocean liners used. Instead, the ammunition would travel on the SS Cape Farewell, a RRF lighter aboard ship (LASH) vessel. A LASH vessel carries small barges filled with cargo. This vessel had been modified to allow stacked containers vice breakbulk cargo in her LASH barges. The barges would be dropped off at the port entrance in Kuwait and Ad Dammam. Tugs would then move the barges to the pier and return retrograde loaded barges to Cape Farewell.

The decision to use the SS Cape Farewell instead of commercial liners was due to the uncertainty in obtaining host nation permission for the exercise. This uncertainty made it exceptionally difficult to contract out the service. Carriers would not agree to a service and price without dates. Additionally, USTRANSCOM was intrigued by Crowley's ocean barge success in TC95 and wanted to test the feasibility of using a modified LASH system. [Ref. 7, 15]

3. TURBO CADS '97 Problems

The only significant problem with this exercise was in obtaining host nation approval. One of the host nations linked approval of TC97 to other unrelated issues. This resulted in an approval delay and required direct intervention by CENTCOM. Once approval was granted, there were no other significant problems.

4. Conclusions

This exercise successfully showed the feasibility of using LASH ships for containerized ammunition transportation.

G. SUMMARY

The TURBO CADS exercises have partially proven the concept of commercial containerized ammunition shipments. TC94, TC95, and TC97 showed that the military ships and facilities could handle containerized ammunition. TC95 also showed that commercial ocean transportation of containerized ammunition was possible although not through commercial ports. Within CONUS, ammunition can be moved commercially via rail or truck with few problems. However,

overseas commercial shipments are problematic. Of the three overseas commercial methods attempted, only one was successful. These methods and their results are as follows:

1. Ocean going tug and self sustaining barge using military ports. This was used successfully by Crowley American Transport to move containerized ammunition from NWS Concord to South Korea during TC95. It is the only entirely commercial method that was successful. Transport time using this option can be an issue and will be explored in Chapter IV.
2. Commercial liner service using commercial ports. This was unsuccessfully attempted in TC95. The main problems appeared to be obtaining required U.S./host nation port waivers and permits, scheduling, and cost problems. These problems will be explored further in Chapters III and IV.
3. Commercial liner service using military ports. This method was attempted during TC95. There were no contracts awarded due to excessive cost and schedule problems. These problems will be explored in Chapters III and IV.

It is important to note the quantities of ammunition shipped during the exercises - 1387 TEUs in TC94, 1772 TEUs in TC95 and 777 TEUs in TC97. This is not a large quantity when compared with the large capacity (4000 TUEs and higher) of modern container ships or the 787,884 short tons (equivalent to approximately 40,000 TEUs) shipped during the Gulf War with Iraq. [Ref. 1, p.24], [Ref. 5, p.27], [Ref. 16, Appendix 10]

The TURBO CADS exercise program has been an effective way of exploring and integrating commercial transportation practices into the Defense Transportation System but is not without its problems.

III. SEAPORT AMMUNITION TRANSPORTATION REGULATIONS

A. INTRODUCTION

The purpose of Chapter III is to examine the various regulations controlling the movement of containerized ammunition through the commercial ports of Oakland, CA. and Pusan, ROK, and the military ports at Naval Weapons Station Concord, CA., Port Hadlock, WA., and Chinhae, ROK. Additionally, specific regulations will be identified that cause transportation of containerized ammunition through commercial ports to be problematic. Regulations governing movement of containerized ammunition through military ports are also covered since using commercial carriers through military ports is also an option.

Key points will be discussed and important details given so that the reader gains an understanding of the regulatory difficulties associated with moving containerized ammunition through seaports. To accomplish this, applicable portions of the following will be discussed:

1. Title 49 and Title 33, U.S. Code of Federal Regulations;

2. DoD 6055.9-STD, DoD Ammunition and Explosive Safety Standards;
3. DoD 5100.76M, Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives;
4. Department of Defense Regulation 4500.9-R-1, Management and Control of the DOD Intermodal Container System;
5. Department of Defense Regulation 4500.9-R, Cargo Movement;
6. Single Ammunition Logistics System Agreement - Korea (SALS-K);
7. Port of Oakland, Tariff No. 2A, Hazardous Materials Rules and Regulations.

Items 1 and 7 deal with movement of explosives through U.S. commercial and military ports, items 2 through 5 are additional DoD requirements for U.S. military ammunition, and item 6 defines how ammunition for U.S. forces will be brought into the ROK.

B. U.S. CODE OF FEDERAL REGULATIONS

1. Background

The Code of Federal Regulations (CFR) is a codification of rules published in the Federal Register by executive departments and agencies of the federal

government. For the purpose of containerized ammunition movement through commercial and military ports, the relevant portions are Transportation (Title 49) and Navigation and Navigable Waters (Title 33). These portions are under the cognizance of the Department of Transportation and enforced by the U.S. Coast Guard. [Ref. 17, Title 49, Part 176.4]

2. Title 49, U.S. Code of Federal Regulations

a. Definitions

Title 49 covers the movement of hazardous materials by seagoing vessels. It applies to all U.S. commercial and military ammunition shipments. Under the Code of Federal Regulations, military ammunition is a Class 1 hazardous material. A Class 1 hazardous material is an explosive and is defined as:

a device which is designed to function by an explosion or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion.
[Ref. 17, Title 49, Part 173.50]

Class 1 materials (explosives) are divided, from highest to lowest volatility, into six divisions which are defined below:

1. Division 1.1 is the most violent, and covers explosives where the entire explosive material reacts instantaneously. This is called a mass explosion hazard.
2. Division 1.2 consists of explosives that have a projectile hazard but not a mass explosion hazard.
3. Division 1.3 refers to explosives that have a fire hazard and either a small blast or projectile hazard.
4. Division 1.4 specifies explosives with a small explosion hazard that would be largely confined to the package.
5. Division 1.5 consists of insensitive explosives. They can have a mass explosion hazard, but are very insensitive to both shock and fire.
6. Division 1.6 includes extremely insensitive explosives with no mass explosion hazard. [Ref. 17, Title 49, Part 173.50]

The six Class I material divisions are further classified by using 13 compatibility group letters. Compatibility group letters identify specific hazards. For example, compatibility group "H" is an article containing both an explosive substance and white phosphorus, while compatibility group "J" is an article which contains an explosive substance and a flammable liquid or gel. [Ref. 17, Title 49, Part 173.52]

These divisions and compatibility group letters are used by the Department of Transportation, Department of Defense and Port Authorities for prescribing safety

equipment, shipping papers, permits, labeling, stowage, material segregation, supervisory requirements, and waivers for the transportation of explosives. [Ref 17, Title 49, Part 173.50]

b. Shipping Papers, Permits, and Safety Equipment

Prior to accepting Class I material for transport, commercial carriers are responsible for ensuring the material is identified on a dangerous cargo manifest. This manifest identifies the material being shipped and lists its hazard classification. Additionally, the carrier must obtain a permit from the U.S. Coast Guard for handling dangerous cargo. This permit certifies that the pier and its equipment are safe for explosives and designates it as an explosive handling facility. Permit requirements include keeping firefighting equipment nearby, no open ignition sources, warning sirens, security guards for preventing unlawful entrance and theft, handling equipment certification, satisfactory lighting, and free space for emergency access. [Ref. 17, Title 33, Parts 126.13-126.37]

The CFR requirements for explosive handling certification ensure safe conditions exist for handling

explosives. However, these requirements also add expense to ammunition shipments. For example, if a pier is not already certified, equipment upgrades, configuration changes and security guards will be required. For piers already certified, there will be expenses for equipment maintenance, inspections, and security guards.

c. Labeling, Segregation, and Stowage

Once a permit is obtained for transporting and loading explosives, specific labeling and stowage requirements must be met.

All explosives are required to have an appropriate label on the outside container corresponding to the division (from 1.1 to 1.6) and the compatibility group letter. This label informs all personnel of the dangers associated with the material and ensures proper identification. Figure 2 shows a sample of these labels. Note that for Class 1.1-1.3, the division number and compatibility group letter replace the double asterisks, while for 1.4-1.6 the compatibility group letter replaces the single asterisk. [Ref. 17, Title 49, Parts 172.411, 172.312, and 173.52]

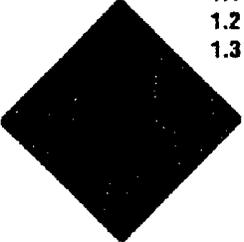
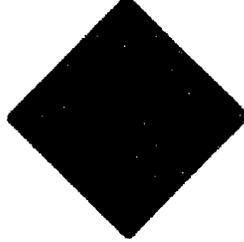
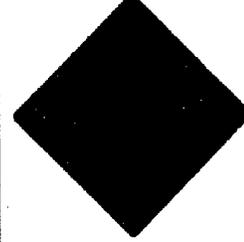
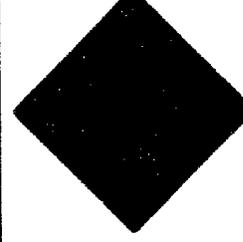
<p>CLASS 1 Explosive 1.1 1.2 1.3</p>  <p>*Include appropriate division number and compatibility group letter.</p>	<p>CLASS 1 Explosive 1.4</p>  <p>*Include appropriate compatibility group letter.</p>	<p>CLASS 1 Explosive 1.5</p>  <p>*Include appropriate compatibility group letter.</p>	<p>CLASS 1 Explosive 1.6</p>  <p>*Include appropriate compatibility group letter.</p>
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Figure 2. Class 1 Explosive Labels

Segregation of Class 1 materials from other hazardous materials aboard ships is required to prevent accidental ignition. Materials such as oxidizing substances, corrosives, flammable gases, flammable liquids, flammable solids, poisons, organic peroxides, and radioactive materials must be separated from explosives. However, the separation varies among the divisions from simply "away from," defined as at least three meters, to separation by compartment or hold. For example, a Class 1.1 explosive must be separated by an intervening compartment or hold from flammable solids while a Class 1.2 explosive must simply be in a different compartment or hold. [Ref. 17, Title 49, Table 176.83]

Ship compartments where Class I materials are stowed must be clean, safe from any sources of fire or ignition, be dry and in a cool part of the ship, have no exposed electrical equipment, and have all cable joint connections enclosed in metal-clad junction boxes. When stowed on deck, containers must be stowed as close to the centerline of the vessel as possible. Any explosives that are sensitive to radar or radio signals must be stowed at a safe distance from all transmitting antennas. This distance is determined by the specific characteristics of the explosives and the signal power of the antenna. [Ref. 17, Title 49, Parts 176.112-176.138]

Segregation of explosive material aboard ship helps prevent accidental explosions. However, this segregation requires additional time for load planning and limits the shipboard locations available for ammunition, both of which increases the expense for ammunition shipments.

d. Supervision

During the loading or unloading of Class I materials, a responsible person with complete knowledge of appropriate regulations must be in attendance. This is to

ensure that all personnel obey rules for handling explosives. [Ref. 17, Title 49, Part 176.104]

e. Waivers

Specific regulations governing explosives for commercial ports may be relaxed by the U.S. Coast Guard. The granting of waivers is a subjective decision, and can be done only when the Coast Guard finds that any of the regulations governing explosives is

not necessary to the safety of security of the port and vessels and waterfront facilities therein, or that its application is not practical because of local conditions or because the materials or personnel required for compliance are not available, or because the requirements of the national defense justify a departure from such provision, the Commandant of the Coast Guard, the District Commander, or the Captain of the Port (local Coast Guard Commander) may waive compliance with such provision, to the extent and under such requirements as they determine. [Ref. 17, Title 33, Part 126.11]

Waivers, when granted, are only for specific regulations covering specific times and shipments. They must be individually requested by the carrier. Additionally, waivers take one person approximately one

working day to obtain. This adds costs to ammunition shipments. [Ref. 17, Title 33, Part 126.11, Ref. 18]

C. MILITARY REGULATIONS

1. Introduction

Military ammunition transportation regulations proscribe safety and security measures, and assign responsibility for ammunition transportation to specific DoD agencies. These regulations cover both commercial and military carriers and are in addition to any local or federal regulations. For example, DoD 6055.9-STD, DoD Ammunition and Explosive Safety Standards, defines net explosive weights (NEW) and gives detailed procedures for calculating the NEW allowed within a certain distance in populated areas. DoD 5100.76-M, Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives, lists very specific security requirements for their transportation. Finally, Defense Transportation Regulation 4500.9-R, Cargo Movement, assigns responsibilities and procedures for moving DoD cargo using commercial or DoD

carriers. Applicable portions of these and other regulations are discussed below.

2. Net Explosive Weights (NEW) - DoD 6055.9-STD, DoD Ammunition and Explosive Safety Standards

This standard is used to protect populations and structures from accidental explosions by limiting the amount or NEW of explosive material allowed within certain areas. For example, the NEW allowed in downtown New York would be much less than that allowed in a wilderness area.

The Department of Defense Explosive Safety Board (DDESB) uses this standard to

provide safety surveys and evaluations of ammunition and explosives facilities and activities worldwide to determine compliance with applicable safety standards and to detect conditions endangering life or property inside or outside DoD installation boundaries. [Ref. 19]

Specifically, DDESB uses the standards and guidelines in DoD 6055.9-STD to establish specific NEWs for commercial and military ports.

The NEW for a specific location is calculated using a quantity distance (Q-D) table and the population of the specific location. The Q-D is the quantity of an explosive

that, if exploded, would cause a limited amount of damage or loss of life outside that distance. There are different Q-Ds for different classes of explosives. Given the different classes being shipped, the Q-D is then overlaid on a local population map to give the maximum NEW for a location. [Ref. 20, p.128-134]

The DDESB has the authority to waive NEW requirements for up to five years. However, waivers are granted only for "strategic and compelling needs" such as an attack on South Korea by North Korea, and only pending correction of the waived condition. [Ref. 20, p.13]

3. Net Explosive Weights (NEW) of Ports

As described above, the NEW allowed varies from port to port, is determined by the DDESB, and is a function of the surrounding population. NEWS for all ports pertinent to this thesis with the exception of Oakland are listed below. The NEW for Oakland will be discussed later in this Chapter.

1. NWS Concord, CA. - 6,000,000-11,235,000 lbs. depending upon the pier.
2. Port Hadlock, WA. - 2,250,000 lbs.
3. Chinhae, ROK - 3,000,000 lbs.

4. Pusan, ROK - 1,500,000 lbs. [Ref. 21, Ref. 22]

The NEW allowed is a controlling factor in the movement of containerized ammunition through ports. Recall that 1772 TEUs of ammunition were shipped during TC95. Since the weight of an ammunition container can exceed 20,000 lbs., a 1,500,000 lbs. NEW can be exceeded with as few as 75 TEUs of ammunition (depending on the type).

4. DoD 5100.76M, Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives

The purpose of DoD 5100.76-M is to set standards and criteria to protect against the loss or theft of AA&E. These procedures apply to DoD components and commercial activities transporting AA&E. The sections that apply to ports and ships will be discussed below.

AA&E are divided into risk categories based on their relative "utility, attractiveness, and availability to criminal elements." [Ref. 23, p.A-1] Specific transportation security requirements are then defined for each risk category. For ammunition, the risk categories are defined below. [Ref. 23, p.A-1]

1. Category I - This category consists of complete explosive rounds for man-portable missiles and rockets. Examples of some man-portable missiles and rockets include Stinger, Javelin, light anti-tank weapon (LAW), and tube launch optically guided weapon (TOW) missiles.
2. Category II - Includes hand or rifle grenades, mines (anti-tank or anti-personnel), explosives used in demolition operations (C-4), and warheads for missiles and rockets under 100 pounds.
3. Category III - This category includes shells and bullets .50 caliber and larger with an explosive filled projectile, incendiary grenades, fuses, blasting caps, and detonating cord.
4. Category IV - This category includes shells and bullets with non-explosive warheads, illumination grenades, riot control agents (tear gas), and any other ammunition not otherwise categorized. [Ref. 23, p.A-2,3]

Most transportation security distinctions occur when ammunition is transported via train or truck. For shipboard movement, ammunition security measure distinctions are made between Category I and Categories II-IV. These requirements are listed below.

1. Category I shipments received or released from commercial or military ports require satellite monitoring (SM) and dual driver protective services (DDPS) to the port of embarkation (POE) and from the port of debarkation (POD). SM is accomplished through the use of transceivers mounted on containers that are queried by satellite to determine location. DDPS requires two personnel maintaining continuous surveillance of the shipment.

2. Category I shipments require that a continuous audit trail from shipper to consignee be maintained.
3. Category I shipments require that each container be checked, sealed and locked in the presence of two responsible agents of the shipper prior to delivery to the carrier. [Ref. 24]

All ammunition categories require the following.

1. Written receipt and release of the ammunition is required from the ship's officer at the POE and the POD.
2. Cargo must be in locked and sealed containers.
3. Containers must be stowed so doors are not accessible to stevedores or ship's crew.
4. Locations of sensitive AA&E must be indicated on the final stow plan for the ship.
5. Vessels moving sensitive AA&E must be U.S. Naval vessels; MSC vessels; or U.S. flagged vessels. [Ref. 23, Table 7-1], [Ref. 24]

The requirements of DoD 5100.76-M increase the time and man-hours needed to move ammunition through ports. Additional inspections are required to ensure that all containers are locked with seals intact and stowed so container doors are inaccessible. These additional procedures slow the loading of containers. This is especially important in commercial ports since higher pierside charges directly increase a ship's operating cost.

**5. Department of Defense Regulation 4500.9-R-1,
Management and Control of the DOD Intermodal
Container System**

The purpose of this regulation is to provide policy for the management and control of DoD owned, leased, or commercially provided containers. The importance of this regulation is the standard prescribed for ammunition shipments. [Ref. 25, p.1-1]

The regulation designates the 20-foot shipping container as the DoD standard for shipping ammunition. The purpose of this standard is to ensure that all DoD components have material handling equipment for 20-foot containers; however, it also excludes 40-foot containers from use. The importance of this exclusion will be discussed in Chapter IV. [Ref. 25, p.1-2]

**6. Department of Defense Regulation 4500.9-R, Cargo
Movement**

This regulation assigns responsibilities for performing DoD traffic management functions. The importance of the regulation to this thesis is that Military Traffic Management Command (MTMC) has been designated by DoD as the point of contact for all matters

pertaining to the establishment, amendment, or clarification of DoD ammunition transportation regulations. Additionally, MTMC is responsible for issuing waivers for DoD regulations and for coordinating any waivers with outside agencies regarding ammunition transportation issues. [Ref. 26, p.204-1]

7. Single Ammunition Logistics Support Agreement (SALS-K)

The SALS-K, signed in 1974, is an agreement between the U.S. and the Republic of Korea (ROK) defining how ammunition is brought into the ROK. Under the terms of this agreement, the ROK Army provides all port handling, inland transportation, storage, security and disposal for ammunition. Additionally, the ammunition pier at Chinhae is the only pier in the ROK designated for ammunition shipping operations. The U.S. acts primarily in a managerial role, ensuring all ammunition shipments conforms to U.S. safety and security regulations. This system benefits the Koreans as the U.S. procures their ammunition, (and ammunition for U.S. forces), while the Koreans control the entry and movement of ammunition within their country. The U.S. benefits by having reduced ammunition material

handling, transportation, and stowage costs. [Ref. 5, p.36], [Ref. 27]

Ammunition safety and security regulations conform to those required by U.S. federal and DoD regulations with ROK Army personnel providing dual driver protective services when required. The one additional requirement is that a ROK Army patrol boat be provided for seaside security during ammunition movement. [Ref. 5, p.36] [Ref. 27]

Moving containerized ammunition into the ROK through any port other than Chinhae is extremely difficult under this agreement. This was shown during TURBO CADS '95, when the ROK, citing terms of the SALS-K agreement, refused to grant permission to transport U.S. ammunition through the commercial port of Pusan.

D. PORT OF OAKLAND REGULATIONS

1. Port of Oakland Tariff No. 2A

The Oakland Board of Port Commissioners has established additional requirements before explosives are allowed within the port area. These regulations primarily deal with the quantity and time that explosive material is allowed within the port. They are summarized below.

1. A Port of Oakland HAZARDOUS MATERIALS HANDLING PERMIT (HMHP) must first be issued by the Oakland Board of Port Commissioners. This permit ensures Port Authorities are aware of shipments, and applicants are familiar with shipment requirements.
2. All explosives must be stowed or contained within sealed hatches or shipping containers prior to entering the port unless specific permission is granted on the HMHP.
3. Class 1.1, 1.2, and 1.3 explosives are limited to a total amount of 13.5 tons net explosive weight (NEW) within the port at any one time. NEW is defined as the total weight of the explosive material. For example, the NEW of a bullet would be the weight of the gunpowder, and wouldn't include the casing and bullet weight.
4. Class 1.1, 1.2, and 1.3 explosives can't remain on the pier longer than two hours, must be loaded on the ship just prior to departure and unloaded as early as possible after docking.
5. Class 1.4 and 1.5 explosives are limited to a total of 100 tons NEW within the port at any one time.
6. Class 1.4 and 1.5 explosives can't remain on the pier longer than 24 hours.
7. Movement of larger quantities of Class 1.1 through 1.5 explosives through the port will be considered only on an individual basis. [Ref. 28, Section III]

These regulations are in addition to those specified or stated in Title 49 of the CFR. They involve quantity and time restrictions and require no additional equipment. Exceptions to these regulations require special permission from the port and are only considered for individual shipments. [Ref. 18]

The important point with these regulations is the NEW restrictions. Depending on the specific ammunition type, the NEW of the port can be exceeded with just two TEUs of Class 1.1 explosive. Unless these restrictions are relaxed, the 1772 TEUs moved during TC95 would require more than one year and over 800 ships to move through the Port of Oakland. Due to the large population nearby, Port Authorities will not easily waive these requirements. This makes regular ammunition shipments through the Port of Oakland improbable. [Ref. 18]

E. SUMMARY

This chapter described various regulations controlling the movement of containerized ammunition through military ports and the commercial ports of Oakland, CA., Pusan, ROK, and Chinhae, ROK. Ammunition movement through Pusan is prohibited by the SALS-K, while movement through Oakland is severely limited by the low NEW listed in the Port of Oakland Tariff. Additional expenses associated with ammunition movement through commercial ports include pier and explosive segregation requirements listed in the CFR and military regulations requiring container inspections

and guards. Viewed together, the CFR, military regulations and local commercial port regulations make moving ammunition through commercial ports more difficult and expensive than through military ports.

IV. COMMERCIAL AND POLITICAL CONSIDERATIONS

A. INTRODUCTION

This chapter examines how the commercial shipboard movement options used or attempted during the TURBO CADS (TC) exercises fit with commercial ocean liner business strategies. This chapter will look at political sensitivities associated with ammunition transportation through commercial ports and the decreasing commercial use of 20-foot shipping containers.

B. TURBO CADS MOVEMENT OPTIONS

Recall the TC discussion in Chapter II. TC94 used two self-loading and unloading (self-sustaining) ships, one from the Ready Reserve Fleet (RRF), and one chartered. TC95 attempted and failed to use commercial ocean liner service through to the commercial port of Pusan. The ammunition was finally moved with a Military Sealift Command chartered small containership and an ocean-going tug and self-sustaining barge chartered from Crowley Maritime Services, Inc. TC96 was canceled and TC97 used a

RRF lighter aboard ship (LASH) vessel modified to allow stacked containers to be carried in the LASH barges.

In an effort to understand why commercial ocean liner service failed while charter worked, these modes are discussed below.

C. COMMERCIAL OCEAN LINER BUSINESS STRATEGIES

Commercial ocean liners offer regularly scheduled transportation service between ports much the same as commercial airliners move passengers. Like the airlines, these companies know that when a ship is not underway moving containers, it is not making money. Commercial ocean liners expand this premise and base their business strategy on maximizing ship usage and volume carried while maintaining schedules. The time a ship spends in port is minimized, companies get more business when schedules are met, and are paid by volumes transported. [Ref 29, 30]

1. Routing and Scheduling

Efforts to maximize ship usage have changed ship routing. Ships no longer travel back and forth between two ports, but travel in a circular route, stopping at many

different ports along the way much like a city bus route. An example of this can be seen in how two shipping companies, Sea-Land and American President Line (APL), route cargo between Oakland, CA. and Pusan or Chinhae, ROK. These companies are used since they are the two major U.S. flagged carriers operating between Oakland and the ROK. The shipping routes are as follows:

Sea-Land: Oakland, CA to Dutch Harbor, Alaska to Yokohama, JA, to Pusan, ROK to Kwang Yang, ROK to Kaoshiung, Taiwan to Naha, JA, to Shangai, PRC to Kwang Yang, ROK to Pusan, ROK to Yokohama, JA, and back to Oakland, CA.

Note: Ships arrive and depart on the same day. Sea-Land will offload at Kwang Yang and truck cargo to Chinhae. Cargo does not change ships. [Ref. 31]

APL: Manzanilla, Mexico to Los Angeles, CA, to Oakland, CA, to Kaoshiung, Taiwan to Naha, JA, to Pusan, ROK to Hakata, JA, to Yokohama, JA, to Oakland, CA, to Los Angeles, CA, and back to Manzanilla, Mexico.

Note: Ships arrive and depart on the same day. APL does not offer service to Chinhae, ROK. Cargo does not change ships. [Ref. 32]

Stops at each port vary from a couple of hours to a maximum of one day, with ships leaving port as soon as possible. The time variance is due to differing amounts of cargo at each port and the different speeds that ports load and offload containers. Slack time is built into the

schedule to buffer unforeseen events such as bad weather or unusually long port turnaround times. Maintaining the published schedule is of paramount importance. [Ref. 30, 31, 32]

Sea-Land and APL use ships that carry approximately 3000 TEUs for the routes listed above. There are two departures per company per week, for a total capacity of 12,000 TEUs weekly. The advertised time between Oakland, CA and Kwang Yang, ROK is 14 days for Sea-Land, and between Oakland, CA and Pusan, ROK is 17 days for APL. [Ref. 31, 32]

It is important to note that a commercial ocean liner carrying containerized ammunition from Oakland, CA to the ROK would have to comply with ammunition transportation regulations in every port where it stopped. That is the primary reason why APL and Sea-Land (and all other eligible commercial liner companies) refused to bid on the TC95 contract requiring ammunition transportation from Oakland to either Pusan or Chinhae, ROK. Lack of volume is the second reason. [Ref 5, 30, 33, 34]

Compare the volume of ammunition shipped during the Pacific TC's exercises (1387 TEUs in TC94 and 1772 TEUs in TC95) with the capacity of the ocean liners. Sea-Land has

the capability of carrying 6000 TEUs per week or 312,000 TEUs yearly from Oakland to the ROK. Dividing the 1772 TEUs shipped during TC95 by the 312,000 yearly capability shows that that business would be only .6 percent. Additionally, since both APL and Sea-Land are using 3000 TEU ships, one ship would be able to haul the ammunition moved in either TC94 or TC95. With this small volume, it is not surprising that commercial liners refused to modify their routes to pick-up ammunition at NWS Concord, CA, or Port Hadlock, WA. [Ref. 30, 33, 34]

D. COMMERCIAL CHARTER

Commercial charter consists of renting a vessel, including crew, for transportation. As discussed previously, this was done in TC94 and TC95. During the exercises, two types of charter were used.

The first was the chartering of containerships. For this, Military Sealift Command requested bids from U.S. flagged charter service companies. The lowest bid meeting capacity and date requirements was used. This method successfully obtained the needed ships. [Ref. 13]

The second charter used was an ocean-going tug with self-sustaining barge. This was successfully employed during TC95 after commercial liner service failed. It had the advantage of being cheaper (smaller crew and lower fuel costs) than a containership charter but with an average speed of 8 knots, it was significantly slower than the 13 knot speed of the average containership. [Ref. 5, 34]

E. FUTURE AMMUNITION CONTAINER AVAILABILITY

1. Introduction

As noted in Chapter III, military regulations require the use of TEU shipping containers for moving containerized ammunition. However, current trends in the commercial shipping industry are moving quickly towards using forty foot equivalent unit (FEU) containers. This trend and its implications are discussed below.

2. Move to Forty-Foot Containers

Beginning in the 1970's, new containership construction began changing from those with a predominance of TEU container slots to FEU slots. Efficiency drove this

change as TEU containers require twice the handling and lifts for the same cargo carried in FEU containers. Currently, in the U.S. flagged fleet, 77 percent of shipboard container slots are configured for 40-foot containers. [Ref 35, p.D-4-5] Today, containerships contain a large percentage of FEU slots with only a handful of TEU slots. Current containership construction shows this trend will continue to reduce the slots available for TEUs. [Ref. 30, 34, 35, p.D-4-5,6]

3. Implications

The exclusive use of TEUs for ammunition transportation limits the military's options when considering movement by commercial ocean liner or chartered vessel. Also, leaving the FEUs open on chartered vessels decreases efficiency and can affect vessel safety. Depending on the location of the TEU cells, loading a vessel with only TEUs can cause trim and stability problems if the FEUs are not used. [Ref. 34, 35, p.D-4-5]

4. Possible Solutions

The simplest solution would be to change DoD policy requiring exclusive use of TEUs for ammunition. This will

expand vessel selection, and increase efficiency by allowing use of FEUs. Military ammunition ports are equipped to handle both TEUs and FEUs. However, ammunition depots and military bases would be required to upgrade container handling equipment (CHE) to allow the use of FEUs. [Ref. 35, p.D-4-5]

Another option would be the use of pontoons along with the newly developed container Quick-tie. The Quick-tie links join two 20-foot containers together, allowing them to use the 40-foot container cells. The pontoon sits under the lowest container and provides center support to allow other containers to be stacked on top. Figure 3 shows how pontoons and Quick-ties would be utilized using 20-foot containers in 40-foot cells.

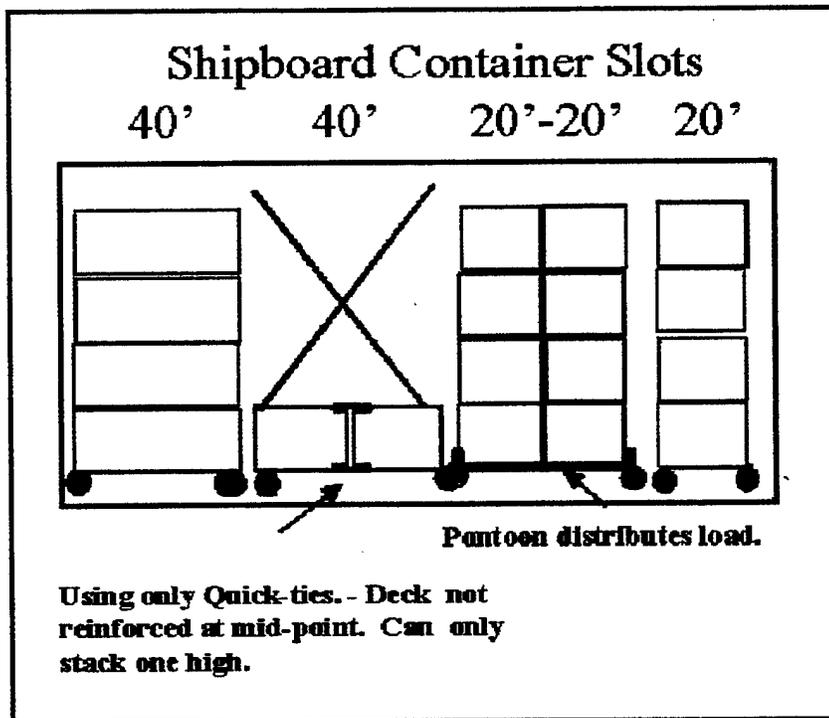


Figure 3. Use of Quick-ties and Pontoons

Once the linked containers reached a military port, they could be unlinked allowing use of 20-foot CHE.

F. POLITICAL CONSIDERATIONS

Public perception is an important factor in deciding how and where ammunition will be moved. This becomes even more important in a peacetime environment where threats to national security are low. Current ammunition transportation practices have significantly lowered the

risk of accidental explosions during ammunition transportation. However, the public must also perceive that ammunition transportation holds little threat to their safety.

This section will briefly look at the current ammunition transportation safety record and show how public perception can affect ammunition transportation.

1. Safety Record

On July 17, 1944, 320 people were killed and another 390 wounded in a huge explosion that occurred while loading ammunition onto two ships at the U.S. Naval Magazine, Port Chicago, CA (now Naval Weapons Station Concord). This explosion had the force of 5,000 tons of dynamite, was felt as far away as Nevada, destroyed a train, a 1200 foot pier, sank one ship, and reduced another ship to pieces no larger than an automobile hood. The cause of the explosion was never determined. [Ref. 36, 37]

In response to this accident, and to previous accidents such as a 1926 ammunition explosion at Lake Denmark, NJ, strict military and federal ammunition transportation regulations were introduced. Since 1944, enforcement of these regulations has prevented any major

accidental explosions while transporting U.S. ammunition.

[Ref. 36, 37]

2. Perception vs. Reality

In 1972, a haunting photo of a young Vietnamese girl, running naked down a road after being badly burned in a napalm raid, was published in U.S. papers. This photo and the accompanying description of how napalm was used were permanently etched into public memory. Today, the word "napalm" still evokes horrible images. [Ref. 38]

In December 1998, the U.S. Navy announced plans to ship Vietnam-era napalm from storage in CA to Pollution Control Industries, a commercial recycling plant in Chicago, IL for conversion into alternative fuel. A political firestorm ensued. Two U.S. Representatives, Peter J. Visclosky of Indiana and Rod R. Blagojevich of Illinois used the public perception and fear of napalm to cause PCI to back out of their contract with the U.S. Navy. [Ref. 39, 40]

The public's fear was unfounded. Napalm is not a high explosive; it's a mixture of gasoline and plastic. In fact, it requires a detonator to ignite and according to the U.S. Environmental Protection Agency, is safer to

transport than gasoline. Since the detonators had been removed, the napalm held less explosive risk than gasoline delivery trucks. [Ref. 41, 42]

Once PCI backed out of its contract to recycle the napalm, the U.S. Navy began receiving calls from companies wanting to take over the job. GNI Group Inc. of Houston, TX was selected for the job. Houston area residents were also given information by the U.S. Navy on the public risks of napalm. Additionally, the Houston Chronicle published a lengthy question and answer article about the upcoming napalm recycling. Although there were some local protests about the napalm shipments, they quickly died down. As of January '99, the recycling of Vietnam-era napalm continues in Houston. TX without protest. [Ref. 40, 41]

DoD should carefully consider public perceptions when considering ammunition transportation routes and modes. Public relations programs designed to educate the public on the actual risks posed by ammunition transportation are important.

G. CHAPTER SUMMARY

This chapter reviewed the failure of attempts to use commercial liner service for moving containerized ammunition during TURBO CADS exercises. The reasons for this failure include current ship routing, commercial port regulations, and the low volume of ammunition to be shipped. The low volume offered up by the government doesn't make it worth commercial liners' time to change ship routing to call on military ammunition ports or deal with ammunition transportation regulations in commercial ports.

DoD must take steps to ensure that the public is provided accurate information on the risks of moving ammunition through commercial ports. Without this information, local politicians and activists may use the negative perceptions from previous accidents to prevent ammunition movement through commercial ports.

Using commercial chartered containerships or ocean going tugs and self-sustaining barges through military ports have been the only successful commercial methods for moving containerized ammunition. These methods may also be jeopardized by the continuing reduction of TEU slots unless

the military shifts to FEU ammunition transportation containers or adopts TEU containers for use in FEU slots.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

Decreasing U.S. military budgets have caused DoD leaders to search for cost savings by adopting commercial practices and outsourcing military jobs to commercial counterparts. The transportation of ammunition is one of these areas.

In 1992, USCINCPAC determined that the current ammunition transportation system relied too much on breakbulk movement. The following year, USTRANSCOM began devising and funding the TC exercises, whose purpose was to develop a containerized ammunition delivery system (CADS) for DoD.

The TC exercises developed the military's CADS and partially proved the concept of commercial containerized ammunition shipments. However, they also showed that federal, military and local regulations as well as international agreements have a large impact on where and how ammunition can travel. Federal regulations strictly control the conditions and permits required prior to moving explosive material. Military regulations add NEW limits as

well as security and inspection requirements to ammunition shipments. Added to these are local commercial port regulations that can limit the NEW within the port as well as the length of time ammunition can remain in port. These regulations severely restrict ammunition shipments through commercial ports. Finally, the SALS-K agreement with the ROK limits ammunition shipments to the military pier at Chinhae.

Business practices also affect commercial ammunition movement. Ocean liners base their business strategy on using regularly scheduled service to maximize the volume carried as well as ships' usage. Ammunition loading and inspection requirements increase port turn-around times, which increase ships' operating costs. Additionally, shipping companies will not divert liner service to military ammunition ports for low volume and infrequent peacetime ammunition shipping requirements.

Military regulations requiring the use of TEU containers limit commercial options since 77 percent of commercial capacity uses FEU containers. Ways to alleviate this problem include changing the regulation to allow the use of FEU containers or using equipment that joins two TEU containers together allowing use of FEU slots.

It is important that military leaders recognize that public perception regarding ammunition transportation can affect movement options. Military leaders must take steps to educate the public on current ammunition transportation safety records. Without this information, local activists may use the negative perceptions from previous accidents to prevent ammunition movement through their area.

B. CONCLUSIONS AND RECOMMENDATIONS

- 1. Conclusion: It is not feasible to move peacetime ammunition shipments through commercial ports.**

This was shown during TC95 and is supported by regulations and commercial business practices. For example, without waivers to Oakland's ammunition transportation regulations, ships could be limited to as few as two ammunition containers. It would be highly unlikely for Oakland to grant regular waivers to a regulation specifically put in place to limit the port's NEW.

Recommendation: Use military ammunition ports to move peacetime ammunition shipments.

Military ammunition ports have the NEW capacity and experience to handle large quantities of ammunition.

- 2. Conclusion: Commercial ocean-going tug with self-unloading barge is the most effective way to commercially transport ammunition overseas.**

This method was successfully used during TC95. Though slower than chartered containerships, it is less costly and more flexible, allowing ammunition movement into ports with limited CHE.

- Recommendation: Use commercial ocean-going tug with self-unloading barge for peacetime ammunition shipments.**

The TC95 after action report recommended this method for incorporation into OPLANs.

- 3. Conclusion: The TEU container is being phased out of commercial transportation systems.**

Currently 23 percent of slots on containerships are for TEU containers. Industry trends show TEU container slots and availability will continue to fall as commercial companies reduce container handling costs by moving to FEU containers.

Recommendation: DoD needs to review its policy of using only TEU containers for ammunition transportation.

There are two ways to go. The first would be to change the policy and allow FEU containers for ammunition movement. This has the advantage of reduced container handling costs and commercial availability, but would require DoD to spend money to upgrade CHE for FEU containers. The second option is to use existing technology to join two TEU containers together to fit in FEU slots. This would probably be cheaper, but may require DoD to maintain a fleet of TEU containers if they are commercially phased out.

4. Conclusion: Public perceptions on ammunition transportation safety can stop ammunition shipments.

This happened when DoD attempted to ship old napalm to Illinois for recycling. Although the napalm held less explosive risk than gasoline tank trucks, politicians and activists fanned negative public perceptions into protests and stopped the shipments.

Recommendation: Ensure that the public gets factual data on ammunition transportation risks.

Once DoD and local newspapers presented the factual hazards posed by napalm transportation, the shipments were sent, without protest, to a Houston area plant for recycling.

C. RECOMMENDATIONS FOR FURTHER STUDY

- 1. Determine the best way to move ammunition during a major regional or local regional conflict.**

Analyze the best mode for moving the higher quantities of ammunition required overseas during wartime. The research would focus on the question of what mode to use and also on the availability of sufficient commercial assets for the quantities required.

- 2. Determine the cost to upgrade CHE at DoD ammunition facilities to handle FEU containers.**

This research would look at DoD ammunition depots, ports and transportation units to determine the cost of upgrading their CHE to handle FEU containers.

- 3. Determine if DoD should change the regulation requiring TEU containers for ammunition shipment to allow FEU containers.**

This research would look at future forecasts of commercially available TEU containers. It would answer the question of whether DoD should continue to use TEU containers and adapt them to FEU slots or switch to FEU containers and upgrade CHE.

- 4. Determine if the port of Chinhae has enough capacity to support a Korean MRC.**

The SALS-K requires that all ammunition brought into the ROK go through the military pier at Chinhae. This research would determine if Chinhae had the container throughput capacity to support a Korean conflict.

LIST OF REFERENCES

1. Muller, Gerhardt, "Intermodal Freight Transportation" Third Edition, Eno Transportation Foundation, Lansdowne, VA., 1995.
2. Mobility Requirements Study, U.S. Joint Chiefs of Staff, January 1992.
3. Telephone conversation with LTC Darrell Roll, U.S. Transportation Command, Mobility Analysis Division, April 3, 1998.
4. United States Transportation Command, "TURBO CADS 1994 After Action Report," 1994.
5. United States Transportation Command, "TURBO CADS 1995 After Action Report," 1995.
6. United States Transportation Command, "TURBO CADS 1996 After Action Report," 1996.
7. United States Transportation Command, "TURBO CADS 1997 After Action Report," 1997.
8. Joint Chiefs of Staff, "A Joint Logistics Roadmap, Joint Vision 2010 Focused Logistics," 1998.
9. Industrial Operations Command Website <<http://www.ioc.army.mil/home/elements/tiering.htm>>, May 16, 1998.
10. Field Manual No. 100-10, Combat Support Operations, Headquarters, Department of the Army, Washington DC, October 1995.
11. Hancock, Sam R. and Lee, Peter J., "The Ammunition Supply Chain and Intermodalism: From Depot to Foxhole," NPS Thesis, 1998.
12. United States Transportation Command, "Today's Vision Leads to Tomorrow's Reality," Pamphlet 35-1, USTRANSCOM Public Affairs Office, September, 1997.

13. Telephone conversation with Mr. Gary Adams, Chief, United States Transportation Command Intermodal Team, August 4, 1998.
14. United States Transportation Command, "TURBO CADS '95 Briefing Slides," Scott Air Force Base, IL (Unpublished).
15. United States Transportation Command, "TURBO CADS '97 Briefing Slides," Scott Air Force Base, IL (Unpublished).
16. Mathews, James K. and Holt, Cora J., "So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Storm," Joint History Office, Office of the Chairman of the Joint Chiefs of Staff and Research Center, United States Transportation Command, 1995.
17. U.S. Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, 1997.
18. Telephone conversation with Warrant Officer Martin, U.S. Coast Guard Marine Safety Office, San Francisco Bay, August 17, 1998
19. Department of Defense Explosive Safety Board Website <<http://www.acq.osd.mil/ens/esb/esbhompb.html>>, Nov 20, 1998.
20. Department of Defense Instruction 6055.9-STD, "DoD Ammunition and Explosive Safety Standards," Department of Defense, August, 1997.
21. Military Sealift Command, Amendment of Solicitation/Modification of Contract N62397-94-R-9424 for TURBO CADS '95
22. E-mail from CDR Lou Walker, USTRANSCOM TCJR-J1, November 23, 1998.
23. Department of Defense Manual 5100.76-M, "Physical Security of Sensitive Conventional Arms, Ammunition and Explosives," Department of Defense, September, 1992.

24. Military Traffic Management Command, "Force Protection," Volume 33, 2nd Qtr, FY-97.
25. Department of Defense Regulation 4500.9-R-1, "Management and Control of the DOD Intermodal Container System," Department of Defense, Apr 11, 1997.
26. Department of Defense Regulation 4500.9-R, "Defense Transportation Regulation Part II, Cargo Movement," Under Secretary of Defense for Acquisition and Technology, August, 1998.
27. Telephone conversation with CDR Lou Walker, USTRANSCOM, TCJ4-J1, Nov 24, 1998.
28. Port of Oakland, Tariff No. 2A, "Hazardous Materials Rules and Regulations," The Board of Port Commissioners, Port of Oakland, July, 2, 1996.
29. International Transportation Management course (MN 4373), Taught by Prof. J. Feitler, Naval Post Graduate School, Jan-Mar 1998.
30. Conversation with Mr. Lou Lambremont, Director of Government Marketing, Sea-Land Service Inc., Oct 29, 1998.
31. Telephone conversation with Ms. Danie Jackson, Sea-Land Service Inc. Customer Service Representative, Long Beach, CA., Dec 21, 1998.
32. Telephone conversation with Mr. Tony Tsang, American President Line Freight Scheduler, Oakland, CA., December 21, 1998.
33. Telephone conversation with Mr. Gary Adams, USTRANSCOM TJ4-LT1, August 20, 1998.
34. Telephone conversation with MR. Kevin Tokarski, U.S. Maritime Administration, (MARAD)/USTRANSCOM Liason Officer, August 13, 1998.
35. Naval War College, "JORDWAR 1997 Final Report," 1997.

36. Port Chicago National Memorial plaque, Located near the Current ammunition piers, Naval Weapons Station, Concord, CA., viewed October 29, 1998.
37. New York Times Special, "Bitter Reminder of a Lethal World War II Tragedy," New York Times, July 18, 1994, p. A10.
38. Gordon Dillow, "Napalm Flaap is Heated, but Misguided," The Orange County Register, April 19, 1998, p. B1.
39. David L. Haase, "Congressman Challenges Navy's Plan to Recycle Napalm in Indiana," The Indianapolis Star, December 31, 1997, p. B1.
40. Terry Collins, "Napalm's Trek Turns Back to California," The Kansas City Star, April 17, 1998, p. C1.
41. Staff Writers, "Some Deer Park Residents Hot Over Napalm," The Houston Chronicle, July 16, 1998, p. 6.
42. William Booth, "Napalm Explodes on the Political Front," The Washington Post, April 15, 1998, p. A3.

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