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PREPARED BY
JOINT CONVENTIONAL AMMUNITION PROGRAM
PACKAGING AND PRESERVATION TASK GROUP

29 JUNE 1977

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Joint Conventional Ammunition Program
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Relation of packaging to ammunition reliability and safety is outlined. History and rationale of development of joint conventional ammunition packaging policies and procedures are reviewed. Current effectiveness of these procedures is appraised. Over $2 million savings from investment of $0.15 million in the Container Design Retrieval System are cited. Specific ammunition packaging problems discussed are: large projectiles, small arms, fuzes, and

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unit loads. A qualitative appraisal is given of possibility of centralizing package design cognizance or, alternatively, of centralizing by technology specialization. Report concludes with recommendations for future action.

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EXECUTIVE SUMMARY

BACKGROUND

1. The Joint Technical Coordinating Group on Packaging (JTCG/PKG) includes in its charter the function of reduction of such duplication of effort in packaging throughout DOD as may be found. Approximately 20 percent of DOD's in-house packaging personnel are concerned with packaging ammunition.

2. No survey of packaging activity in DOD can be considered complete without including the activities of the ammunition packaging community. Accordingly, the JCAP Packaging and Preservation Task Group, which has been particularly active in ammunition packaging standardization, agreed to respond to any questions that JTCG/PKG cared to ask. This report is the result.

DISCUSSION

1. The historical role of ammunition and its packaging in the art of war is sketched. Since earliest time the role of the package has been, and still is, to insure that ammunition is delivered to the user, wherever and whoever he may be, with no loss of the reliability or safety built in when the item was produced thousands of miles away and, possibly, decades earlier. The $15.1 billion size of the ammunition production base and some wartime production rates, such as 84 million rounds of 105MM ammunition shipped to SE Asia, are quoted. Seven storage and transportation external interfaces for the ammunition package are identified as well as eight user interfaces which must be satisfied by the designer. Typical work breakdown structures which integrate package development with round development are shown. Twelve joint and individual Army Regulations covering ammunition package development are identified. Change control procedures and feedback procedures from the field are also explained.

2. Using the foregoing frame of reference, the role of the JCAP JOPP and the regular meetings of the JCAP Packaging and Preservation Task Group in controlling duplication of effort is stressed. As of the date of this report, there are no known duplications of effort. Task Group efforts have resulted in progress in developing a Life Cycle Packaging Cost Model is mentioned and 34 examples of interservicing are given.

3. The complete rationale underlying the differences in palletizing Army and Navy projectile is given. The differences are, fundamentally, based on Service logistic differences. Both methods represent packaging reduced to the minimum to satisfy customer needs, and the costs are comparable.

4. The 18 basic types of small arms ammunition are identified, plus the variants dictated by customer desire, such as clipped, linked and in bulk. Development history of the various metal boxes used for small

arms ammunition is traced and reasons for standardization on the M2A1 and M19A1 series boxes are given. The basic standardization achieved is at the container level, with inner packaging arrangements, and quantity per unit package, being dictated by customer desires.

5. The unit load is an extension of the package. In fact, most definitions of packaging include palletizing as an integral part of the function. This one factor explains why several activities are involved in the design, test and evaluation of unit loads. Normally, the Services accept each others unit load designs. This has been made easier by the Task Group's sponsoring MIL-STD-1660, Design Criteria for Ammunition Unit Loads. Two areas of exception to interservicing are discussed and the basic management tools to prevent unnecessary duplication are reviewed. Such differences as remain are known and are based on differing, identified, Service logistic factors.

6. Some semantic difficulty was encountered in answering the question: Are packaging organizations conducting developmental testing on like or common items? The word developmental was interpreted to mean any work in support of design, either RDT&E or Product Improvement, but excluding routine quality assurance. Like items were construed to mean either a similar packaging process or material or an ammunition item sufficiently similar, even though not necessarily functionally interchangeable, to warrant consideration of a standard package. A common item is characterized by a single DODIC/NALC and is readily interchangeable between the Services. With these definitions, there is no duplication in the materials or process area. Some known controlled effort is occurring, or has just occurred, in the packaging of flares, the development of restraint systems for ammunition loaded in commercial ISO transport containers, and in packages for some 38 items of Army ammunition used by the Marine Corps where the quantity per unit pack must be reduced to comport with Marine Corps combat usage rates. No other duplications of effort exist and each case cited has passed critical review for necessity.

7. In order to answer questions concerning fuze packaging, the role of fuzing in ammunition performance effectiveness is sketched. It is pointed out that all explosive rounds have a fuze and that, therefore, there may well be as many different fuze package designs as there are fuzes. Most fuzing is, however, applied during load, assemble and pack of the final round. Significant exceptions, where fuzing is accomplished just prior to combat usage, are in bomb fuzes and Army artillery fuzes. There are about 40 different fuzes theoretically available for use in bombs. Package designs for some of these fuzes go back to World War II. For current procurements, however, the Air Force has standardized on two fuzes as being most compatible with their mission and perceived targets while the Navy is procuring only three types. For projectile fuzes there is a Navy bulk pack (since Navy projectiles are distributed fuzed) and an Army user pack. Even greater package standardization is expected from phase-in of usage of the NATO fuze shape for artillery rounds.

8. The question was also asked: Is there any reason why fuze packaging could not be performed by one activity? From a technical standpoint, the answer is that it could be but it is questionable whether management efficiency would be gained. This answer is gone into in greater detail later. In any case, however, firm decisions should be delayed pending rationalization of fuze RDT&E functions being conducted by the JLC chartered Fuze Management Organization.

9. To respond to questions concerning industry interfaces, the close continuing relation with the American Defense Preparedness Association (formerly American Ordnance Association) is stressed. In addition, procurements prior to full scale production can involve very many rounds and both the package suppliers and the contractors who will perform the packaging operations are given ample opportunity to recommend changes which will enhance producibility, improve performance or cut cost without loss of performance.

10. The packaging history for 20MM rounds is reviewed to provide a frame of reference for the variety of ammunition boxes used and the internal packaging configurations available to satisfy customer demands. It is noted that the Navy's MK 1 MOD 0 small arms ammunition box was introduced during or just prior to World War II whereas the M548 box, developed by the Army, was not Type Classified until 1970. Under present safeguards, it would be very difficult, indeed, to start development of the M548 box yet, on an initial investment basis, use of the M548 is approximately 1 cent per round cheaper. This differential is to be multiplied by a wartime production rate of 10,000,000 rounds per month to arrive at a total cost differential. When new rounds are proposed, the M548 is the container of choice.

11. Considerable discussion is devoted to the possibility of centralizing all package design and testing into a single activity. Technically it could be done but it appears, based on experience gained with an Air Force laboratory and a Navy laboratory that certain inevitable undesirable consequences would ensue:

a. Military construction would be required to house the larger single organization and additional testing facilities needed;

b. Vital highly specialized skills, built up over the years, would be lost as older personnel refused the move. This expertise would not be restored for five to ten years.

c. Responsiveness to the needs of the individual Service, more particularly to the paramount needs of the operating forces, would be difficult (if not almost impossible) to achieve.

d. If responsiveness were lost, the activity would become a useless economic burden.

12. Finally, the JTCG/PKG asked: Serious consideration is being given to assigning lead laboratories for materials testing and packaging processes. Would a similar concept apply to ammunition packaging? The ammunition packaging community is now specialized towards the type of round being packaged. A package designer for a specific round must have access to all the disciplines which combine to form the art of packaging. Nevertheless, and for a variety of reasons, some 13 areas of specialized expertise have evolved in the ammunition packaging community which require recognition by the remainder of the DOD packaging community. In ammunition packaging, it is standard practice for each activity to consult the experts before proceeding independently. Further, work and funds flow to the expert depending upon the nature of the help needed.

CONCLUSIONS

1. Ammunition packaging is important to the ability of the United States to conduct military operations. It achieves this status by being a part of the configuration of the round delivered to the user and performing the role of insuring that round reliability, as produced, is not degraded by prolonged storage nor by physical distribution to the user.

2. Ammunition packaging involves a host of individual item packaging problems, which must be solved expeditiously and responsively. About 22,000 individual line items are involved. Each of these line items has an engineered, tested and safety certified package.

3. Differences in ammunition logistics and employment by the using Service combat units often dictate differences in details, even where the round is similar or, even, identical. The standardization problem is to insure as much commonality as possible while insuring that customer needs are satisfied. The latter is paramount.

4. Some duplication of effort in ammunition packaging, has occurred in the past. Through joint efforts, such as those of the JCAP Packaging and Preservation Task Group, common procedures and management techniques have been effective and there is currently no known duplication of work in the ammunition packaging community. These joint efforts are worth continuing.

5. The ammunition packaging community is integrated through common policies and procedures and regular interchanges of information, direct with each other and through joint service coordinating groups. Consolidation into a single activity would not improve this condition.

6. Immediate consolidation of the ammunition packaging community into a single organization would be counterproductive.

7. The ammunition packaging community can absorb changes in design cognizance for specific items on a case by case basis. The logical way

to do this is to have package development responsibility follow item development responsibility.

RECOMMENDATIONS

Based on the information contained herein and the conclusions which can reasonably be drawn therefrom, it is recommended that:

1. A centralized laboratory to perform all package testing not be established.

2. The existing concept of division of design responsibility and expertise in the ammunition packaging community be left substantially as it is.

3. Transfer of ammunition packaging design and test cognizance between the Services be keyed only to, and be a part of, any transfer between the Services of end item design cognizance.

4. The Container Design Retrieval System, developed by the ammunition packaging community, and used by it, be adopted and used by the entire DOD packaging community.

5. The non-ammunition packaging community in DOD take advantage of the expertise and knowledge gained by the ammunition community. This applies with particular emphasis to the packaging of hazardous materials, where ammunition's safety record is exemplary.

6. The methodology adopted and the success achieved by the ammunition packaging community in arriving at consistent management and standardized packaging be taken as a model of what can be accomplished by the rest of the DOD community.

7. The JCAP Packaging & Preservation Task Group continue as a functioning entity.

8. This report, in its entirety, be included in any report to be submitted to the JLC by JTCG/PKG on rationalization and standardization of all DOD's packaging.

SECTION I

BACKGROUND

1. The Joint Technical Coordinating Group on Packaging, (JTCG/PKG) was chartered by the Joint Logistics Commanders (Commander, Army Development and Readiness Command; Chief of Naval Material; Commander, Air Force Systems Command; and, Commander, Air Force Logistics Command). Hereinafter, the Joint Logistics Commanders will be referred to by the acronym JLC.

2. Pursuant to its charter to reduce overall duplication of effort in packaging JTCG/PKG formed an Ad Hoc Committee on Packaging Capabilities to explore: who was in the packaging management, administration, test, and evaluation business in the Department of Defense; what test facilities they had; and what they considered to be their technological strengths in the collection of technical disciplines that combine to form the art of packaging. In this latter connection, packaging is most conveniently defined as the art of preparing goods for safe and reliable physical distribution.

3. The preliminary survey conducted by the Ad Hoc Committee showed that 15-20 percent of DOD's in-house personnel were involved in packaging ammunition.

4. It is self-evident that no report to the JLC involving packaging capabilities, and possible methods of eliminating duplication of effort, would be complete without including the packaging efforts of the ammunition community.

5. Within the foregoing frame of reference, the JCAP Packaging and Preservation Task Group agreed to respond, through channels, to any and all questions asked by JTCG/PKG's Ad Hoc Committee. The specific questions are shown in Appendix A.

6. This report is an in-depth response to the questions asked and draws the appropriate conclusions and recommendations.

SECTION II

DISCUSSION

A. GENERAL.

1. Before entering into detailed response to the specific questions asked, we must establish the frame of reference within which ammunition packaging efforts are conducted. This background makes each answer to an individual question a part of a coherent whole. A package for a given ammunition end item uses the same industrial base as does the package for anything else, e.g. paper and paperboard, wood, metal and the almost infinite variety of plastics. The basic engineering principles are substantially similar in that ammunition packagers are concerned with techniques for deterioration prevention and the mechanical engineering of structures which will withstand the rigors of the transportation, handling, and storage environment. The paragraphs which follow delineate some of the more cogent reasons for the existence of this specialized sub-set.

2. Ammunition is the leading edge of the Armed Forces' ability to conduct military operations when and where the national leadership directs. Over the centuries, man has fought effectively in rags, without medical attention, without transportation other than his own feet, and even without food or shelter beyond that which he could scrounge while living off the country. Since the discovery of projectiles, be they stones, javelins or arrows, however, soldiers have been unable to fight effectively for any length of time without ammunition. In olden days, the victor in an engagement could usually resupply himself with used rocks, spears and crossbow quarrels from the battlefield. With the advent of gunpowder, the basic precursor to all high explosives, the soldier became dependent upon a supply chain starting with the primitive industrial processes of charcoal burning, sulfur refining and saltpeter mining. These three products were then combined to form the classical black powder which, vastly improved, is still used in some ammunition.

3. With the advent of gunpowder, the characteristics of ammunition packaging began to assume critical military importance. In the beginning, powder was supplied in bulk in waterproofed kegs, the universal package of the time. For retail use, the rifleman had his powder horn and the naval gunner had his silk or cotton bags stowed in tight containers. Whatever its form, the package served the dual purpose of retaining volatile components, some of which include water, and keeping excess water out and other contaminants out.

4. As ammunition became more complex with industrial advancement, so too did its packaging increase in complexity. The basic role of ammunition packaging has not changed, however, since the earliest days. That role is to insure that ammunition is delivered to the user, wherever and whoever he may be, with no loss in the reliability or

safety built in when the ammunition item was produced thousands of miles away and possibly decades earlier. This essential role, coupled with the huge size of the ammunition logistics organization, have imposed managerial and engineering sophistication upon ammunition packagers. Ammunition management in the respective Services has consistently recognized the vital role of packaging in achieving ammunition effectiveness and has fostered both the necessary growth in engineering capability and its integration into the total life cycle management process.

5. How large is the production base? Plants and industrial facilities devoted to production of the simpler forms of ammunition, e.g. not counting guided missiles, naval mines or naval torpedoes, are listed in Table 1.

TABLE 1

THE AMMUNITION PRODUCTION BASE

Government owned production plants	37
Production equipment packages, government owned but held by private industry	160
Industry agreements to respond to demand	681
March 1977 replacement value of government owned plant and equipment, billions of dollars	15.1

6. The production rate of ammunition varies depending upon whether the nation is at peace or war. The peacetime, production volume is relatively low, being oriented towards insuring that satisfactory war reserves, as determined by highest authority, are built up and maintained. One fundamental reason for a war reserve is that we must be ready to fight with what we have on hand until such time as the production base can be mobilized to produce ammunition as rapidly as it is consumed. From a packaging standpoint, this condition produces a paradoxical comparison to packaging of other supplies. In peacetime, because of prolonged storage periods for the war reserve, we must apply maximum packaging protection. In wartime, where storage periods are short -- although they may be in the open under very adverse conditions -- we may consider reducing protection for selected items. It is normal practice to design the simpler forms of ammunition and its packaging for a shelf life, with no maintenance, of at least ten years.

7. The size of the ammunition production base is keyed to wartime needs. These needs, established by the Joint Chiefs or Staff, are not small. Examples, drawn from SEASIA figures include:

a. 100 million rounds per month of 5.56 MM ammunition;

b. 75-85 million pounds per month of TNT;

c. 90 thousand 750-lb bombs per month; and

d. 30 million 105MM cartridges per year.

8. The package provides an interface between the round and the world around it. Table 2 lists some of the physical interfaces which must be identified and satisfied during the course of package design.

TABLE 2

EXTERNAL PHYSICAL INTERFACES AFFECTING PACKAGE DESIGN

Storage and Transportation	User Interfaces
Cargo Aircraft	Ammunition Supply Ships
Shore Magazines	Organic Transport and MHE
Foreign & Domestic Rail Lines	Tactical Vehicles
Foreign & Domestic Trucks	Man portability
ISO Containers	Transfer-at-Sea
Cargo Ships	Aerial Resupply
Material Handling Equipment (MHE)	Ship Magazines
	Loading Mechanisms

9. The package for a given round of ammunition undergoing development is a logistics critical item of equipment, as defined in MIL-STD-490. The package goes through the same developmental stages as the round and with similarly named major milestones, to wit: Performance base line, allocated base line, and product base line. For the package, therefore, we have the same developmental stages as we have for the end round: conceptual, advanced development, engineering development and production. The package development effort normally starts later than round development, but must be so managed as to be complete in all respects at the time the round is approved for service use. Without the package, the round cannot be distributed. Without distribution capability, the round is not ready for service use or for production.

10. Package development is integrated with round development. Table 3 shows some typical round development work breakdown structures. These simplified work breakdown structures show only the packaging for the end round. There are also packages for components delivered to the government. In the case of HARPOON missile, which is delivered to the fleet as an all-up round in five different configurations, there are a total of 25 container designs required.

TABLE 3

TYPICAL ROUND DEVELOPMENT WORK BREAKDOWN STRUCTURES

Level of Indenture	All Up Round Guided Missile	Artillery Round
0	Guided Missile System	Gun WPN System
1	Fire Control System Missile Launcher System Missile	Fire Control System Gun Mount Complete Round
2	Safe and Arm Guidance and Control Motor Booster Packaging	Fuze Projectile Propelling Charge Primer Packaging

11. Development integration means precisely that; the package development must be covered by a critical item development specification (MIL-STD-490), or in-house equivalent. Further packages for new ammunition items must undergo full operational test and evaluation procedures. Among the disciplines which must be considered by the designer in satisfying the interface constraints in optimal fashion are:

a. DODD 5000.1, Acquisition of Major Defense Systems.

b. Configuration Management (AR-70-37/NAVMATINST 4130.1A/MCO 4130.1A/ AFR 65-3/DSAR 8250.4/NSA-CSS 80-14/DCAC 100-50/DNAINST 5010.181).

c. Engineering for Transportability (AR 70-44/OPNAVINST 4600.22A/ AFR 80-18/MCO 4610.14B/DSAR 4500.25).

d. Operational Test and Evaluation, DODD

e. System Safety, MIL-STD-882

f. Explosive Hazard Classification Procedures (TB 700-2/ NAVORDINST 8020.3/ TO 11A-1-47/DSAR 7220.1).

g. Integrated Logistic Support (DOD Directive 4100.35).

12. In addition, each service has a set of rules covering the whole range of development. The following Army rules are typical and are in addition to those implementing the foregoing joint regulations:

a. Research, Test and Evaluation of Materiel for Extreme Climate Conditions (AR 70-38). Packages are tested at climatic extremes expected as well as under ambient conditions.

b. Criteria for Air Transport and Air Drop of Materiel (AR 71-6).

c. Ammunition and Explosive Safety Standards (AR 385-64).

d. System Safety (AR 385-16).

13. Once an ammunition item, and its package, are approved for production, disciplined change control is enforced. All changes, no matter what the source, which affect form, fit or function must survive the searching review process of MIL-STD-480 and individual Service Configuration Review Boards to insure that interfaces are not violated and that the change is cost effective. When a change is approved, it is not backfitted into existing stocks, unless it is clearly proven that the existing package is not performing properly. Such instances are rare, largely because of thorough initial development.

14. Well documented feedback systems exist to insure that discrepancies are promptly reported. In addition to the usual DD-6 and DISREP reporting, each Service uses Explosive Accident/Incident and Malfunction Reports (e.g. Army: AR385-14 and AR75-1) to cover serious packaging failures. In the case of an accident or serious incident, notification is by dispatch. In addition to the above, routine ammunition quality control and safety monitoring insures additional feedback on packaging deterioration trends. Army examples of these features are:

a. AR 702-6, Ammunition Stockpile Reliability Program; and

b. DARCOMR 385-12, Life Cycle Verification of Materiel Safety.

15. Ammunition is a dangerous product, subject to the regulations (49CFR) issued by the Department of Transportation (DOT) pursuant to the Transportation Safety Act of 1974. A careful reading of these regulations will disclose that DOT does not prescribe the specifications for containers to be used on military ammunition. This is because the safety record with our packages is exemplary. The reason for this safety record is, basically, total integration of packaging management into ammunition's life cycle management and our exhaustive safety certification programs.

B. JOINT POLICIES AND PROCEDURES.

1. The question was asked: What procedures does the JCAP Packaging and Preservation Task Group have to eliminate unnecessary duplication of effort if it is found to exist?

2. The fundamental charge placed upon the JCAP Packaging and Preservation Task Group was to arrive at common policies and procedures for life cycle management of the packaging aspects of ammunition logistics to optimize efficiency and economy. It follows that one objective of the optimizing function is to eliminate unnecessary duplication.

3. The second charge placed upon each member of the JCAP Packaging and Preservation Task Group can be paraphrased: Within your respective Services, manage your affairs within the guidelines you developed and account to us how well you are doing, on a regular basis. The JCAP Packaging and Preservation Task Group reports to the JCAP Operating Group (Colonels and Navy Captains drawn from the respective services and the JCAP Executive Director) on a monthly basis concerning the status of all on-going tasks, and on particular problems as they arise. The Operating Group, in turn, reports quarterly to the Coordinating Group, consisting of Flag and General Officers responsible for the ammunition logistics functions of their Services. The Coordinating Group reports regularly to the Joint Logistics Commanders.

4. The fundamental written tool used for maximizing efficiency and economy is the Joint Operating Policies and Procedures (JOPP) contained in Part 13 of the JCAP Agreement, which is binding upon all of the Services. A copy of this Part 13 is furnished herwith as Appendix B.

5. Perusal of the contents of Appendix B will verify dedication to the twin goals of eliminating unnecessary duplication and enhancing cross servicing. It will show, also, that the Task Group can, on its own, eliminate duplication which may be found to be unnecessary. Only disagreements have to be adjudicated by higher authority.

6. The Task Group meets regularly (not less than once per quarter) and mutual problems are discussed and action plans to resolve problems in a coordinated manner are placed in effect. Regular reports are required to insure acceptable progress.

7. The Task Group has not been satisfied with simply applying poultices to specific cases of duplication of design and study efforts. It has sought, and will continue to seek, to eliminate the root causes of such duplication. One such cause has been the difficulty of determining what designs already exist. It was fairly common for a whole new design to be created when, in another Service, there was already a container design that was usable as is, or with minor modification. The Armament Development and Test Center was found to have developed a sound, low cost method of design retrieval.

8. After careful consideration all possible alternatives the Task Group determined that the ADTC System offered the best method for tri-service use. The Task Group then worked with ADTC to make the system usable by all services and supported the Air Force program to make the system operational. Initial inputs to the computer data bank were from the ammunition community. Attention is invited to the fact that the JCAP JOPP makes use of the Container Design Retrieval System (CDRS) mandatory upon all ammunition commands. Table 4 summarizes status of CDRS through 1 July 1977. Formal coordination of proposed MIL-STD-1510 will render CDRS readily available to all of DOD. Its utility is not limited to ammunition. Similarly the Task Group is sponsoring development of a standard Life Cycle Costing Model to be used by container designers. No such model exists, yet most packaging decisions must have an unbiased economic as well as technical basis. The JCAP Models Directorate is charged with developing this model, which is now being tested and refined.

9. Formal interservice cooperation did not begin with the formation of JCAP. An earlier group, sponsored by the Joint Technical Coordinating Group on Air Launched Non-Nuclear Ordnance (now JTCG/ Munitions Development, or JTCG/ MD), called the Working Party for Air Launched Non-Nuclear Ordnance (ALNNO) Shipping and Storage Containers, was formed in response to a General Accounting Office report critical of apparent duplication in air launched ordnance packaging. This group sponsored a number of standardization studies, particularly of missile containers and standardized many designs. In addition, the Working Party sponsored a joint regulation, AFSC/AFLC Regulation 80-31/AMC Regulation 70-54/OPNAVINST 10580.1A of 19 June 1972 which is currently being revised to cover all ammunition. The Working Party and the Packaging and Preservation Task Group have consummated a de facto merger and all meetings of the two units are conducted as joint meetings, under a single chairman.

10. Even before chartering of JTCG/MD and JCAP, and their subordinate packaging coordinating activities, inter-service exchange of information, criteria and requirements in all aspects of munitions development, production, storage, and distribution were intensively cultivated. This state of affairs stemmed directly from the fact that the Army and Navy have regularly produced ammunition for each other and for the Air Force, the United States Marine Corps, and the United States Coast Guard. In general, the members of the ammunition community -- and this applies with equal force to its packaging personnel --were intellectually closer to their counterparts in the other Services than with their non-ammunition colleagues in their own Service.

11. It must be remembered, also, that most of the activities involved in ammunition package design are project or industrially funded and that short deadlines within rigid dollar constraints are the norm. There is, therefore, strong pressure on each activity to consult, use, and fund the activity with known expertise in a given aspect of a problem. In the long run, these face to face contacts between individual

activities will pay off even more than those specific studies initiated formally within the Task Group sitting as a corporate body.

12. Examples of interservice cooperation in ammunition packaging are not limited to design and test phases of the round's life cycle. Table 5 lists some typical cases -- going back to 1964 -- of exchanges of technical information, designs, and physical assets. The Packaging and Preservation Task Group does not claim sole credit for the asset exchanges since they were arranged directly between the item managers concerned. Part 13 of the JCAP JOPP does, however, insist that cross-servicing be considered at every opportunity. The Task Group does claim credit for making it easier.

13. No part of this essay should be construed as claiming that considerable duplication, some of it qualifying as unnecessary, has not occurred in the past. One of the compelling reasons for the establishment of the JTCG/MD Working Party and of this Task Group was to eliminate unnecessary duplication. The answers to some of the later questions will show that duplication has occurred and that some of it, with 20-20 hindsight, could be judged to be unnecessary.

14. JCAP and JTCG/MD have established strong, continuing controls which: insure there is no unnecessary duplication; that such differences as remain are fully justified by the round's logistics; and that our packages meet the expressed needs of the total spectrum of users, be they combat infantrymen, fighter pilots or weapons officers of major combatant ships. There are no known on-going efforts which do not meet these criteria.

TABLE 4

OVERVIEW OF CDRS

ITEM	QTY
Total number of designs in System	11,775
Total number of request for service	231
Gross Savings to date	$2,139,778
Annual Operating Cost	$150,000
Current Savings - Cost Ratio	14:1

TABLE 5

SOME EXAMPLES OF INTERSERVICING
IN AMMUNITION PACKAGING

YEAR	ITEM	PARTICIPANTS	ACTIONS
1964-1977	Conventional Ammunition	Army, Navy & Air Force	Army is the primary producer of Air Force ammunition, except for bombs, certain "Eye" weapons and most pyrotechnics. Air Force checks Army or Navy packaging and unitizing requirements before MIPR's are prepared. When the prescribed Army or Navy package will serve the Air Force purpose it is prescribed in the MIPR. Unit loads have been designed and tested by Army or Navy when a potential problem is identified during production or fielding. This is an on-going procedure.
1964-1977	Conventional Ammunition	AAPSA/MUCOM/ ARMCOM/ARRCOM & USMC	The Marine Corps has assigned a liaison staff to work for with Army on a daily basis and handles day-to-day problems and liaison inherent in the procurement, renovation, and supply management of ground ammunition and ammunition packaging.
1965-1977	Conventional Ammunition	DARCOM, DARCOM AC, ARMCOM/ARRCOM, NWHC, OOALC & ADTC	All services are on distribution for unitizing, storage, and outloading drawings prepared by the DARCOM Ammunition Cen-

YEAR	ITEM	PARTICIPANTS	ACTIONS
			ter and NWHC at Colts Neck, NJ. Interchange of visits, test results, drawings and associated data is on a continuing basis.
1967-1977	Chapparal	NSWC Crane & MICOM	MICOM designed a composite plastic foam & aluminum container and furnished outer container. NSWC molded foam in container and completed assembly.
1972	Packaging Material (various small arms boxes, boxes and fiber containers for artillery, mortar & rockets ammunition, etc.)	ARCOM, SPCC, OOALC, USMC	Coordination of requirements resulted in Army furnishing Navy 2,215 pieces of packaging material, Air Force 12,930 pieces of packaging material, and Marine Corps 2,340,198 pieces of packaging material for use in C&P, maintenance and production operations.
1972	Nuclear Weapons Small Arms Ammo	ARCOM, DARCOM Ammo Center, ARRADCOM and AFWL	Tiedown Tests of items on the Air Force 463L pallet system.
1972-1975	Army Design Nuclear Weapons Container	PA, AFWL, FC/ DNA, AFPEA, NWEF & AFLC	Provided transportability engineering reports on containers and provided descriptions, detail drawings and tiedown and lift provisions to include stress analyses of tiedown/lift points.
1972-1975	New Packaging Foam	NAVORD, ADTC & NSWC Crane	Jointly funded program on evaluation of phenolic foam as a fire resistant packaging material.

YEAR	ITEM	PARTICIPANTS	ACTIONS
1973	Packaging Material	ARMCOM, SPCC, OOALC & USMC	Coordination of requirements resulted in Army furnishing Navy 10,298 pieces of packaging material, Air Force 8,277 pieces of packaging material and Marine Corps 373,309 pieces of packaging material for use in C&P, maintenance and production operations.
1974	Packaging Material	ARCOM & USMC	Coordination of requirements resulted in Army furnishing Marine Corps 11,120 pieces of packaging material for use in C&P, maintenance and production operations.
1974	Sprint Warhead Section	ARMCOM, ARRADCOM & AFWL	Tiedown tests were conducted for movement of the Sprint Warhead Section in Air Force aircraft. Tests included suitability determination of container tiedown and handling features.
1974	Nuclear Warhead Sections	ARCOM, PA, AMC Ammo Center & MAC	Tests were conducted to evaluate a modified "Roll-A-Lift" design for loading and securing warhead sections in C141 aircraft. (Roll-A-Lift is a hydraulic dolly-like handling device for moving large containers.) Technical data on container tiedown points and aircraft restraint systems were interchanged.

YEAR	ITEM	PARTICIPANTS	ACTIONS
1974	Sprint & Spartan Warhead Containers	PA & AFWL	Exchanged requirements on container design (tiedown features, internal construction, etc.) for preparation of Air Force tiedown procedure test.
1974	Lance warhead section, Pershing warhead section, Nike Hercules warhead section, Honest John warhead section	PA & MAC	Army provided Air Force data on the pressure the containers can withstand without structural damage and data on pressure equalizing devices in the containers.
1974	Honest John warhead section, Nike Hercules warhead section, Sergeant warhead section, Lance warhead section	PA, NWEF, Navy Squadron HC6 & USATEA	Army facilities, handling equipment and technical personnel and Navy aircraft and flight personnel were used in the preparation of test loading and tiedown of Army containers in Navy CH46 helicopters.
1974	All Army designed nuclear weapons containers	DARCOM, DADCSLOG, ARCOM, PA, CNO, SPCC, FMFLANT, CSS 6th Naval Air & USMC	Army provided technical and logistical data and assistance on container design features, special equipment requirements, procedures for obtaining special equipment or deviation authorizations, etc., for joint Army/Navy emergency evacuation operational planning.
1975-77	Marine Corps Ammunition	ARCOM, DARCOM AMMO CTR, USMC NSWC Crane & NWHC	Using USMC provided funds, NSWC conducted complete evaluation of import of Army Type unit loads used by USMC

YEAR	ITEM	PARTICIPANTS	ACTIONS
			on handling systems built into Navy amphibious assult shipping and identified management and technical action required for satisfactory compatibility.
1975-1976	Marine Corps Ammunition	NSWC Crane, PA & USMC	Army unit package quantity for some 38 items used by USMC is too large for effective battlefield use by USMC. NSWC designed and tested modified packaging for these items to be carried in USMC inventory. Designs and test data were then turned over to PA for final drawing authentication and release to production.
1975	Nuclear Weapons System	PA, NAVSEA, AFSC & ERDA	Provided technical data and assistance regarding design of Army containers to a joint services special safety study group on air shipment.
1975	M483, M480, M487, M511, & M467 Containers	PA, DARCOM & AFWL	Provided technical data and a complete set of container drawings for Air Force use in developing tiedown patterns for AF aircraft.
1975	Army Design Nuclear Weapons Container	PA, DARCOM & DNA	Provided information on containers, such as dimensions, center of balance, weight, pressure relief features, etc. for the revision of a joint technical publication (Army number - TM 39-45-51A).

YEAR	ITEM	PARTICIPANTS	ACTIONS
1975	Packaging Material	ARMCOM, SPCC, OOALC & USMC	Coordination of requirements resulted in Army furnishing Navy 250 pieces, Air Force 293 pieces, and Marine Corps 2,000 pieces of packaging material for use in C&P, maintenance, and production operations.
1975	Accident Resistant Containers for Nuclear Weapons	DA, DARCOM, ARMCOM, PA, FC/DNA, MAC, CNO, Sandia Labs	Proposed container designs were evaluated by joint group. Technical data on design concepts, logistical impacts of alternatives, design requirements and deficiencies in proposed designs were discussed.
1975	Navy Nuclear Cargo & Army containers used by Navy	PA, USATEA & NWEF	Discussed a proposed joint Army/Navy manual and provided technical information regarding Army containers used by Navy.
1975	Nuclear Weapons System Containers	PA & ADTC	Army provided Air Force necessary information for input of containers into CDRS.
1976	Packaging Material	ARCOM & SPCC	Coordination of requirements resulted in Navy furnishing Army 120,000 wooden boxes for 90MM M7/Al cartridges for use in a renovation program. (Obtained from a Navy demilitarization program).
1976	Army Design Nuclear Weapons Containers	PA, ARCOM & FC/DNA	Reviewed contents of a proposed change to a joint manual (Army TM-39-45-51) covering handling and transpor-

YEAR	ITEM	PARTICIPANTS	ACTIONS
			ting nuclear weapons containers.
1976	Packaging Material	ARCOM & SPCC	Coordination of requirements resulted in Army furnishing Air Force 20 pieces and Marine Corps 5,000 pieces of packaging material for use in C&P, maintenance and production operations.
1976	Packaging Material	ARCOM & USMC	Coordination of requirements resulted in USMC furnishing Army 40,419 M229A1 fiber containers and 57,190 wooden boxes for use in a C&P/renovation program for 3.5" rockets.
1976	Pyrotechnics	NSWC, ADTC & PA	NSWC designed plastic container for LUU-2 flare to be used by all Services.
1976	TM 55-607 OP 3221, Rev. 1	Army Navy	Coordination of requirements for loading and stowage of A&E aboard breakbulk merchant ships.
1977	Packaging Material	ARMCOM/ARRCOM & SPCC	Coordination of requirements resulted in Army furnishing Navy 850 pieces of packaging material for use in C&P, maintenance or production programs.
1977	AGM-12C Container	ARRCOM, OOALC, CINCPAC & FORSCOM	Army requires four AGM-12C containers for use in the packaging of leaking Air Force chemical bombs stored by the Army. Excess Air Force containers have been lo-

YEAR	ITEM	PARTICIPANTS	ACTIONS
			cated in an Army depot. Army/AF now plan to procure parts needed for rehabilitation of the containers and furnish serviceable containers to the storing activity.
1977	Pyrotechnics	NSWC Crane & ADTC	Using ADTC funds, NSWC designed and tested a modified Navy surplus container for the Air Force's LUU 10/B marker.
1977	CBU Dispenser	DARCOM Ammo Center & ADTC	Ammo Center is conducting transportability testing of AF CBU Dispenser for ADTC.

C. PROJECTILE PALLETIZING.

1. Two questions were asked:

a. What is the difference in packaging between a 155MM projectile and a 5" projectile?

b. Why are the differences necessary?

2. The fundamental technical differences are summarized in Table 6. Particular attention is invited to the significant differences in the physical constants of the rounds. Note, also that Army rounds are fuzed at the battery. Navy rounds, on the other hand, are fuzed at the load, assemble and pack plant and all subsequent storage, shipment and handling involve only the fuzed projectile. The high rate of fire (up to 45 rounds per minute) of modern Navy 5" guns and the limited space in shipboard magazines, simply preclude taking the time and space to assemble fuzes to projectiles aboard ship.

3. Aside from fuzed versus non-fuzed rounds, there are significant differences in gun ammunition logistics between the Army and the Navy that strongly influence the general type of palletizing selected and the details of the specific design.

4. The Navy's case for using all metal unit loads weighing almost 2 short tons reduces to the following:

a. Use of metal does not introduce additional combustibles into shipboard magazines.

b. If operationally necessary, metal pallets can be discarded overboard without leaving a telltale trail of floating debris.

c. The foregoing were the original reasons for concentrating on metal. Although the importance of these two factors has lessened, metal unit load members do not shrink nor are they attacked by termites and the other ailments of wood. Experience has shown that the physical properties built into all metal unit loads remain. In sum, Navy ammunition unit loads are extremely reliable and safe for many years without maintenance. The Fleet Commanders-in-Chief, either directly or through their principal logistics commanders, have recently reiterated that they desire only metal unit loads. In order to enforce compliance with this customer demand, only one office in the Naval Shore Establishment, physically located in the Naval Sea Systems Command, is authorized to grant waivers on a limited, case by case, basis.

d. Navy unit loads must be optimized for safe, efficient, transfer-at-sea. Metal pallets are so designed. Mechanical materials handling equipment with 4000 and 6000 pounds capacitiy is readily available to all ships concerned. Recent ship designs include pallet elevators directly to the magazines to reduce manual handling during the final strikedown process.

e. The basic flow path of ammunition to a shooting ship involves Tidewater Depot to Ammunition Supply Ship to Combatant. There is normally ample time and space to recover, and return, reusable assets to CONUS, leaving CONUS land transportation and refurbishment prior to reuse as operating costs.

f. Navy ammunition embarked in any Navy ship does not stay in that ship indefinitely. Every time a ship has to enter a repair yard for significant work, all ammunition must be offloaded because of safety considerations. The Navy must have assets readily available to handle such offloads. Even where the original package or pallet is intact, this offload, and subsequent reload, produces multiple handling. Durable metal unit loads make this operation more efficient. Many of these offloads are conducted at sea.

5. The Army, by contrast, operates in the following logistics climate:

a. Fire resistance of the packaging is not of such compelling concern as it is to the Navy, since a fire does not pose an immediate threat to the survival of a major combatant unit. The total cost of making wooden boxes and pallets fireproof using today's technology would far exceed the cost of ammunition losses to fire in SE Asia.

b. Once delivered to a combat unit, and to its immediate forward supply points, little ammunition, if any, returns. If reusable pallets and pallet adapters were to be used, there cannot, or in any case should not, be a group whose sole function is to tidy up the battlefield. Further, collection and retrograde shipment costs are real, out of pocket expense, compared to the Navy's essentially closed loop system.

c. The lumber removed from ammunition packages and unit loads has valid secondary uses to Army personnel in the combat zone, who do not have the hotel facilities available aboard Navy ships.

d. Until quite recently, mechanical materials handling equipment near the end of the pipeline limited Army unit loads to one long ton maximum gross weight.

6. The logistic differences between war on the ground and war at sea are considered basic and are absolute drivers of the differing engineering solutions to design of the unit loads for the respective projectiles. Since there is no Army gun which can shoot 5" ammunition, nor any Navy rifle that can accommodate a 155MM round, there is no requirement to push for cross-servicing potential in the Theater of Operations.

7. In the final analysis, both palletizing methods represent packaging reduced to the minimum to satisfy customer needs. The Army unit load costs about $0.90 per projectile. The Navy unit load

costs $1.93 per projectile on an initial investment basis. The true costs of the two methods are comparable when the Navy achieves two round trips.

TABLE 6

COMPARISON BETWEEN
155MM AND 5" PALLETS
(ROCKET ASSISTED AND GUIDED PROJECTILES NOT INCLUDED)

	155MM	5"/38	5"/54
Round			
Nominal Diameter, in	6.1	5.0	5.0
Nominal Weight, as palletized, lbs.	95	60	70
Fuzed	No (1)	Yes (2)	Yes (2)
Unit Load			
Pallet			
Style	Special Purpose	General Purpose MK 3	General Purpose MK 3
Material	Wood	Steel	Steel
Type	2 way	4 way	4 way
Plan Form, ins.	27-1/8x13-5/8	40x48	40x48
Approx. Weight, lbs.	39	105	105
Adapter Weight, lbs.	NA	36	36
Unit Load Data			
No. Rounds/Adapter	NA	12	12
No. Rounds/Pallet	8	48	48
Approx. Volume, cu. ft.	6.8	31	37
Gross Weight, lbs (3)			
Min.	727	2910	3625
Max.	831	3085	3775

(1) Shipped with lifting ring attached.
(2) Fuze protective cap used.
(3) Weight varies depending upon specific configuration of round, including different explosive fills.

D. SMALL ARMS AMMUNITION PACKAGING.

1. Two basic questions were asked concerning small arms ammunition packaging:

a. What are the reasons for the numerous methods of packaging small arms ammunition?

b. Is there any reason why this packaging cannot be performed by one organization?

2. Small arms ammunition is generally considered to include all gun fired ammunition 20MM and below. This conforms to the definition of Small Arms Ammunition qualifying as Class C Explosives in the Department of Transportation Regulations.

3. At least one reason for the number of different package configurations is that there are 18 different basic types of small arms ammunition. Within each basic type there are sub-types which may or may not dictate packaging differences. Table 7 lists the principal configurations of small arms ammunition currently stocked by DOD, except for the variants within the 20MM category. This latter size is taken up in Section II-I.

4. Significant differences in the configuration of the round to be packaged arise from the needs of the firing weapon and of the operating forces. As a result, rounds may be furnished in bulk, clipped, clipped in bandoliers, or linked. When linked, the specific desired order of round variants creates different configurations.

5. The effect of these "as packaged" configurations on packaging 7.62MM ammunition is illustrated by Table 8.

6. Other variances can be introduced by logistics or by simple economics. Examples, here, are the existence of domestic ("commercial") packs for smaller ammunition used in training. Such packs are in addition to the full military pack capable of world wide distribution.

7. The final source of variance is technological advance. The packaging engineering community may simply find a better, or cheaper, or both, way to do it. If this new way survives searching review of effectiveness, cost analysis, user acceptance and producibility, it is introduced into production at a point which will minimize changeover costs. Obviously, previous package designs are not retroactively reworked to the new configuration unless the ammunition itself needs maintenance or unless the old package design was demonstrably not performing adequately. In wartime, the user may see several varieties of a package for the same round as the war reserve stocks are drawn upon.

8. A condensed history of small arms ammunition packaging may be helpful. During World War I there was but a single package for small arms ammunition, the metal lined, M1917 wooden box. Troops had to unpack the ammunition by pulling nails and cuttng the metal lining. Prior to World War II, the Navy, conscious of the fire hazard aboard ships, began using metal containers (such as the MK 1 MOD 0 small arms ammunition box). These are still valid container designs and many of the containers produced during World War II are still in use. The Navy's small arms ammunition box was deliberately sized so that its exterior dimensions were the same as the M1917 box in order to produce minimum changes in shipboard magazines.

9. The Army, by contrast, began development and successive improvement of a family of small arms ammunition boxes. There resulted a family of low cost (because of high volume requirements and successive production engineering improvement), watertight metal containers which are man portable and which are, in fact, reusable. Particularly in wartime, however, the cost of collection on the battlefield, return and refurbishment of empties for reuse has not been deemed cost effective. The Army does not consider these containers to be recoverable assets when shipped to Theaters of Operation. Table 9 lists the metal container designs usable for small arms ammunition.

10. The Services have basically followed a policy of standardizing on the outer package for small arms ammunition. Of necessity, therefore, quantity per pack, and the inner packaging details, must vary with the specific configuration of the round. There still remain significant variances in pacakging aircraft 20mm ammunition, which are discussed in further detail in Section II-I.

11. All small arms ammunition packaging design is performed by one activty and has been for many years. Design activity has been Frankford Arsenal. Design responsibility is, pursuant to internal Army reorganization and consolidation, being transferred to Army Armament Research and Development Command (ARRADCOM).

TABLE 7

SMALL ARMS AMMUNITION

STOCKED BY DOD

TYPE	NOTES
Shotgun Ammo	
12 ga	In some gages pellet size and quantity varies
20 ga	
28 ga	
410 ga	
.22 Cal	
Blank	Further divided into specific uses, e.g. standard and match
Short	
Long Rifle	
.30 Cal	
Carbine, Ball	Also stocked as match, rifle and machine gun grades
Armor Piercing	
Tracer	
Armor Piercing, Incendiary	
Blank	
.32 Cal Match	
.38 Special Cal	Match grades available
Blank	
Ball	
Wad Cutter	
.45 Cal	
Blank	Match grades available
Blank, line throwing	
Ball	
Tracer	
.50 Cal	
Practice	
Ball	
Tracer	
Spotter-Tracer	
Incendiary	
Armor Piercing	
Armor Piercing, Incendiary	
Armor Piercing, Incendiary, Tracer	

TABLE 7 (Continued)

TYPE	NOTES
5.56mm	
Blank	
Ball	
Tracer	
Rifle Grenade	
7mm Rem Match	
7.62mm	
Blank	Some match grades available.
Ball	Some configurations NATO stand-
Tracer	ardized.
Rifle Grenade	
7.62 x 39	
9mm Ball	For Parabellum pistol
14.5mm	For M31 trainer
20mm	See Table 10

TABLE 8

7.66MM AMMUNITION

PACKAGING CONFIGURATIONS

GUN USE	NO./SHIPPING CTR	PACKAGING
M16 Rifle	840	5 carts/clip 12 clips/bandolier 7 bandoliers/M2A1 box 2 M2A1 boxes/wrbnd box
Modified M1 Rifle	864	8 carts/clip 6 clips/bandolier 9 bandoliers/M2A1 box 2 M2A1 boxes/wrbnd box
M60 & M73 MG[1]	600	100 carts/M13 link belt 1 belt/bandolier 1 bandolier/carton 3 cartons/M2A1 box 2 M2A1 boxes/wrbnd box
M60 & M73 MG[1]	800	100 carts/M13 link belt 1 belt/bandolier 1 bandolier/carton 2 cartons/M19A1 box 4 M19A1 boxes/wrbnd box
Minni Gau-2B MG	1500	750 carts/M13 link belt 2 belts/M548 box
Bulk[1]	960	20 carts/carton 12 carts/M19A1 box 4 M19A1 boxes/wrbnd box
Bulk[1]	920	20 carts/carton 23 cartons/M2A1 box 2 M2A1 boxes/wrbnd box

[1]The two packs are interchangeable on the production line, depending only on the availability of M2A1 or M19A1 metal boxes. Bulk ammunition must be clipped or linked prior to use.

TABLE 9

SMALL ARMS AMMUNITION BOXES

DESIGNATOR	APPROX. INSIDE DIMENSIONS	TARE WEIGHT	UNIT COST (APPROX.)	
Army-				
M19A1	10-1/4 x 3-1/2 x 6-1/2	3-1/2	2.38	(1)
M2A1	11 x 5-1/2 x 6-3/4	5-3/4	2.86	(1)
M548	18-1/2 x 8-1/2 x 14-1/2	23-1/4	9.00	(1)
Navy				
MK 1 & MODS Small Arms Ammo Box	18.5 x 9.5 x 14.8	32	7.20	(2)
MK 1 & MODS Ammo Component Box	15.16 x 11.97 x 14.54	21	9.00	(2)
MK 2 Ammo Component Box	15.36 x 12.35 x 14.55	25	9.00	(2)

(1) Projected current dollars, based on 500,000 quantity buy.
(2) 1976 price.

E. UNIT LOAD DESIGN AND TEST.

1. The question was asked: Why do the Army Ammunition Center, Picatinny Arsenal and NWHC develop unit loads for ammunition?

2. The question is incomplete because unit loads can also be developed, for Air Force peculiar ammunition items, by ADTC and by Ogden Air Logistics Center.

3. Starting an organized engineering approach to ammunition palletizing is generally credited to the Naval Ordnance Materials Handling Laboratory at Naval Ammunition Depot Hingham, MA, just prior to World War II. In passing, it is interesting to note that the basic patent on full four way entry pallets was issued to the then LCDR Norman A. Cahners, USNR, while Officer-in-Charge of the Laboratory. After World War II, Mr. Cahners founded and was Chairman of the Board of Cahners Publications, publisher of, inter alia, the magazine Modern Materials Handling. When Hingham was closed, the palletizing design and test function, and test equipment, were transferred to Naval Weapons Station Earle into what is now know as the Naval Weapons Handling Center (NWHC). Thus, NWHC has almost 40 years continuous corporate experience in the design of unit loads for Navy ammunition and in the design and test of the specialized handling equipment needed to transfer these unit loads at sea by connected replenishment and by vertical replenishment. Other constraints on Navy unit load design involve the physical characteristics of both sending and receiving ships, including all the gear built into the ship for stowage, deck handling and strike up and strike down. Logistic factors affecting Navy unit load design have been previously summarized in Section II-C.

4. The DARCOM Ammunition Center has a similarly long corporate memory in designing unit loads for Army ammunition. Although the Ammunition Center has the basic Army wide mission of designing and testing unit loads for Army ammunition, it does not, as NWHC does on most items, also have package design responsibility for specific rounds. Package design responsibility is, in the Army, vested in the various mission commands. ARRADCOM therefore, is responsible for the design of unit loads for separate loading projectiles, such as the 155MM projectile discussed in Section II-C.

5. Ogden Air Logistics Center (OOALC) generally accepts the unit loads designed by the Army or the Navy for most of its ammunition, since these have been the producing Services. One major exception occurred during Southeast Asia when an operational requirement developed for palletizing AF 500 lb low drag bombs differently from using the standard Navy MK 9 metal pallet. In addition to needing more space between layers to permit loading and handling at Air Force SAC installations, return rate of the high initial cost metal pallet was not sufficiently large to justify the cost. Accordingly, OOALC developed, cooperatively with NWHC, a low cost single trip combination wood and plywood pallet for their version of the MK 82 bomb. This caused no

particular difficulty on the production line because the Air Force MK 82 has a different explosive fill than the Navy's version. The two bombs were always produced in separate runs.

6. The Navy bomb also changed in external configuration. In order to increase cook-off time in a conflagration, such as the two catastrophic aircraft carrier fires, intumescent paint was substituted for the normal paint, thus increasing diameter by 1/2 inch. This forced the development of the MHU-122/E pallet for thermally coated MK 82 bombs.

7. Even with a change in saddle diameter, the MHU-122/E was not operationally acceptable to the Air Force because there is insufficient space between the two layers of bombs to permit forklift depalletizing. The Air Force (OOALC) then funded NWHC to develop the MHU-149/E metal pallet for the Air Force version of the MK 82 bomb. This pallet was used in the last major procurement of Air Force bombs for War Reserve stocks.

8. The Navy, on the other hand, could not accept the extra height of the Air Force pallet, caused by providing forklift access between layers. Studies of combatant ship magazine and ammunition supply ship hold overhead heights showed that only two high stacks of pallets could be achieved whereas the Navy version permitted three high stacks. Hence, there would have been a 1/3 reduction in bomb allowances per ship; patently operationally unacceptable.

9. The net result of the foregoing is that there are three current designs of MK 82 bomb pallets; one Navy and two Air Force. The wooden pallet is usable by the Air Force during a war when consumption is high. The metal pallet can be used for War Reserve stocks in peacetime, where long term freedom from deterioration assumes economic and readiness importance.

10. ADTC also designs unit loads for new ammunition items for which it has design responsibility, because the unit load is just a larger package. One advantage of designing the package and unit load at the same activity is that there can often be a logical allocation of functions between the two. This is of particular potential value to the Air Force which does not face the ground troop problem of the individual man being the last link in the transportation system.

11. The Packaging and Preservation Task Group addressed the fact that there were no published design criteria for ammunition unit loads. The various activities, while treating the design as simply a larger package, were operating with different dimensional limits, weight restrictions, testing stress levels and acceptance or rejection criteria. A special ad hoc sub-task group was formed to develop common criteria and peformance standards, wherever possible, and to list those criteria which were different because of the differing logistics and operation stresses imposed on the unit loads. The result is MIL-STD-1660, Design Criteria for Ammunition Unit Loads, dated 8 April 1977.

12. One area of overlap, or potential duplication, that has caused concern is NWHC's family of designs for unit loads compatible with amphibious operations (WR-55, Amphibious Unit Loads). These were designed, for the most part prior to SE Asia for compatibility with some older amphibous assault shipping and with helicopters which have now phased out of the inventory. During SE Asia, the Marine Corps operated extensively using Army ammunition palletized Army style and found, with some exceptions, that it was adequate for their operational needs. The fact remained, however, that some Army unit loads were still incompatible with fixed size horizontal and vertical pallet conveyors and elevators permanently installed in assault shipping such as the LHA, LPD, LPH and LKA class ships. The problem was to clearly identify what the ship constraints were, and which specific Army unit loads (both existing and projected) would not fit.

13. Commandant, Marine Corps funded a study by Naval Weapons Support Center Crane, in conjunction with Naval Weapons Station Earle, and the DARCOM Ammunition Center, to establish exactly which Army loads were and were not compatible with current active amphibious assault ships. The results are contained in NWSC, Crane Report NWSC/CR/RDTR-54, April 1977, and detailed indexes which will be submitted separately.

14. With the technical data of the Crane Report and the new MIL-STD on design criteria in hand, the Task Group's next effort will be to sort out the management responsibilities involved and assign functions, including detailed ship checks as deemed necessary, to insure Marine Corps capability of carrying out its assigned mission.

15. It is possible that the drafter of the original question was really asking: "Why should not one single activity develop all ammunition unit loads?" Since the unit load is, in all current official definitions, considered to constitute one aspect of "packaging", this possible deeper question will be discussed in Section II-J.

F. DEVELOPMENTAL TESTING ON LIKE OR COMMON ITEMS.

1. The question asked was: Are packaging organizations conducting developmental testing on like or common items? If so, identify.

2. This question is difficult to answer without first defining, for purposes of the answer, some of the terms used in the question. Hence:

a. The word "developmental" is interpreted to include work (other than that of a strictly quality control nature) in support of design. Thus the word encompasses not only work done with RDT&E funds in support of new round development but also design type work done for product improvement purposes, to correct known deficiencies, or to evaluate ideas for change, whatever the source, but definitely including contractor change proposals, beneficial suggestions and response to reports of difficulty from the operating forces. Thus, procurement and maintenance funds may also be involved.

b. Like items are ammunition items which, although not necessarily interchangeable between the Services, are sufficiently similar to warrant consideration of a standardized packaging approach. Low drag bombs are an example. A like item might also include a packaging material or process having potential application to more than one Service.

c. A common item is an ammunition item freely interchangeable between Services and distinguished by having the same DOD ammunition identification code (DODIC/NALC), indicating interchangeabilty at the firing weapon. Common items may or may not have identical stock numbers.

3. There used to be a fair amount of duplication in the materials and processes area. Practically all activities have, at one time or another, investigated the use of plastic pallets for ammunition. General results have been poor. Because of severe quality problems, both the Ammunition Center and NWHC have critically examined what constitutes sound metal strapping and strap sealing. Both the Army and the Navy have done work in rotationally molded containers and in non-metallic strapping.

4. The Packaging and Preservation Task Group maintains a continuing overview of material and process development efforts (beyond the casual screening test of an idea) through its standing Sub-Task Group on Exploratory Development and through constant interchange of information on problems as they arise. Unknowing duplication of effort in the materials and processes area simply exists no more.

5. Both the Army and the Navy are in the process of developing laser guided projectiles and both services are looking at suitable container concepts for the rounds involved. Certain characteristics (principally external geometry) of the containers for Navy rounds are already

fixed because ship installation studies are proceeding in parallel. The two round development projects are being drawn closer together pursuant to DOD (DDR&E) and congressional guidance. However, the rounds are of different caliber and there will be differences in the container designs.

6. ADTC developed a bulk shipping container of about pallet box size for the LUU-2 flare with the full knowledge of the Navy. In fact, with the full approval of the Navy, because such a box saves the Air Force money even though it is not, and cannot be, compatible with aircraft carrier handling of the same flares.

7. In some cases, the Packaging and Preservation Task Group will actively support more than one activity engaging in design and test efforts to achieve a solution sooner. Provided this effort is suitably coordinated to insure that the technical approaches do not overlap, this redundancy does not constitute unwarranted duplication, but rather, sound management. A particular case in point is the recent effort to develop ammunition restraint systems for use in commercial ISO containers. The national goal is clear: For ammunition containerization to be a reality in wartime, commercial ISO containers must be used. Yet, commercial containers do not have built-in restraint systems for ammunition sufficient to meet Department of Transportation safety requirements.

8. With the full knowledge of all concerned, including the staff of DOD(I&L)'s Containerization Steering Group, the redundancy approach was used with commercial container ammunition restraint systems. Two contractors, one Navy activity and two Army installations were involved in the design and evaluation. Testing was performed by the Ammunition Center and NWHC, plus Military Sea Lift Command and Miesau Army Depot. Following is a description of the alternate methods evaluated and the development and testing organizations associated with each:

a. The Brooks and Perkins International, Inc. Type A Restraint Kit. This system was developed by Brooks and Perkins on a contract with the US Army MERADCOM and tested by the US Army DARCOM Ammunition Center at Savanna, IL. It consists of adjustable steel sidewall panels which accept conventional cargo restraint bars or crossmembers. These panels are mounted on rails which are bolted to the commercial container walls. This system was tested and approved for the transport of ammunition. It is being compared from an economic point of view with the systems described below.

b. The Brooks and Perkins Type B Restraint Kit. This system was developed by Brooks and Perkins on a contract with MERADCOM and was tested by the DARCOM Ammunition Center. It utilizes complete sidewall aluminum panels with belt rails incorporated. The panels bolt to the container wall, while the custom crossmembers fit into slots in the belt rails. This sytem was also treated and approved for the transportation of ammunition.

c. The Value Engineering Corporation Restraint Kit. This system was developed by Value Engineering Corp. on a contract with MERADCOM and tested by the DARCOM Ammunition Center. It consists of steel panels, to which custom crossmembers are attached, and extruded rails, to which the panels are attached. The rails are bolted to the container at the floorline only. This system was tested but failed to gain approval since it did not pass rail transportation tests.

d. The Wood Dunnage Restraint System. This system was developed by the Storage and Outloading Division of the DARCOM Ammunition Center and tested by the Evaluation Division of that Center. This system utilizes nailed lumber dunnage and steel rear corner supports. This system was tested and approved for the transportation of ammunition. One phase of the testing program was a simultaneous trial rail shipment of inert ammunition by the Naval Weapons Handling Center at Earle, NJ and the DARCOM Ammunition Center to Miesau Army Depot, Germany. The four containers were then unloaded, inspected, reloaded and shipped back to the respective originating installations.

e. The IRSKIT #12 Restraint System. This system was developed by the Naval Weapons Handling Center (NWHC). This system utilized a wood dunnage restraint method but without the dual directional strut configuration of the system described in paragraph d above. Rather, it employs a cable and turnbuckle arrangement which secures the lading to the front corner posts of the container. Container on flatcar (COFC) approval testing was conducted by the NWHC, while trailer on flatcar (TOFC), road and tilt approval testing will be conducted by the DARCOM Ammunition Center. In addition, a round trip trial rail shipment will be conducted between the DARCOM Ammunition Center and the NWHC.

9. Work has also been done on like items, with the knowledge of those concerned and pursuant to the change clause of Chapter 4 of Part 13 of the JCAP JOPP. Specifically, Marine Corps experience showed that, for some 38 line items they used from Army stocks, the quantity per unit package and per pack was too high for the manner in which Marines used the items in the field. The change clause of the packaging JOPP requires that the Service desiring a change in an in-production, standard pack must fund the engineering of the change. This is simple logic and has the beneficial effect of putting a throttle on frivolous change requests. After consideration of workload through appropriate advanced coordination, the design and test work was assigned to NWSC, Crane. Drawings and test data were then turned over to ARRADCOM, which validated the drawings and issued them under a ARRADCOM CODE IDENT.

10. In sum, the various packaging activities in the ammunition community do design and test work on similar and like items, but only when necessary or desirable and with full knowledge of all concerned.

G. FUZE PACKAGING.

1. Three questions were asked about fuze packaging:

a. Why are five activities: ADTC; ARRADCOM; NSWC, White Oak; and NWHC involved in fuze packaging?

b. Who determines the package design requirements for fuzes?

c. Is there any reason why fuze packaging cannot be performed by one activity?

2. The question is incomplete. Among the activities which have engaged in fuze packaging are: Harry Diamond Laboratories (formerly Diamond Ordnance Fuze Laboratory); NUSC, Newport; Naval Mine Engineering Facility, WPNSTA Yorktown; and NWC, China Lake. In order to establish a correct frame of reference, some background on the role of fuzing in munitions performance and effectiveness is sketched.

3. As used herein, a fuze is a detonating device used to initiate explosion of the main charge of a projectile, rocket, missile, bomb, torpedo, mine, depth charage, grenade, etc. It performs this function by responding to two separate stimuli:

a. First, appropriate indication "telling" the fuze that it is safe and proper to be ready to perform the next function, and

b. Second, "knowledge" that it is the correct time to initiate the explosion.

The second stimulus can be selected to be any one of, or a combination of some of, the following: Direct impact, passage of time, radar (the proximity fuze), infrared radiation intensity, local or hydrostatic pressure, or changes in hydrostatic pressure or in the local magnetic field, and classified others.

4. Fuzes may assume other names, including exploder, actuator or safe and arming device. It will be noted that the limited definition used here excludes other devices used to initiate explosive type action. Sepcifically, blasting caps are not included nor are primers used to ignite the propelling charge in gun and artillery ammunition. As bag charge guns become increasingly rare, primers--although produced separately in most cases--are almost invariably assembled into the cartridge at the load, assemble and pack (LAP) plant.

5. Every explosive ammunition item has a fuze when it is launched against a target. Or, in the case of mines, when the target arrives near it. Each fuze is designed to work with a particular item of ammunition and to perform its function at the time and place desired. If any one element of ammunition could be rated as more vital than any

other fuzes would head the list. Fuze designs are constantly changing as ways are found to improve ammunition effectivenss, reliability and safety.

6. It can be seen that one reason there are many fuze design activities is that there are many fuzes to be designed. One reason for the large number of fuze packages is the large number of fuzes, with varying geometry, weights, environmental resistances, and fragilities. These factors control the fuze package design, and thus lead to a large number of fuze packaging configurations, even before service logistic differences are considered.

7. Potential duplications and overlaps in fuze design technology, inherent in the number of fuze design activities in the several services, has not escaped top management attention. The JLC has chartered the tri-Service Fuze Management Organization with a view to insuring greater standardization, cross-servicing and elimination of unnecessarily duplicative approaches to essentially common problems. It is expected that, from this, will also come specific fuze RDT&E responsibility assignments and, in time, fewer fuze configurations requring unique package designs.

8. Most of the fuzes used in ammunition are installed during the LAP process. Missile safe and arm devices are a part of the missile and are installed wherever the missile is assembled. Hence, the details of the packaging of such fuzes are not invariably visible in DOD controlled specifications and drawings. Where the producer of the fuze is a subcontractor to a government owned, contractor operated (GOCO) plant, detailed packaging control by the government can be counterproductive. What the government must control is the packaging of fuzes which will be attached to the ammunition item by Service personnel. The principal fuzes which are installed by a combat unit or its immediate support activity are: Naval torpedo exploders, Naval mine actuators, artillery projectile fuzes and fuzes for simple, high explosive bombs such as those falling into the low drag bomb series. Of these four, the first two are strictly Navy problems peculiar to the weapons involved, which are so limited in number that weapon supply accountability is on a serial number basis. Hence, to save time and space, the discussion which follows will be limited to simple, high explosive bomb fuzes and to projectile fuzes.

9. Bombs are normally fuzed just prior to loading onto the aircraft or onto multiple launch racks. In the Air Force, and in Marine Corps squadrons operating ashore, this operation is normally performed well away from the flight line. Aboard aircraft carriers this operation is performed in special bomb assembly areas, remote from the flight and hangar decks. Navy bomb fuzes are packed in reusable metal containers. As has been indicated before, the Navy's use of metal containers stems from the fact that they can be, and are, returned for reuse and because metal containers reduce the fire hazard. An additional advantage is gained because, in the tight confines of the bomb assembly area, inner packaging pieces can be tossed back into the metal

container to help keep the area clear of trash. Reduction of trash build up enhances both safety and efficiency.

10. A casual review of a fuze stock list will show that there are about 40 different bomb fuzes which are theoretically available. However, these fuzes are not necessarily functionally interchangeable. Many of the older fuzes, moreover, were designed for World War II type bombs, only one of which is still used, the M117 750 pound bomb, used by the Air Force. No further procurements of this bomb are contemplated. Older fuze designs in stock were used during SE Asia. For current procurement the Navy is procuring only the M904 series impact nose fuze and the followng electrical tail fuzes: MK 344 and MODS and MK 376. Substantial stocks of M990 tail fuzes are held in war reserve but are not being actively procured. Air Force immediate future procurements are limited to FMU-110/B, FMU-112/B, and FMU-113/B.

11. Packaging of current procurement bomb fuzes is shown in Table 10. Design agent for Navy bomb fuze packaging in NSWC, White Oak while design agent for the Air Force fuzes has been ADTC since about 1970. The only time NWHC entered the fuze packaging design picture was in evaluating a value engineering proposal to use the 2.25 rocket box as an alternate to the MK 2 MOD 0 ammunition component box. A large number of the rocket boxes were available and the adoption resulted in a 3 year cost avoidances of $364,545.

12. Primary designer of Army projectile fuze packaging is ARRADCOM. Even where a package design was detailed by Harry Diamond Laboratories for a fuze they designed, basic concepts developed by ARRADCOM are used. All of these packages are designed to be used at the battery. A typical packaging arrangement is shown in Figure 1.

13. The Navy used to use a wide variety of packaging for projectile fuzes. Towards the close of te SE Asia involvement, however, NSWC, White Oak was tasked to update all Navy projectile fuze production data packages, including the packaging data. Since Navy fuzes are shipped to the LAP plant for installation on the round, White Oak designed a bulk package for MK 70 and MK 90 series fuzes consisting of styrene foam trays with a cell for each fuze. The overpack is a cap and tube fiberboard box with fork truck handling features on the bottom. Because the Navy had a requirement for some spare fuzes aboard ships (this requirement is no longer valid), the trays are scored so that they can be cut apart. Individual sections so formed will pack neatly into an M548 metal container. The bulk pack for all but the MK 72 and MK 92 fuze contains 360 fuzes while the M548 box holds 10 fuzes. For the exceptions, the numbers are 576 and 16.

14. The largest single factor which will produce projectile fuze packaging standardization is the adoption by the United States of the NATO fuze shape for all projectiles 75MM and larger. Eventually, as the older fuze shapes are retired from the inventory, we can look forward to two standard projectile fuze packs, one for projectiles fuzed at the battery and a bulk pack for interplant shipments. The bulk pack has already been designed and tested. It is similar to the earlier design bulk box, except that the cut apart tray sections fit an M2A1 metal box. The quantities are 576 per bulk pack and 8 per M2A1.

15. Package design criteria for fuzes are developed from the physical characteristics of the fuze iteself, i.e., fragility, dimensions, weight, center of gravity and moments of inertia, and from the fuze's resistance to climate caused deterioration. Fuze packaging is designed to support the safety design criteria of MIL-STD-1316. Environmental performance expected of the fuze, and of its packaging, are contained in MIL-STD-331. This latter standard is under constant review by the Fuze Engineering Standardization Working Group. This Group was formed under the chairmanship of ARRADCOM acting as Assignee Activity for fuzes under the Defense Standardization Program. Finally, logistic constraints must always be satisfied.

16. Could all fuze packaging design be performed by a single activity? Technically the answer has to be yes. Whether or not it would be good management to do so is another question. The current practice is to make the design agent for the fuze responsible for insuring that the package is integrated with the fuze characteristics. The basic question is better answered as a part of the answer to a later question, discussed in Section II-J. Consideration of fuze packaging design centralization should await the results of such realignment of fuze RDT&E functions which are expected to ensue from the deliberations of the previously mentioned Fuze Management Organization.

TABLE 10

BOMB FUZE PACKAGING

TYPE FUZE	PACKAGING
Navy	
M904	12 per MK 2 Ammunition Component Box
MK 344 & MK 376	12 per MK 2 2.25 Rocket Box
Air Force	
FMU-110/B	2/M548
FMU-112/B	2/M2A1 (Modified)
FMU-113/B	2/M548

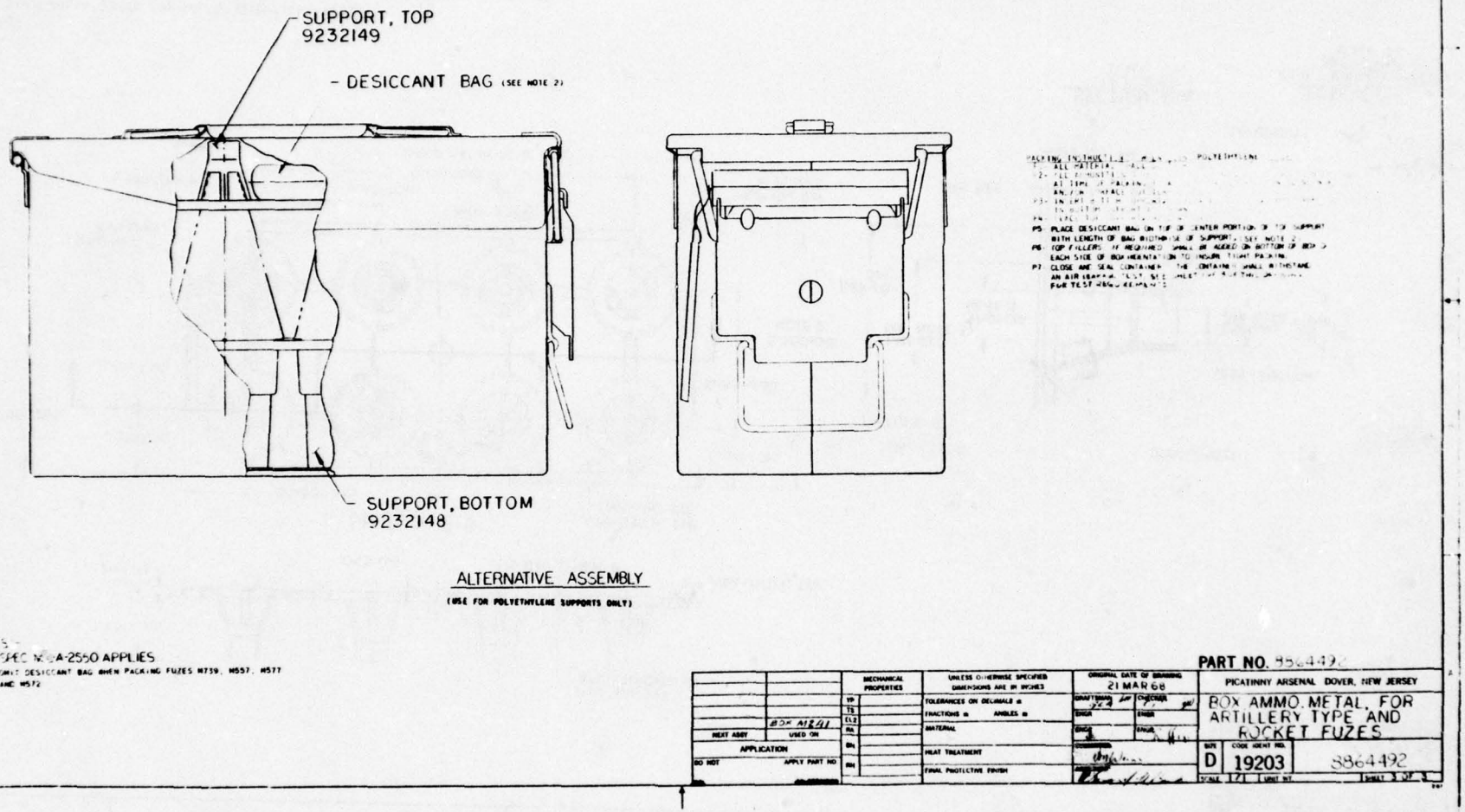
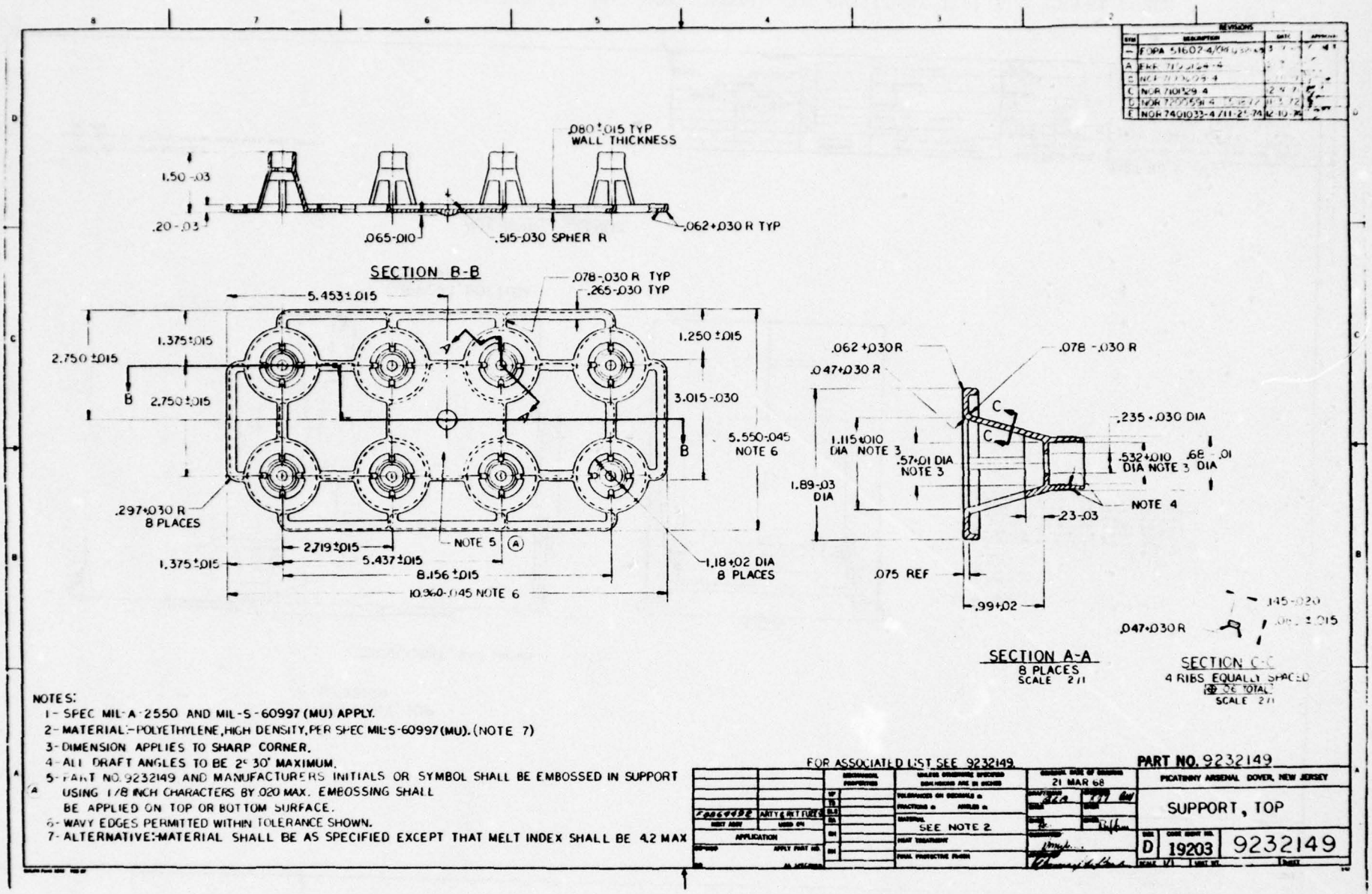


FIGURE 1 - BOX AMMO, METAL, FOR ARTILLERY TYPE AND ROCKET FUZES



NOTES:

1- SPEC MIL-A-2550 AND MIL-S-60997 (MU) APPLY.
2- MATERIAL:-POLYETHYLENE, HIGH DENSITY, PER SPEC MIL-S-60997 (MU). (NOTE 7)
3- DIMENSION APPLIES TO SHARP CORNER.
4- ALL DRAFT ANGLES TO BE 2° 30' MAXIMUM.
5- PART NO. 9232149 AND MANUFACTURERS INITIALS OR SYMBOL SHALL BE EMBOSSED IN SUPPORT USING 1/8 INCH CHARACTERS BY .020 MAX. EMBOSSING SHALL BE APPLIED ON TOP OR BOTTOM SURFACE.
6- WAVY EDGES PERMITTED WITHIN TOLERANCE SHOWN.
7- ALTERNATIVE:-MATERIAL SHALL BE AS SPECIFIED EXCEPT THAT MELT INDEX SHALL BE 4.2 MAX

FOR ASSOCIATED LIST SEE 9232149

SEE NOTE 2	21 MAR 68

PART NO. 9232149

PICATINNY ARSENAL DOVER, NEW JERSEY

SUPPORT, TOP

D | 19203 | 9232149

FIGURE 1A - SUPPORT, TOP

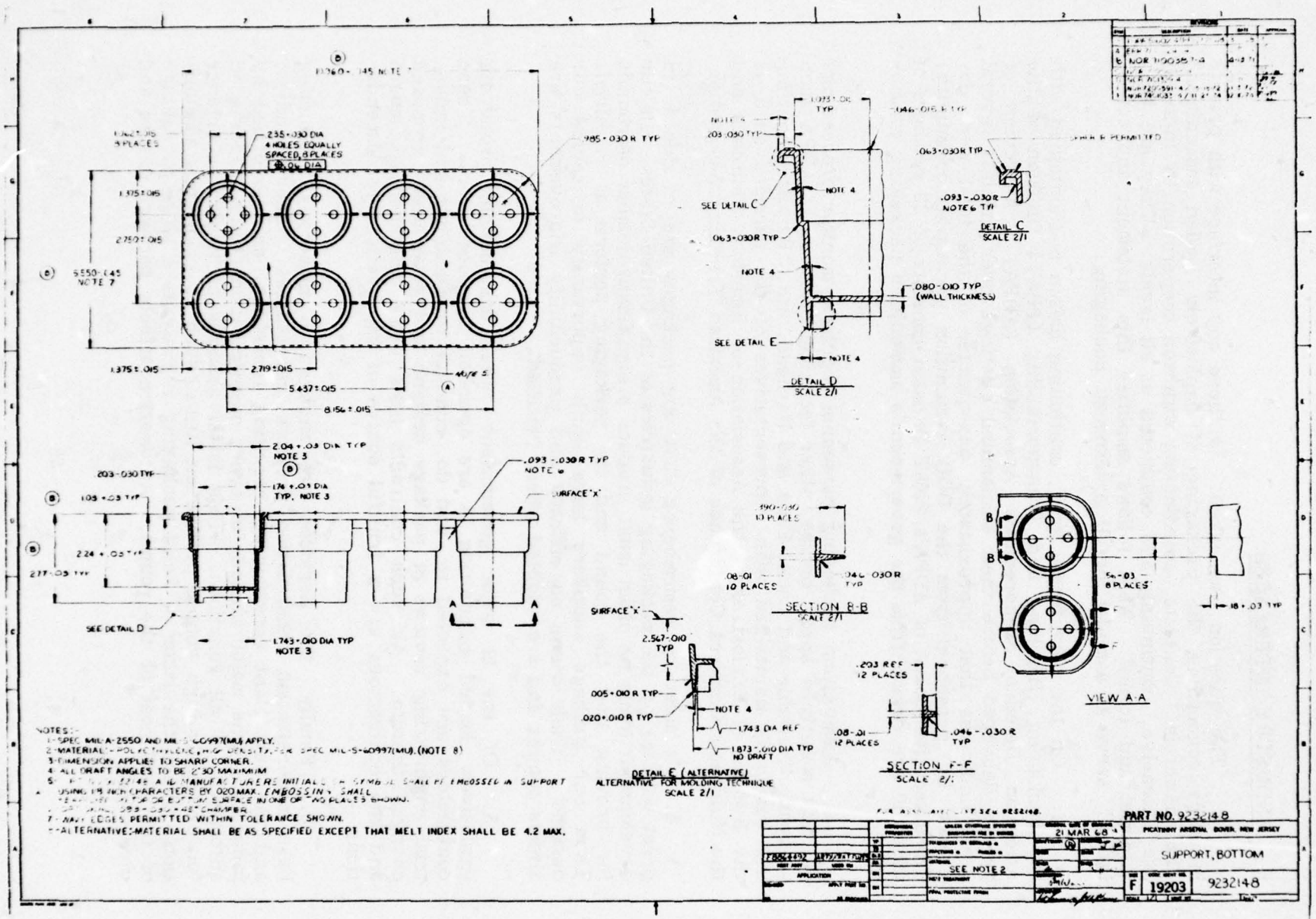


FIGURE 1B - SUPPORT, BOTTOM

H. INDUSTRY INTERFACES.

1. The question was asked: Is there any interface with private industry concerning the packaging of explosively loaded ammunition? The answer is: Contacts, coordination with and cooperation by industry are extensive, continuing and conducted at all levels. They are both informal and formal. What follows amplifies this statement and could, indeed, serve as a model for all government packaging.

2. On the more formal level, continuing liaison is maintained with the Packaging, Handling and Transportability (PH&T) Division of the American Defense Preparedness Association (ADPA). A review of papers delivered before their semiannual meetings over the last several years indicates that approximately one-quarter of the total were delivered by personnel from the DOD ammunition packaging community. The Executive Board of ADPA's/PH&T Division consists of 32 members of whom 10 are drawn from the government's ammunition packaging community.

3. Ammunition packaging personnel regularly monitor proceedings of, and sometimes speak before, other technical divisions of ADPA such as Load, Assemble and Pack, Fuze and Warhead, etc. Regular, continuing liaison is maintained with representatives of the carriers such as the Bureau of Explosives of the Association of American Railroads and the Munitions Carriers Conference of the American Trucking Association.

4. It must be remembered that our packages are produced (in great volume) by the packaging industries of the United States. In our development cycle we often must produce a significant number of rounds for proving that the round and its packaging perform as required. Thus our package suppliers have ample opportunity to review our designs. Their views on efficacy and producibility improvements are always sought and are adopted where justified.

5. Of the 19 major government owned installations producing explosively loaded ammunition 14 are operated by contractors. These contractors are expected to, and do, conduct producibility and industrial engineering reviews of package designs and government proposed changes thereto. All such contracts have Value Engineering clauses and the contractors are a fruitful source of improvement recommendations.

6. Finally, the Services are engaged in numerous production base modernization construction projects and studies. These studies, and the new plant construction resulting therefrom, are performed by industry. One major element in every modernization study is increased automation of all functions. This latter assumes particular importance for extremely high volume production items, such as small arms ammunition, where the labor of hand packaging represents a large percentage of the total cost of the round. Automation affects package design and vice versa.

I. 20MM AMMUNITION.

1. The question was asked: How many different design/container/configurations are there for aircraft 20MM ammunition? Acount for the differences.

2. The complete answer must be sought from understanding of the variety of 20MM ammunition available. Table II lists these varieties organized in terms of compatibility with the firing weapon. What Table II does not show is that, until just recently, all aircraft guns fired linked ammunition. Although linking can be accomplished by the activity rearming the aircraft, it is time consuming. Using units have, for many years, insisted that a substantial portion of all rounds be furnished linked. The sequence of types of rounds--e.g. 9 API, 5 HEI, 4 API, 1 APT--varies in accordance with the general type of mission anticipated. Further, for some guns, the order must be reversed depending upon whether the gun is left or right hand feed. The Navy link is different from the Air Force link for electric primed rounds. It is especially designed to provide reduced hazard from electromagnetic radiation encountered on the flight deck of aircraft carriers. All of these conspire to produce a very large number of packaging configurations if one counts, as one must, a difference in package marking as a change in configuration. It also produces a significant variety of internal packaging arrangements. These configuration differences would hold true even if all 20MM rounds were packed in the same outer container.

3. There are a limited number of external packaging schemes still in stock, of which the following are typical:

a. Unlinked Rounds:

(1) 180 rounds, in MK 3 MOD 20MM ammunition box. Used only on Oerlikon configured rounds and not under active procurement.

(2) 55 rounds per M21 can, 3 cans per MK 1 MOD 0 small arms ammunition box.

(3) 50 per M21 can, 2 cans per wooden box.

(4) 25 per metal container, 6 containers per wooden box.

(5) 10 per carton, 12 cartons per wooden box.

(6) 10 per carton, 17 cartons per MK 1 MOD 0 small arms ammunition box.

(7) 1 per paper tube, 50 tubes per M2A1 metal box.

(8) 165, 180, 210, 224 or 238 rounds per MK 1 MOD 0 small arms ammunition box.

(9) 200 rounds per M548 box.

b. Linked Rounds:

(1) 40 per belt, 1 belt per metal can, 3 cans per MK 1 MOD 0 small arms ammunition box.

(2) 40 per belt, 1 belt per metal can, 3 cans per wooden box.

(3) 50/belt, 3 belts per M548 metal box.

(4) 110 per belt, 1 belt MK 1 MOD 0 small arms ammunition box.

(5) 100 per belt, 1 belt MK 548 metal box.

Of the variations listed above, the most common are a(8) with a quantity per unit pack of 224, a(9), b(4) and b(5). All others are considered inactive for new procurement. Some designs go back to World War II and the fact that they are still listed as potentially issuable shows, indirectly, that ammunition packages last a long time due to their high reliability.

4. The Navy's metal containers for ammunition were (as previously noted in Section II-D) developed and introduced into service just prior to or early in World War II and have been used by the Navy ever since, particularly when the Navy had repairable assets available until well into the SE Asia involvement. One particular reason for continuing this use was that aircraft carrier 20MM magazines were laid out to fit containers. The Navy has, however, been progressively modifying the older carriers to provide for warehouse type magazines for ammunition. All the new construction carriers are so configured. Under this concept, unit loads of ammunition are struck down and stowed intact. Hence, the exact size of individual containers for aircraft 20MM ammunition no longer assumes the importance once assigned. This has encouraged reassessment of what the future optimum pack should be for the Navy's aircraft 20MM ammunition.

5. It is not clear why the Army and Air Force began development of the M548 box, other than obvious dissatisfaction with the cost and unpackaging inconvenience of some of the older packs described above. Early versions of the M548, then called the T46, began to appear in the inventory in the late 1950's and early 1960's. The final design version of this container was Type Classified, for both Army and Air Force ammunition, in 1970.

6. Introduction of linkless ammunition feed systems, as used in the M61A1 gun in the LAU-2A gun pod, for example, are also encouraging a trend towards 20MM ammunition packaging simplification. This gun is now used on the A-7, F-14, F-16 and F-18 aircraft. Total commitment to packaging unlinked rounds is not yet possible since the A-4, OV-10 and AH-1J aircraft guns still require linked ammunition. The M548 box holds 200 rounds of unlinked ammuniton quite comfortably. The M548 is the outer container of choice for compatibility with all linkless ammunition loading systems. When a decision is made to process linked stock to obtain a supply of unlinked ammunition, the yield of this unlinking and round exterior maintenance operation is repackaged in M548 boxes.

7. Careful cost comparisons have been made between the 110 linked round per MK 1 MOD 0 Small Arms Ammunition Box and the 100 linked round per M548 box configuration. The latter is about one cent per round less costly. This figure rapdily becomes a sizable sum of dollars when multiplied by the total number of rounds procured, $120,000 per year savings at present and $1,200,000 per year during SE Asia. This cost difference led to packaging the new depleted uranium linked round used in the Navy Close-in Weapons System (Phalanx) in the M548 box. This round is classified as mission oriented and consumption will not be large. Phalanx is scheduled for installation in a large number of smaller ships. Their relatively small magazines are being laid out and sized to handle the M548 box, depalletized.

8. While the basic initial investment in the M548 type box packaging scheme is less than that of the MK 1 MOD 0 arrangement, the one cent differential does not hold if, for instance, the MK 1 is available empty and the M548 must be purchased new. It is anticipated that the MK 1 MOD 0 box will continue to be used as an alternate, so long as production line support quantities can be economically obtained from inventory of used boxes. It is false economy to discard usable assets simply to achieve standardization.

9. Under the safeguards developed by the JCAP Packaging and Preservation Task Group, including development of the Container Design Retrieval System, it would be very difficult indeed to start development of the M548 container today. Yet, all things considered, it provides equal protection to the 20MM round compared to the MK 1 MOD 0 Small Arms Ammunition Box, and at less cost per round. Even duplication which would be labeled unnecessary can sometimes lead to beneficial results.

TABLE 11

REPRESENTATIVE TYPES OF 20 MM AMMUNITION

TYPE	NOTES
For Oerlikon Type A/A Guns	Varieties; BL-T, HEI, HET-DI, BL-P, APT
For M3, MK 16 and MK 22 A/A Guns	
M95	APT
M96	INC
M97	HEI
M99	TP
M204	HEI-T
M210	HEI
For CIWS	
MK 149	Depleted Uranium, Mission Oriented
For MK 11 and MK 12 A/C Guns	
MK 105	TP
MK 106	HEI
MK 107	API
MK 108	APT
For M39, M61 or M197 A/C Guns	
M55	TP
M56	HEI
M220	TP-T
M242	HEI-T

J. CENTRALIZING AMMUNITION PACKAGE DESIGN AND TESTING.

1. The question was asked: What would be the impact on the ammunition packaging community if all ammunition package developmental testing was conducted at one central activity?

2. The literal answer to the uninterpreted question is that such centralization is impossible. The package development process is not complete until the round, as packaged, is approved for service use, or Type Classified in Army terminology. Such final approval testing is conducted, under conditions as close to operational as it is possible to achieve, by independent commands: Test and Evaluation Command for the Army, Operational Test and Evaluation Force for the Navy, and Air Development and Test Center for the Air Force. There is simply no way that the extensive ranges and Naval operating areas can be co-located.

3. Although the question referred only to package developmental testing, we consider that the idea of creating a centralized package testing activity, capable of performing the vast majority of laboratory scale tests (except for operational evaluation), to be totally counterproductive unless the design responsibility for the packaging also be centralized. Ammunition package design is an engineering process during which engineering tradeoffs must be made. Many engineering designs require a successive series of evaluation because of the complexity of the test matrix. with testing of components, combinations of components and finally the complete container configuration. To separate the designer physically from the testing activity is to tie his hands, or more accurately, to cut them off. One of three things results:

a. Inordinate delays as the designer waits for test results, particularly, where he has no control over priorities. These delays cannot be tolerated because:

(1) They may delay the national or international Initial Operational Capability commitment (required fielding date).

(2) They may affect production schedules with high dollar impact since standby time has to be paid by the government. The product cannot legally be moved without the approved package.

If failures are noted, additional time is spent finding out exactly when the failure occurred and attempting to deduce the cause of the failure, second hand. In many cases, minor failures or weaknesses found during preliminary testing can be corrected on the spot.

b. The designer goes totally conservative, being humanly unwilling to risk formal reports of failure of his design being transmitted by official correspondence. The result is overdesign with resulting weight and cost penalties.

c. The designer runs tests anyhow, so that he does not get "surprised" by the centralized testing activity. This definitely duplicates effort and increases engineering cost.

4. Another disadvantage to geographic separation of design and test activities is the cost of transportation of test samples to the test activity. This also produces program delays.

5. The question, then, reduces to what would be the effect of combining both design and laboratory scale testing in a single facility. The fundamental principles of sound package design are independent of the contents or of the color of the uniform of the owner. Similarly, package laboratory testing methods, and the equipment to perform it reliably and with repetitive results, have been the subject of intense standardization effort for the past 40 or more years, with the American Society for Testing and Materials being the fundamental leader in the field. There can be no doubt, that such a centralized design and test activity could be organized. The core question thus reduces to the following sub-questions:

a. Would it produce better designs than are now being obtained?

b. Would it cost less than the existing system?

c. Would it be more responsive to the needs of ammunition designers?

d. Would it be more responsive after release to production, to producing command, e.g. Single Manager for Conventional Ammunition?

e. Most important, would it be more responsive to problems generated by the user of the ammunition, wherever he may be?

Quantitative answers are impossible without conducting a formal study leading to comparison of several alternative sites, one-time moving costs, effect of probable key personnel losses, plus costs of travel and paper flow to insure continuing liaison with round designers. Some qualitative answers can be deduced from past experience.

6. At the end of World War II, the Air Force had a viable packaging engineering and testing function, physically located at Wright-Patterson Air Force Base, as a component of the old Air Corps Materiel Command. This unit had no practical ammunition packaging experience, but had the capability of developing it as the Air Force went through its friendly divorce from the Army. In 1959 this responsibility was moved to Brookley Air Force Base, and began anew to develop the capability. In 1967 the entire activity was moved back to Wright-Patterson Air Force Base, as a component of the Air Force Logistics Command. When this move was made, 88 percent of the on board

civilian personnel declined to move. It was 3 years before all the displaced equipment was reinstalled and operating. The general consensus among knowledgeable colleagues in other commands in the Department of Defense was that the Air Force Package Evaluation Agency did not regain the technical competence it left behind in Brookley until approximately 4 years after the move.

7. In the meantime, the need for packaging engineering and testing services grew. Air Force Systems Command developed its own packaging expertise, although the only major in-house design and test function was limited to ADTC, the design agent for Air Force peculiar munitions. Within the Air Force Logistics Command, the Air Logistics Centers developed their own expertise and all now have some core package testing equipment, e.g. drop testers, inclined impact or pendulum impact testers, and L.A.B. type low frequency "vibration" testers which can be used on a go-no-go test basis.

8. When the Navy tried the organizational experiment called the Bureau of Naval Weapons, an in-depth study was conducted on the optimum method of providing centralized direction and control to packaging and handling of the full range of Navy ammunition. The Naval Weapons Handling Center is the result of this effort. It should be noted that the centralization of packaging and handling effort into one field activity was specifically intended to, and still is, being conducted with the following constraints on precipitous action:

a. Where package design and test capability existed in an ammunition RDT&E facility (e.g. NSWC, White Oak) it could remain in place so long as effective, but the designers would take guidance from NWHC on logistic system interfaces.

b. All transitions were to take place gradually, with minimum disruption of on-going effort.

c. NWHC was to be continually measured on performance, including responsiveness.

9. The basic mission of NWHC includes not only packaging of ammunition but also its handling, storage, stowage and transportability. The functional acronym is PHST to emphasize the importance of an integrated approach to the support engineering functions which make it possible to deliver reliable ammunition to the Fleet safely. In this respect, NWHC is unique in DOD for there is no other laboratory type packaging and handling activity which covers the complete factory to user sequence.

10. The experience with NWHC, after about 15 years of gradual centralization, indicates that it can be made to work. One of the prices paid is the cost of continuing liaison with round design and in-service engineering agents to insure interfaces. This requires constant meetings, with associated travel, backed up with written data to insure

package suitability. This also requires constant management attention to maintaining clear boundaries between the functions of the respective activities involved.

11. Assume that one of the major ammunition packaging design developmental testing facilities (ARRADCOM, DARCOM AMMO Center, NWHC, or ADTC) be selected as the centralized activity. The following would ensue automatically:

a. Staff would have to be increased to handle the workload.

b. Testing facilities, real estate, and equipment would have to be increased to handle the additional workload.

c. The staff would have to be organized in terms of Service customer and sub-specialties within the Service area.

d. A new building would have to be constructed to house the larger staff and support facilities required. With the MILCON budget as chronically short as it is, it could well be many years before needs would be translated into brick and mortar.

12. Even after absorption of a high one time cost, it is doubtful if there would be significant personnel reduction.

13. Precipitate merger of ammunition package design and developmental testing into one single activity would have the following qualitative impacts:

a. Vital skills, built up over the years, would be lost as key personnel refused the move. This expertise would not be restored for four or more years.

b. Responsiveness to the needs of individual Services, more particularly to the paramount needs of the operating forces, would be difficult to achieve.

c. If responsiveness were lost, the activity could become a non-productive economic liability.

14. The foregoing is not to imply that specific package design and test functions cannot or should not be transferred. The package is a part of the configuration of the round as delivered. If design cognizance of a round, or class of rounds is transferred, so too should package design and test cognizance be transferred. Such is routinely done.

K. TECHNOLOGY SPECIALIZATION.

1. The question was asked: Serious consideration is being given to assigning lead laboratories for materials testing and packaging processes. Would a similar concept apply to ammunition packaging.

2. The ammunition design and developmental test activities are primarily concerned with the design of a specific structural configuration of a container system to protect a specific configuration of an ammunition item. The designer must have access to all the technological disciplines which combine to constitute the art of packaging. Specialization by ammunition item worked already exists. To limit the activity by technology would be counter productive.

3. Because each activity has its own pool of highly qualified talent, concentrations of expertise have developed because of many designs using a preferred technology, or because an answer was needed to a problem and no one in DOD was working the area. The following concentrations of expertise are recognized throughout the ammunition packaging community:

a. Injection molding in packaging: ARRADCOM.

b. Spiral wound paperboard and metal composite containers: ARRADCOM.

c. Wirebound boxes: ARRADCOM.

d. Plastic foam containers and cushions: NWSC, Crane.

e. Fire resistance of wood and cellulosic products: Frankford Arsenal (capability being transferred to ARRADCOM).

f. Anti-Static treatments: NAEC for films, NWSC Crane for foams.

g. Heat Flux into containers in storage and transit: NWC, China Lake.

h. Temperature effects on plastic foam performance: MIRADCOM, Redstone Arsenal.

i. Pallets for ammunition: DARCOM Ammo Center for wood and NWHC for metal.

j. Metal and plastic strapping: NWHC, DARCOM Ammo Center.

k. Automated design equipment: NWHC.

l. Design of complex shock and vibration systems: NWHC, ARRADCOM.

m. Design retrieval: ADTC.

4. It is standard practice for each design activity to consult the experts before proceeding independently. Further, work and funds flow to the expert depending upon the nature of the help needed.

SECTION III

CONCLUSIONS

1. Ammunition packaging is important to the ability of the United States to conduct military operations. It achieves this status by being a part of the configuration of the round delivered to the user and performing the role of insuring that round reliability, as produced, is not degraded by prolonged storage nor by physical distribution to the user.

2. Ammunition packaging involves a host of individual item packaging problems which must be solved expeditiously and responsively. About 22,000 individual line items are involved. Each of these line items has an engineered, tested and safety certified package.

3. Differences in ammunition logistics and employment by the using Service combat units often dictate differences in details, even where the round is similar or, even, identical. The standardization problem is to insure as much commonality as possible while insuring that customer needs are satisfied. These latter are paramount.

4. Some duplication of effort in ammunition packaging, has occurred in the past. Through joint efforts, such as those of the JCAP Packaging and Preservation Task Group, common procedures and management techniques have been effective and there is currently no known duplication of work in the ammunition packaging community. These joint efforts are worth continuing.

5. The ammunition packaging community is integrated through common policies and procedures and regular interchanges of information, direct with each other and through joint service coordinating groups. Consolidation into a single activity would not improve this condition.

6. Immediate consolidation of the ammunition packaging community into a single organization would be counterproductive.

7. The ammunition packaging community can absorb changes in design cognizance for specific items on a case by case basis. The logical way to do this is to have package development responsibility follow item development responsibility.

SECTION IV

RECOMMENDATIONS

Based on the information contained herein and the conclusions which can reasonably be drawn therefrom, it is recommended that:

1. A centralized laboratory to perform all package testing not be established.

2. The existing concept of division of design responsibility and expertise in the ammunition packaging community be left substantially as it is.

3. Transfer of ammunition packaging design and test cognizance between the Services be keyed only to, and be a part of, any transfer between the Services of end item design cognizance.

4. The Container Design Retrieval System, developed by the ammunition packaging community, and used by it, be adopted and used by the entire DOD packaging community.

5. The non-ammunition packaging community in DOD take advantage of the expertise and knowledge gained by the ammunition community. This applies with particular emphasis to the packaging of hazardous materials, where ammunition's safety record is exemplary.

6. The methodology adopted and the success achieved by the ammunition packaging community in arriving at consistent management and standardized packaging be taken as a model of what can be accomplished by the rest of the DOD community.

7. The JCAP Packaging & Preservation Task Group continue as a functioning entity.

8. This report, in its entirety, be included in any report to be submitted to the JLC by JTCG/PKG on rationalization and standardization of all DOD's packaging.

APPENDIX A

APPENDIX A

QUESTIONS FOR JCAP/PKG AND PRES TASK GROUP

1. What procedures do JCAP/PKG have to eliminate unnecessary duplication of effort if it is found to exist?

2. What is the difference in the packaging of a 155MM projectile and a 5" projectile? Why are the differences necessary?

3. What are the reasons for the numerous methods of packaging small arms ammunition? Is there any reason why this packaging cannot be performed by one organization?

4. Why do the Army Ammunition Center, Picatinny Arsenal and NWHC develop unit loads for ammunition?

5. Are packaging organizations conducting developmental tests on like or common items? If so, identify.

6. Why are five activities: ADTC, Eglin AFB; Picatinny Arsenal; NAVSURFWPNCEN; and NWHC involved in fuze packaging? Is there any reason why fuze packaging cannot be performed by one activity?

7. Who determines the package design requirements for fuzes?

8. Is there any interface with private industry concerning the packaging of explosively loaded ammunition?

9. How many different design/container/configurations are there for aircraft 20MM ammunition in DOD? Account for differences.

10. What would the impact be on the ammunition packaging community if all ammunition package developmental testing was conducted at one central activity?

11. Serious consideration is being given to assigning lead laboratories for materials testing and packaging processes. Would a similar concept apply to ammunition packaging?

APPENDIX B

PART 13 - PACKAGING AND PRESERVATION

Chapter 1 - General Policies and Procedures

1. Purpose.

This part establishes joint operating policies and procedures that will promote interservice coordination and standardization of ammunition packaging and preservation and establishes procedures to be followed in attaining these objectives. Effective management of ammunition logistics requires early involvement of packaging in the research, development, test and engineering phase of round development. It is for this reason that Chapters 2 and 3 of this part are provided, although it is recognized that research and development of packaging, and other related areas such as the design retrieval system, are not within the purview of JCAP.

2. Scope.

These operating policies and procedures apply to the ammunition commands specified in the JCAP Coordinating Group Charter.

3. Definition.

Packaging and Preservation. As used in this part, packaging and preservation is to be construed as meaning all the techniques and devices required to prepare ammunition for distribution. Included in this definition are temporary corrosion preventive techniques and materials, containers, marking (other than end item marking), shock isolation where peculiar to the distribution environment, and techniques and materials for assembly into unit loads capable of delivery to the user. Excluded from this definition are the final engineering for transportability, such as techniques and materials used for railcar loading, truck loading, aircraft loading, ship loading, and loading into multimodal transportation containers meeting applicable International Standards Organization (ISO) standards. (These areas are under the cognizance of Handling and Transportation Task Group.) Also excluded are integral protective techniques or markings which remain with the ammunition item to its target.

NOTE: Designers must take into account that certain marking normally used only as a part of packaging may have to be permanently applied to the item where that item is not completely enclosed in a container incident to packaging, e.g., palletized bombs.

4. Packaging and Preservation Functional Interfaces.

Packaging and preservation interfaces affect current and planned facilities and operations that are, or will become, part of the Conventional Ammunition Production Base and Production Base Management. Those facilities and operations specifically affected are:

a. Production facilities, including industrial preparedness facilities.

b. Storage facilities, required to protect the item from the environments and to provide security.

c. Production line operations, to ensure that the production line operations and packaging and preservation operations are compatible, safe and efficient.

d. Intra-activity handling of packaged or utilized loads to and from production lines within a facility and between facilities within an activity to ensure compatibility.

e. Military-owned multimodal container (MILVAN) loading and unloading, including handling methods and equipment for movement of the package or unit load into or out of the container, and dunnaging within the container, to ensure compatibility with the packaging and preservation.

f. Carrier loading, including handling methods and equipment for loading on or off the carrier, and dunnaging, to restrain the packaging and preservation on the carrier for shipment, to ensure compatibility with the package or unit load and with existing transportation regulations.

g. Transportation modes, including rail, truck, ship and aircraft for safe, economic and effective delivery of the packaged and preserved item.

h. Transshipment handling and storage, including receipt, handling and storage required at the transshipment activity.

i. Ship loading/unloading, including transportation to dockside, handling to, within and from the ship, and dunnaging with the ship to be compatible with the packaging and preservation and with existing regulations.

j. Operational users' operations, including receipt, handling, storage and use to meet operational needs.

k. Retrograde shipments, including packaging and preservation preparation, handling and shipment, to be compatible with safety regulations.

l. Retrograde Continental United States (CONUS) receipt and transshipment, including receipt, handling, storage and transshipment to inland destinations.

m. Demilitarization operations, including disposition of packaging and preservation items/components.

n. Recycling/inventory/disposal of packaging and preservation items/ components.

5. General Policies.

a. Packaging and preservation, including quantity per unit pack for a specific round of ammunition and its components, shall be standardized among the Services, insofar as practical and consistent with tactical needs of the respective Services.

b. Maximum interchangeability and standardization shall be constantly sought through:

(1) Freely using existing container designs while maintaining configuration control.

(2) Prior to undertaking new design, querying the Container Design Retrieval System, maintained at Armament Development and Test Center, Eglin Air Force Base, to ensure maximum usage of existing designs or design features.

(3) Maintaining full interchange of information from the exploratory development stage throughout the life cycle of the end item.

c. Data concerning each final design of a specialized container shall be added to the Container Design Retrieval System as soon after formal release as practicable.

d. The round, or component, design activity is responsible for keeping the packaging and preservation design activity fully informed concerning configuration (and changes thereto) affecting package design throughout the life cycle of the round.

e. The packaging and preservation design activity is responsible for ensuring acceptability of the design for use (multi-Service use, where applicable) throughout the logistic system, satisfying all identified interfaces.

6. General Procedures.

a. Optimized approaches to the functional interfaces defined in this chapter shall be assured by coordination with the pertinent JCAP Task Groups on a formal basis and with the members of these task groups on an informal basis; e.g., face-to-face contact, telephone, etc.

b. Formal coordination shall be maintained by interchange of minutes of all meetings with the pertinent JCAP task groups.

c. Joint meetings with affected JCAP task groups will be held, as appropriate, to resolve issues which may develop. Issues not so resolved shall be referred to the JCAP Operating Group for resolution.

d. Because of the close interrelation of packaging with safety, handling and transportation, particular attention shall be paid to close coordination with the Safety Task Group and the Handling and Transportation Task Group.

e. The joint operating policies and procedures contained in this part shall be periodically appraised and modified as necessary. Proposed changes will be considered by the Packaging and Preservation Task Group and coordinated with other JCAP task groups prior to submittal to the JCAP Operating Group for approval.

PART 13 - PACKAGING AND PRESERVATION

Chapter 2 - Research and Exploratory Development Coordination

1. Purpose.

This chapter delineates joint policies and procedures designed to achieve inter-service coordination among those organizational elements charged with the research and exploratory development (R&ED) of preservation and packaging for ammunition to:

a. Avoid duplication of effort.

b. Ensure that R&ED effort is undertaken in all necessary areas concerned with ammunition packaging and preservation.

c. Exploit applicable findings of other Services.

d. Anticipate requirements generated by changing user practices.

e. Develop new methods and techniques that will result in better protection of ammunition at reduced cost and to ease the logistic burden of the user.

f. Obtain JCAP Operating Group endorsement for proposed packaging and preservation R&ED efforts.

2. Scope.

These joints operating policies and procedures apply to the ammunition commands specified in the JCAP Coordinating Group Charter.

3. Definition.

Research and Exploratory Development. Research and exploratory development is to be considered as any packaging or preservation development or testing which is not specifically oriented towards the engineering development of a specific package for a specific round, regardless of the specific appropriation funding the effort.

4. Policies.

a. Each Service is responsible for developing and funding its own R&ED packaging programs. Where appropriate, funding support may be given by other Services.

b. In the course of developing its program, it is incumbent on each Service to coordinate its proposed tasks with the other Services.

c. Points of contact for this purpose will be those maintained in the JCAP Packaging and Preservation Task Group roster.

d. Methods of coordination are left up to the individual Service; e.g., mail, telephone, and/or personal visits.

e. In the event of unresolved conflicts, any of the Services may request the Chairman, JCAP Packaging and Preservation Task Group to convene a meeting to discuss and resolve such conflicts.

f. Final appeals may be submitted to the JCAP Operating Group position.

g. Services conducting ammunition R&ED packaging tasks will submit copies of their normal quarterly and final reports to their counterpart contacts. These reports will be submitted in addition to other reports that may be routinely sent to other Services.

h. Each Service is responsible for performing, for its own ammunition packaging:

(1) Review of advances in packaging state-of-the-art (foreign, commercial and non-ammunition oriented) for possible exploitation.

(2) Review of feedback reports, to determine packaging shortcomings that appear on an across-the-board basis.

(3) Review user doctrine, to determine future operational plans in the final delivery to user phase of the logistic cycle.

(4) Evaluate user requirement documents, to establish trends in future packaging needs.

(5) Review value engineering change proposals and beneficial suggestions to ascertain general areas requiring attention.

(6) Consider the general impact on packaging requirements that may be generated by plant modernization, changes in user tactics, and changes in the transportation system. Examples of the latter two are authorization for mechanized materials handling equipment in the user's organization, more use of airlift, and containerization of cargo.

5. Procedures.

a. To assist in obtaining funding, JCAP related programs may be submitted with JCAP Operating Group endorsement recommending initiation of the effort.

b. To obtain JCAP endorsement, proposed tasks must first be staffed through Service counterparts.

c. Proposed programs should be prepared on standard format (DD Form 1498 or AMC Form 1534-R) for ease of coordination.

d. Proposed programs, upon obtaining tri-Service endorsement, shall be submitted to the Chairman, JCAP Packaging and Preservation Task Group.

e. The Chairman, JCAP Packaging and Preservation Task Group will be responsible for obtaining JCAP Operating Group endorsement and returning proposed program to originator.

6. References.

a. DD Form 1498, Research and Technology Work Unit Summary

b. AMC Form 1534-R, RDT&E Program Data Sheet

PART 13 - PACKAGING AND PRESERVATION

Chapter 3 - Engineering Development

1. Purpose.

This chapter establishes joint policies and procedures to ensure that fully tested and documented packaging and preservation materials, procedures and container designs are available upon completing engineering development of a specific ammunition round, i.e., as a part of the round's product base line.

2. Scope.

These joint operating policies and procedures apply to the ammunition commands specified in the JCAP Coordinating Group Charter.

3. Policies.

a. Development Responsibility. Responsibility for development of packaging for a new ammunition item shall be as designated by the cognizant ammunition end item acquisition/project manager, consistent with the standing procedures applicable to his Service. Where it appears likely that the round will be cross-serviced, special packaging needs of the other Services shall be solicited and satisfied wherever practicable. Problems arising in satisfying cross-servicing needs shall be referred to the Chairman, Packaging and Preservation Task Group for staffing. Final resolution, if necessary, shall be by the JCAP Operating Group.

b. Funding. Costs of engineering development for a package for a specific ammunition item, and for any or all of its components, shall be funded as a part of the ammunition end item development cost. The product, development, or acquisition manager for the end item is responsible for ensuring adequate planning, liaison and funding support of his designated packaging development activity.

c. Time Phasing. Engineering development of packaging for a specific ammunition round, or any or all of its components, shall be undertaken in timely fashion so as to ensure that:

(1) Prototype production packaging is available for any hazard classification testing required; e.g., Class A, B, C explosive, or non-regulated.

(2) Prototype production packaging is available for round test and evaluation in accordance with the approved round development plan.

(3) Prototype production packaging is available for any transportability testing or demonstration required. [See Part 12]

(4) The final production release documentation for the ammunition item shall incude a complete, proven by test, producible design disclosure for its packaging.

d. Configuration Management. Packaging for ammunition shall be an integral part of the applicable base line of the ammunition item or component. Packaging development criteria shall be generated as a part of the conceptual phase of the ammunition item. As a minimum, firm package configuration shall be established as an integral part of the product base line prior to full scale production.

e. Engineering for Transportability.

(1) Live ammunition is usually, by definition, a transportability problem item. Few ammunition items are, however, so configured as to:

(a) Exceed the dimensional thresholds of MIL-STD-1366, thus requiring special routing studies or special aircraft loadability analysis.

(b) Contain combinations of substances not normally permitted in combination by the Department of Transportation regulations (e.g., rocket ammunition, with fuze and warhead and a liquid fuel), requiring action through channels to obtain exemptions for their shipment.

(c) Be of such dangerous or sensitive nature as to require technical escort during transportation.

(2) It shall be the responsibility of the developing Service to identify those few items falling in the foregoing problem areas to the Services' designated Transportability Agents in timely fashion so as to ensure shipment capability. These actions shall be coordinated with the JCAP Handling and Transportation Task Group, where appropriate.

(3) Packaging is a recognized first approach to solution of a transportability problem. Packaging shall, therefore, be designed to ensure safe, efficient loading and handling into railcars, trucks, cargo aircraft, break bulk shipping, and large transport containers.

(4) A part of the round development process is engineering for transportability. Neither the package nor the round shall be released for full scale production until all transportability engineering is

complete, to include coordination with logistics centers, and documented; i.e., carloading, truckloading, shiploading (where necessary), transport container loading (stuffing), and aircraft loading (if necessary) procedures are documented and approved. Procedures for accomplishing this effort shall be as prescribed by each Service.

4. Concepts.

Engineering development of packaging for ammunition shall be conducted within the framework of the following concepts:

a. Guiding Documents. Packaging development shall be conducted within the guidelines of the documents referenced in paragraph 6 of this chapter issued and in effect at time development is initiated.

b. Criticality. Packaging for ammunition shall be considered to be, by definition, logistics critical, as defined by MIL-STD-490. Configuration management shall be imposed by the developing activity at an appropriate time, but not later than release for full scale production.

c. Cost Goals. The basic cost goal for ammunition packaging shall be lowest life cycle cost of the round, not lowest acquisition cost of its packaging. In weighing methods of achieving this goal, the packaging development activity shall consider the following:

(1) Engineering development cost

(2) Procurement costs for elements of the package

(3) Labor costs for packaging and unpackaging

(4) Costs for return of empty containers (if applicable) and forward area recouping costs for retrograde ammunition.

(5) Handling and shipping costs for empty and loaded containers

(6) Efficacy, and associated costs, in transport vehicle loading (including containerization)

(7) Cost savings associated with secondary uses of packaging materials

(8) Maintenance and storage costs

(9) Costs of compliance with Occupational Health and Safety regulations

(10) Costs of disposal with minimum adverse affect on the environment

d. Safety. There shall be no compromise with explosives safety nor with sytems safety.

e. Legal Constraints. Effectiveness criteria shall also include due efforts to satisfy and obtain appropriate waivers from, where necessary, the constraints imposed on packaging ammunition by the Department of Transportation, the Environmental Protection Agency, the Department of Labor, and the Public Health Service.

f. Trade-Off Studies. Effectiveness criteria and lowest life cycle cost shall be established, insofar as practical, by trade-off studies, including studies of reusable versus non-reusable containers. Where reusable containers are being considered, trade-off studies shall include container logistic support and contributions to system reliability and maintainability.

g. Delivery to the User. Of equal or greater importance, packaging shall also be designed for effective, safe, delivery to the ultimate user and safe, efficient storage, stowage, handling, unpacking and disposal by this ultimate user. This design goal recognizes that more than one package may be needed for a given ammunition item so as to take into account such factors as:

(1) Differing user needs for quantity per unit package.

(2) Differing package configuration dictated by mode of delivery to consumer; e.g., helicopter delivery to a battery, delivery by organic surface transportation, transfer-at-sea, etc.

(3) Stowage space available in ship, airplane or ground combat vehicle. While user needs, as identified by a particular Service, must be satisfied, every effort shall be made to keep package design proliferation to a minimum to maximize production efficiency. This countervailing goal will assume greater importance as automated packaging techniques are introduced.

h. Unit Loads. In developing unit load configurations, consideration shall be given to the weight handling limitations of the using organization and to optimizing the dimensions to take into account the dimensional constraints of transportation media and assure safe, economical restraints in these media.

5. Procedures.

a. Container Design Retrieval System (CDRS) Interrogation. Prior to initiating a design for a new specialized container, the CDRS shall be interrogated to determine whether an existing design can be used as is or with minor modification. Inquiries should be submitted as soon as preliminary container design needs are formulated. Inquiries shall be addressed, in the format indicated in Appendix I of MIL-STD-1510, to Armament Development and Test Center (SDMT), Eglin AFB, FL

32542. Inquiries from contractors shall be submitted via the cognizant Contract Administration Services office.

b. Feedback from CDRS. Feedback from the CDRS shall be considered for the proposed container and in detailing the design. It is the responsibility of the design activity to obtain up-to-date drawing packages of promising container designs from the container's design activity or technical data repository.

c. Use of Existing Container Designs. When a design activity determines that an existing container can be used as is or with minor modification, the activity with design cognizance of the existing container and the CDRS Management Office shall be informed.

d. Support Agreement. When a container becomes common to more than one Service by the foregoing process, specific agreement shall be reached on procurement responsibility, intermediate and depot level maintenance responsibilities and other supply support to ensure effective supply management. [See Chapter 4]

e. Use of Portions of Existing Designs. Use of CDRS feedback may lead to a decision that the changes to an existing design are so extensive that maintaining functional interchangeability will not be cost effective. Yet there may be substantial features of the design--e.g., shell weldment, latches or other details--which can be adopted without change. In the latter case, the original design activity shall be informed of this usage so that the usage block on the pertinent drawing can be changed as an indicator that future Class I engineering change proposals (those affecting form, fit or function) must be coordinated with that activity using the drawing. [See Chapter 4]

f. Feeding CDRS. As soon as practicable after release of a new container design, or of a modified design where the modifications were of significant magnitude to cause a change in formal nomenclature (e.g., MOD 0 to MOD 1), pertinent data shall be furnished to the Armament Development and Test Center, Eglin AFB, FL 32542, for incorporation into CDRS. Data concerning the container and its contents shall be in substantial conformity with Appendix II of MIL-STD-1510. Even where an existing container design is being used as is, data concerning the contents, keyed to the existing container, shall be furnished.

g. Data Exchange. In addition to the foregoing, data concerning the results of packaging development effort shall be exchanged between the Services as outlined in Chapter 7.

h. Coordination. The life cycle implication of engineering developments in packaging and preservation shall be recognized and provided for by mandatory coordination between development centers and logistics centers early in the development cycle, and at appropriate development and testing stages thereafter, in order to assure adequate provision for logistics considerations.

6. Compliance with Department of Transportation (DOT) Regulations.

The Services are bound, pursuant to Act of Congress, to ship ammunition in conformity with the Hazardous Materials Regulations of the Department of Transportation. These regulations contain specific restrictions on types of containers to be used and, in many instances, restrictions on the gross weight or weight contents allowable in a single outside container. These regulations do, however, grant substantial leeway to the Department of Defense to vary from the letter of the DOT Regulations and also provide for exemptions in certain cases. The following specific procedures shall be followed in interpreting the authority granted to the Department of Defense.

a. The Authority Granted. Section 173.7(a) of the DOT Regulations stipulates that shipments of hazardous materials offered by or consigned to the Department of Defense (DOD) of the US Government must be packaged, including limitations of weight, in accordance with the regulations or in containers of equal or greater strength and efficiency as required by DOD regulations. In 1971, DOT issued a written interpretation of this paragraph stating unequivocally that the phrase "limitations of weight" did not apply to containers meeting DOD specifications provided that determination is made that a package is of equal or greater strength and efficiency than the prescribed DOT container. Nowhere, however, has the phrase "equal or greater strength and efficiency" been defined in objective terms. What follows constitutes joint agreement concerning what constitutes equal or greater strength and efficiency, how to demonstrate it, and who may certify compliance with the cited paragraph of a regulation issued pursuant to Public Law.

b. Options Open to the Designer. There are four options open to the container designer. These options are:

(1) Option 1 - Full compliance,

(2) Option 2 - Partial compliance,

(3) Option 3 - Certification under 173.7(a), and

(4) Option 4 - Seeking exemption, the least desirable choice.

c. Full Compliance, Option 1. Full compliance consists of adhering to any weight limitations given in the commodity description and, where a DOD container specification is prescribed, using such a container, properly marked to show compliance with the pertinent specification. Where a DOT specification is not prescribed but, rather, the regulations speak to a generic container (e.g., "strong wooden box"), the designer may use the generic container, conforming to government specification of choice. In this, connection, the phrase "government specification" shall be construed to mean any Federal or Military specification or standard, or any accepted engineering drawings without associated procurement specification, provided the drawings include

complete quality assurance provisions such as sampling plans and classification of defects. Regardless of container specification used, the complete package must be tested to demonstrate performance equal to, or exceeding, the pertinent requirements of MIL-STD-648, since use of a specification construction for the outer container does not, in and of itself, guarantee protection and retention of the contents.

d. Partial Compliance, Option 2. Partial compliance consists of adhering to any weight limitations given in the pertinent commodity description, sections 173.21 through 173.398 of the DOT Regulations, but using a government specification instead of the prescribed DOT specification. Attachment 2 of "Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft" contains a list of many of the Federal and Military specifications which may be prescribed in lieu of the corresponding prescribed DOT specifications. In addition, the designer may choose to prepare drawings (with or without an accompanying procurement specification) based on the DOT or the Federal or Military specification. When this latter option is exercised, there shall be one to one correspondence between the drawing requirements and the corresponding specification being followed. In addition, the top assembly drawing shall be specifically annotated as follows: "Conforms to (DOT, Federal or Military specification number)". Also, as before, the performance of the complete package must be demonstrated by test.

e. Certification, Option 3. The choice of seeking certification under section 173.7(a) is normally made when a round or material is covered by an allowable commodity description, 173.71 through 173.398 of the DOT Regulations and it is necessary or desirable to ship in containers grossing more than the weight allowable or to ship in containers of an entirely different construction than those formally authorized. In order to obtain certification, the design activity must make special application to his own Service approving command in accordance with the following procedures:

(1) Approving Command Defined. Authority to certify under section 173.7(a) of the DOT Regulations is limited to the following commands in the respective Services:

(a) For the Army: US Army Armament Command
(AMSAR-RDS)
US Army Missile Command
(AMSMI-SD)

(b) For the Navy: Naval Sea Systems Command
(SEA-06G3)

(c) For the Air Force: Armament Development and Test Center (SDMT)
Air Force Logistics Command
(LOTP)

Inclusion of office codes in the foregoing command designations is solely for the purpose of identifying a first point of contact. Final approval authority shall be as delegated in each command.

(2) Data Required. All requests for certification shall be accompanied by summaries of all safety tests performed on the round or material and by a complete test report demonstrating that the complete package successfully met performance criteria equaling or exceeding in severity those contained in MIL-STD-648. In addition, where distribution will normally be in unit loads, a copy of the proposed unitizing procedures, supported by test results, may also be required by the approving command.

(3) Coordination. It shall be the responsibility of the first point of contact within each approving command to ensure coordination within that command. In addition, where the proposed shipping configuration may be incompatible with transport aircraft, or where the round contains liquid or semiliquid explosives or propellants or products particularly corrosive to aircraft if spilled, or gas under high pressure, coordination with Air Force Logistics Command (DSPX) prior to formal certification is also required. For all other cases, a copy of the pertinent container and unit load data shall be furnished to that activity by the design activity after completion of the action required by certification.

(4) Certification. Where approval is granted under section 173.7(a), such approval shall be explicitly stated in a letter from the approving command or as a part of the production release certification. Wherever stated, the approval for a specific package design shall be signed by an official qualified to do so. Such approvals shall become a part of the permanent engineering record supporting the container design.

(5) Drawing Annotation. Upon receipt of approval, the design activity shall annotate the top assembly drawing as follows:

> "Approved pursuant to section 173.7(a), DOT Regulations, by (abbreviated name of approving comment) in (reference numbers and date of approving document)."

(6) Approval Limitation. Approvals are limited to specific end items in specific container designs. Significant changes in either require reapproval. Data required for submittal are limited to those pertinent to the change.

f. Seeking Exemption, Option 4. Exemption from the DOT Regulations can only be granted by the Office of Hazardous Materials Operations (OHMO) of the Department of Transportation. The procedures and data required are contained in Part 107 of the DOT Regulations and are complex and lengthy. Further, an exemption is not permanent but must be renewed not less frequently than once every two

years. Because of this complexity, exemptions will normally only be sought where it is contemplated that shipment of the ammunition or explosive will involve items forbidden by the DOT Regulations, or not specifically classifiable thereunder, or requiring transportation vehicle configurations prescribed thereby. Non-exclusive examples of these three categories are: Nitroglycerin desensitized with a material whose vapor pressure is below that of nitroglycerin; a rocket or missile round complete with fuze, warhead and liquid fuel; an item so temperature sensitive as to need temperature control devices in the transport vehicle powered by any flame producing mechanism. No specific cut-and-dried procedure which will guarantee DOT granting the exemption on the first try can be formulated. The following principles shall prevail:

(1) Early Planning. As soon as it becomes clear that an exemption will be needed, the project manager, the acquisition manager, the integrated logistics suppport manager, the design agent for the item, or the design agent for the round's packaging, collectively or severally, shall contact the approving command defined in paragraph 6e(1), preferably informally. The purpose of this contact is to ensure that item safety data will be available in the depth required by DOT and that packaging or transportation concepts, or both, are definable in sufficient depth to satisfy DOT within the technical and quasi-political environment then prevailing.

NOTE: The DOT Regulations currently require formal docketing of exemption requests 120 days before the propsed effective date, unless it be shown that an emergency requires otherwise. In the normal engineering development of a new round or ingredient, 120 days is ample time. Bad planning rarely justifies a claim for emergency.

(2) Petition Preparation. When satisfied that sufficient data are in hand to warrant submittal to the DOT, the approving command identified in paragraph 6e(1) shall prepare a petition to DOT for exemption from the pertinent regulation, in the form and to the depth required by Part 107 of the DOT Regulations. Such petition shall be submitted to the OHMO via Commander, Military Traffic Management Command, or as provided otherwise in DOD directive. The approving command shall also ensure timely submittal of any further data or clarifications requested by OHMO, plus any replies deemed necessary to comments from interested persons obtained as a result of the formal docketing of the application for exemption in the Federal Register.

(3) Drawing Annotation. Upon receipt of notice of approval of a request for exemption, the design activity shall annotate all drawings covered by the DOT exemption with the reference data of the OHMO notice of approval.

(4) Shipper Notification. It shall be the responsibility of the approving command to notify, in accordance with its standard procedures, all shippers and potential shippers (including transhipment

points) of the existence of the exemption, any conditions attached thereto to OHMO, and the expiration date of the exemption.

(5) Renewals. It shall be the responsibility of the approving command to initiate action for timely renewal of exemptions about to expire in accordance with the requirements of Part 107 of the DOT Regulations. If, after approximately two renewals (or less if a substantial number of shipments have occurred), it appears that the need for shipping the item covered by an exemption will continue, the approving command should prepare a petition for formal rule making under Part 102 of the DOT Regulations in order to avoid future repetitive submittal of exemption requests.

g. Exception. Under unusual circumstances, such as where the complete "package" involves major investment in a limited number of items, the approving command may consider requests for certification or exemption without prototype hardware having been built or tested. Data required for review include drawings suitable for critical design review, supported by engineering calculations such as stress analyses and shock and vibration performance predictions, a safety analysis (preferably in the form of a fault tree) and description of critical proof of design tests which will be performed.

h. Retroactivity. The procedural rules outlined above shall not be interpreted as requiring action to comply therewith on existing designs construable as having been approved under Options 1, 2 or 3 hereof. Where existing Special Permits are scheduled to expire, however, compliance with Part 107 of the DOT Regulations is mandatory.

7. References.

a. 49CFR102, 107, 170-179, Hazardous Materials Regulations of the Department of Transportation.

b. MIL-STD-1367, Packaging, Handling, Storage, and Transportability Program Requirements (For Systems and Equipments).

c. MIL-STD-1666, Packaging, Handling, Storage, and Transportability System Dimensional Constraints, Definition Of.

d. MIL-STD-648, Design Criteria for Specialized Shipping Containers.

e. MIL-STD-490, Specification Practices.

f. MIL-STD-1510, Container Design Retrieval System.

g. AR 70-37/NAVMATINST 4130.1A/MCO 4130.1A/AFR 65-3/DSAR 8250.4/NSA/CSS 80-14/DCAC 100-50-2/DNA INST 5010.18, Department of Defense Configuration Management.

h. AFM 71-4/TM38-250/NAVSUP Publ 505/MCO P4030.19/DSAM 4145.3, Packaging and Handling of Dangerous Materials for Shipment by Military Aircraft.

i. AFSC-AFLC Reg 80-31/AMC Reg 70-54/NAVMATINST 10580.1, Shipping and Storage Containers for Air Launched Non-Nuclear Ordnance (ALNNO) Material.

j. DOD Directive 5000.1, Acquisition of Major Defense Systems.

k. ANSI MH10.1-1972, American National Standard, Unit load sizes for dimensioning transport package sizes.

l. ANSI MH10.2-1973, American National Standard, Transport package sizes for ANSI MH10.1 unit load sizes.

PART 13 - PACKAGING AND PRESERVATION

Chapter 4 - In Production and In Service Phases

1. Purpose.

This chapter establishes joint policies and procedures for the control of packaging and preservation while the round is being produced and/or is in service.

2. Scope.

These operating policies and procedures apply to the ammunition commands specified in the JCAP Coordinating Group Charter.

3. Policies.

a. Configuration Control. Once released for production, configuration control of the preservation and packaging of an ammunition end item shall be maintained by the activity with engineering responsibility for the end item's packaging.

b. Waivers, Deviations and Changes. MIL-STD-480 and MIL-STD-481 are the preferred methods of requesting and supporting waivers, deviations and changes in packaging. Where an activity does not use MIL-STD-480 or MIL-STD-481, that activity is responsible for providing adequate documentation and justification for changes it proposes to a package or container whose design is controlled by another Service.

4. Concepts.

a. Sources of Changes. Changes in packaging can arise from many sources. These sources included changes from the need to accommodate changing use concepts, enhance producibility, correct deficiencies, update the procurement data package as a result of specification changes, change proposals generated through value engineering or beneficial suggestions, as well as changes resulting from formally established product improvement engineering effort.

b. Change Control. Changes which enhance safety or reliability or reduce life cycle cost without degrading safety or reliability, are obviously desirable. It is necessary, however, to ensure that changes are incorporated in a responsible manner, without harming the interests of any user or producer Service.

c. Change Costing. In analyzing packaging cost impact of proposed changes, the elements of costs identified in paragraph 4c, Chapter 3, should be considered. This will, in many cases, justify an increase in packaging cost, to attain a larger cost saving elsewhere in the system, e.g., in transportation. Cost impact should be analyzed on the basis of current and projected production rate as represented in the Five Year Defense Plan (FYDP). During peacetime conditions, cost impact should also be figured on the full planned mobilization production rate.

5. Procedures.

a. Proposing Changes. Any Service using an ammunition item may propose a change in the packaging of that item.

b. Sole User Changes. Where the specific ammunition stock number concerned is solely used by the requesting Service and the packaging (including the outer container) is peculiar to that Service, further engineering coordination is not necessary. The change must be coordinated with the producing Service to determine production cost impact and an effective date. If the proposed change, however, involved a change in configuration of an outer container used by more than one Service, the proposed change must be coordinated with Services in accordance with paragraph 5b, Chapter 3.

c. Multiple User Changes. Changes affecting packaging of items used by more than one Service shall be coordinated in accordance with paragraph 5b, Chapter 3.

d. Documentation Update. The only packaging changes not requiring coordination with users and/or producers are simple reference changes in drawings or specifications to update these references, e.g., updating the specification number of a prescribed paint. However, making such changes is the prerogative of the activity with design responsibility for the container.

e. Other Changes. Each Service shall establish procedures for preliminary review of the feasibility of Beneficial Suggestions and Value Engineering Change Proposals. If they appear worthy of further evaluation, they shall be forwarded to the activity with design responsibility for the package for final evaluation, together with such comments as may be appropriate.

f. Ammunition Stock Numbering. Any one of the following changes in packaging may require assignment of a new stock number:

(1) Change in Quantity Per Unit Package. Where the pallet is the unit package (e.g., bombs or separately loaded projectiles), then and only then this rule applies to the quantity per pallet.

(2) Significant Changes in External Configuration of Unit Container. Examples are significant changes in dimensions; changes in container material, such as wood versus metal; changes in container type, such as substitution of M548 box for Navy MK 1 ammunition box. Where a stock number change is indicated, the proposed change shall be coordinated with the Defense Logistics Services Center through the individual Service's Inventory Manager/Item Manager (IM), in accordance with established procedures.

6. References.

a. MIL-STD-480, Configuration Control, Engineering Changes, Deviations and Waivers.

b. MIL-STD-481, Configuration Control, Engineering Changes, Deviations and Waivers (Short Form).

PART 13 - PACKAGING AND PRESERVATION

Chapter 5 - Container and Pallet Management

1. Purpose.

This chapter establishes joint policies and procedures for supply management of containers and pallets, with particular emphasis on reusable containers and pallets.

2. Scope.

These joint operating policies and procedures apply to the ammunition commands specified in the JCAP Coordinating Group Charter.

3. Concepts.

a. Economical operation requires fullest practical use of all assets, particularly those that are capable of reuse.

b. There are varying degrees of container reusability, ranging from fully reusable to simply recloseable. Definitions of these varying degrees are contained in MIL-STD-1367. Unit cost of containers, which are capable of reuse, ranges from a few cents to thousands of dollars.

c. All pallets are reusable. Metal pallets have a longer service life than wooden pallets, particularly when exposed to an adverse environment.

d. Decision to reuse an available asset, particularly if it happens to be overseas and is needed at a CONUS production facility, is primarily an economic decision in which the costs of refurbishment and retrograde transportation play a large role. Hence, the decision must be on an item-by-item basis tempered by urgency of need for the particular asset.

4. Policies.

a. Costs of refurbishment and transportation to the point of reuse shall be borne by the Service having a need for the reusable container or pallet.

b. The container or pallet design activity shall insure that refurbishment instructions (technical orders, maintenance manuals, repair procedures) are adequate and available prior to release for service use.

c. The ammunition procuring activity shall coordinate all procurements with the reusable container or pallet item manager/inventory manager (IM) to insure utilization of available containers and pallets and their repair parts.

5. Procedures.

a. Cataloging. Only reusable containers and pallets will be cataloged. Action to obtain a National Stock Number will be taken as soon as design is stable and drawings are available.

b. Provisioning. The procuring activity will take action to provide source code and procure hardware and components necessary to maintain and repair returned or damaged containers/pallets.

c. Return Instructions. Each Service shall, in accordance with its own procedures, take action to insure return of assets, when needed, to a designated point. Where an asset is used by several Services, the Procuring Service shall inform the appropriate IM of each using Service that an asset is reusable.

d. Storage. Pallet/containers returned to depot stock after munitions have been expended will be stored at various authorized sites in appropriate condition code.

e. Stock Management. Reusable pallet/container IM will maintain constant surveillance over all container/pallets inventory and take timely disposition action on obsolete, unserviceable or uneconomical to repair containers/ pallets, to preclude incurring unnecessary storage and transportation costs.

f. Stock Held by Other Services. Some reusable pallets/containers are multiple Service items. Since there is no inter-Service inventory information readily available, there is no automatic cross-leveling. Other Services will be interrogated as to availability of either a reimbursable or non-reimbursable basis prior to procurement of those items known to be multiple Service items.

g. Repair. The pallet or container IM will, upon receipt of a validated requirement from the ammunition item IM, initiate refurbishment action to put the desired assets into serviceable condition on schedules to match the production schedules. Refurbishment will, where possible, be performed by the storage activity on a Service Work Order (WO) or on a DD Form 448, Military Interdepartment Purchase Request (MIPR). The WO or MIPR will reference the applicable refurbishment procedure (see paragraph 4b above). Where a written procedure does not exist, a work statement shall be attached to and made a part of the WO, MIPR or contract.

6. References.

MIL-STD-1367, Packaging, Handling, Storage and Transportability Program Requirements (for Systems & Equipment).

PART 13 - PACKAGING AND PRESERVATION

Chapter 6 - Retrograde Ammunition

1. Purpose.

This chapter establishes joint operating policies and procedures for the packaging or repackaging of ammunition which is to be retrograded in the Department of Defense logistics system from a forward activity/ship to CONUS or to a major overseas depot-type activity.

2. Scope.

These joint operating policies and procedures apply to the ammunition commands specified in the JCAP Coordinating Group Charter.

3. Concepts.

a. Retrograde shipments of ammunition are an essential part of the overall ammunition logistics system.

b. Problems arise because either the ammunition must be repackaged or because the existing package is deteriorated from exposure to an adverse environment.

c. Use of defective packaging has grave safety implications for all concerned in transporting and handling the ammunition and the civilian populace.

d. As a minimum, packaging which does not conform to the Department of Transportation regulations, or officially authorized exceptions thereto, causes delay or unacceptable additional workload at the first US port of entry before it can legally be moved through the US transportation network.

4. Policies.

a. Repackaging. Repackaging for retrograde movement will be held to the minimum consistent with safe and efficient movement.

b. Service-Peculiar Packaging. Packaging designs, which have been approved by the responsible engineering activity of any one Service for logistical movement of a specific item by the specific mode of transportation, shall be acceptable to all Services for retrograde movement of that item in that mode.

c. Obsolete or Superseded Package Design. Obsolete or superseded package designs (including markings), whether Service-peculiar or common to two or more Services, shall be acceptable for retrograde purposes, except when the Service with design responsibility has declared that peculiar design to be unsafe for movement by the mode(s) of transportation involved.

5. Procedures.

a. Inspection. Ammunition identified as a retrograde candidate shall be inspected by an ammunition quality assurance specialist, a member of an Explosive Ordnance Disposal (EOD) team, or a member of a Mobile Ammunition Evaluation and Repair Unit (MAERU) to determine its suitability for transportation to the intended destination.

b. Criteria for Suitability for Transportation. Suitability for transportation shall be based on Service drawings and standards coupled with requirements of the Department of Transportation regulations. Packing material shall be inspected prior to use, to ensure the absence of rodents, snakes, snails, or insect infestation. Insecticides, fungicides, and/or rodenticides shall be used as prescribed by Service, agriculture, or health directives pertinent to the geographic area.

c. Repackaging. When it is necessary to replace the packaging of an item, the following priorities of choice apply: first, replace with packaging material generated as a result of consumption of tactical unpackaging of like items; second, replace with packaging material requisitioned through the supply system, whether in-theater or from CONUS; third, use a non-standard package (see paragraph 5d(3)).

d. Operating Guidelines.

(1) If an item which requires repackaging is being consumed in a theater by any Service, it is almost certain that serviceable packaging material is available for reuse. In this situation, any reluctance of either a tactical or support type unit of any Service to relinquish ammunition packaging material should be immediately referred to higher command channels for resolution. Both the supply packaging components from CONUS and the offshore procurement/manufacture of packaging are costly and time-consuming when compared to the use of consumption-generated material. When searching for availability of consumption-generated packaging material, it should be remembered that packaging material for several versions of the same basic item may be interchangeable, e.g., the packing box used for a high explosive rocket may be identical, except for marking, to the packing box of comparable size used for smoke producing rocket; the wooden container used for the MK 10 MOD 4 Charge may be functionally interchangeable with the metal container used for the MK 10 MOD 1 charge; and the pallet used for small arms ammunition may be identical to the pallet used for propelling charges. When, for example, a metal box is used for the packaging of an item in lieu of a wooden box, the palletization procedures

normally prescribed for the metal box should be used. Various other palletization procedures may have been tested and may also be authorized for retrograde use by the cognizant CONUS design activity.

(2) Packaging material requisitioned through the supply system or manufactured local to meet design requirements normally requires less stringent inspection prior to use than does packaging material reclaimed from the user. The in-theater supply systems of all Services should be queried for availability prior to manufacturing or requisitioning from CONUS. When it is determined that packing material is to be manufactured in an overseas theater and that materials, such as wood species, do not meet the design description, the responsible CONUS activity (NAVORD, NAVAIR, ARMCOM, ADTC and Ogden ALC) shall be contacted to verify suitability for use. When conversion of dimensions such as between inches and millimeters is necessary for "foreign" material, the rule will be to use a foreign (metric) dimension which is larger than its inch equivalent unless specific authority to the contrary is obtained from the responsible CONUS activity.

(3) When it is impossible or impractical to obtain packaging materials specifically approved for an item, or when exigencies so dictate, it may be necessary to utilize packaging materials and/or methods which are not used for the packaging of ammunition for issue. Prior to the use of improvised packaging methods, the responsible prime Service activity in-theater and in CONUS shall be queried regarding the acceptability of the method and the availability of alternate methods which may have been tested and approved for such contingency use. It must be recognized that nonstandard packaging methods are subject to the same regulatory restrictions that apply to standard issue packaged for that same portion of the logistical pipeline, and that while deviating from requirements may ease a problem at one location it may create difficult problems at another location. The total impact on all Services will be considered prior to use of packaging methods which may impact the operations of another Service.

e. Documentation. Documentation for retrograde ammunition shall be the same as for other movements of ammunition. Any deviations from standard issue packaging practices (including marking) shall be annotated on the shipping documents and should be immediately made known to intended recipients in order that appropriate receipt planning may be initiated.

f. Reports. The prime Service will obtain reports and document the results of shipments using non-standard packaging. That Service will evaluate the effectiveness of the shipment in order to facilitate subsequent uses of effective methods and to eliminate use of packaging methods having undesirable characteristics. This documentation should be furnished to the cognizant elements of other Services in order that they may also benefit from the experience.

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6. Reference.

49CFR170-180, Hazardous Materials Regulations of the Department of Transportation.

PART 13 - PACKAGING AND PRESERVATION

Chapter 7 - Information Exchanges

1. Purpose.

This chapter establishes joint operating policies and procedures pertaining to the information exchanges between the Services necessary to promote maximum standardization and eliminate duplication of effort.

2. Scope.

These joint operating policies and procedures apply to the ammunition commands specified in the JCAP Coordinating Group Charter.

3. Policy.

a. Information shall be exchanged during the regular meetings of the Packaging and Preservation Task Group and by direct contact between the members by any communication means.

b. Data shall be exchanged in accordance with the procedures contained herein.

c. Data shall be in the format used by the originating Service.

d. Pertinent data shall be exchanged between the Services to the maximum extent.

e. The data to be exchanged under this operating policy and agreement is limited to technical data and reports. Data required for cross-Service procurement planning purposes shall be exchanged in accordance with procedures established by the JCAP Procurement and Production Task Group.

4. Procedures.

a. Data to be exchanged are of two types:

(1) Type 1 Procurement and production data packages such as specifications, drawings, Transportation Packaging Orders (TPOs), etc.

(2) Type 2 Formal reports of the results of technical effort related to packaging and preservation.

b. Regular exhange of Type 1 data shall normally only be required to be in connection with planned procurements from another Service. It is the obligation of the customer Service to furnish these data to the Service with production responsibility for the end item.

c. In addition to the foregoing, unit load drawings or the customer top assembly drawing, when the product is not unitized, shall be furnished automatically upon approval to each ammunition loading port, to wit:

Naval Ammunition Depot Earle, NJ 07722
Military Ocean Terminal Sunny Point, Southport, NC
Naval Weapons Station, Concord, CA 94520
Naval Torpedo Station, Keyport, WA 98345

Any special handling equipment required for moving, loading or unloading the container/unit load shall also be identified.

d. Where ammunition belonging to one Service is being stored or renovated by another Service, the required exchange of technical data is covered by Part 16 of the JOPP.

e. Type 2 data shall be furnished upon release. Each JCAP Packaging and Preservation Task Group principal member shall be responsible for developing the detailed mailing list applicable to his Service and furnishing the list to each other principal member. Each such list shall be updated semiannually, coincident with regularly scheduled meetings of the Packaging and Preservation Task Group.

f. In addition to the foregoing, data exchange with the Container Design Retrieval System shall be in the format and at the frequencies prescribed in Chapter 3 of this Part 13.

Distribution List (1 copy each unless otherwise indicated)

US Army armament Materiel Readiness Command
Rock Island, IL 61201
(JCAP-EX) (5), DRSAR-PA, DRSAR-PP, DRSAR-MMU, DRSAR-SF, DRSAR-AS (5),
DRSAR-TM, DRSAR-QAD, DRSAR-MMP-S, DRSAR-MAD, DRSAR-LE1)

US Army Armament Research and Development Command
Dover, NJ 07801
(DRDAR-PM, DRDAR-LCU-TP (5), DRDAR-LCU-S)

Project Manager for Munitions Production Base Modernization and Expansion
Dover, NJ 07801
(DRCPM-APM, DRCPM-PBM-PC)

DARCOM Ammunition Center
Savanna, IL 61074 (SARAC-DEV)

US Army Materiel Development and Readiness Command
5001 Eisenhower Avenue
Alexandria, VA 22333
(DRCDE-DW-W, DRCSA-JS, DRCMM-ST)

US Army Troop Support & Aviation Materiel Readiness Command
4300 Goodfellow Blvd.
St. Louis, MO 63120
(DRSTS-QNP)

US Army Electronics Command
Fort Monmouth, NJ 07703
(DRSEL-MM-DP)

US Army Missile Materiel Readiness Command
Redstone Arsenal, AL 35809
(DRSMI-SP)

US Army Tank-Autmotive Materiel Readiness Command
Warren, MI 48090
(DRSTA-GSP)

US Army Mobility Equipment Research and Development Center
Fort Belvoir, VA 22060
(DRMDME-VK)

US Army Training and Doctrine Command
Quartermaster School
Fort Lee, VA 23801
(ATSM-CTD-MS)

US Army Medical Materiel Agency
Frederick, MD 21701
(SOMMA-LD)

Joint Military Packaging Training Center (5)
Aberdeen Proving Ground, MD 21005
(DRXPT-T)

Deputy Chief of Staff for Logistics
Department of the Army
Washington, DC 20310
(DALO-SMS-R)

Tobyhanna Army Depot
Tobyhanna, PA 18466
(DRXTO-T)

Military Traffic Management Command
Washington, DC 20315
(MTMC-SA, MTMC-IN, MTMC-IT, MTMC-SS)

MTMC Transportation Engineering Agency
PO Box 6276
Newport News, VA 23606
(MTT-TR)

Naval Sea Systems Command
Washington, DC 20362
(SEA-04J, 04H, 04533, 06G3 (5), 98, 605)

Naval Air Systems Command
Washington, DC 20361
(AIR-532, 53443C, 41251A, 8013, 03P2, 350, 4121, 4104)

Chief of Naval Operations
Washington, DC 20350
(OP-411)

Naval Weapon Support Center
Crane, IN 47522
(505, 304)

Ships Parts Control Center
Mechanicsburg, PA 17055
(730, 772, 8151)

Naval Weapons Engineering Support Activity
Washington Navy Yard
Washington, DC 20374
(ESA-2082)

Commandant, US Coast Guard
400 7th Street SW
Washington, DC 20590 (FS-L)

Naval Ammunition Production Engineering
Naval Weapons Support Con Center
Crane, IN 47522
(SEA 042252B)

Commanding Officer
Naval Ordnance Station
Indian Head, MD 20640
(Code 611D)

Naval Air Engineering Center
Lakehurst, NJ 08733
(Code 93)

Ogden Air Logistics Center
Hill AFB, UT 84406
(MMJ, MMWREA, DSTCM)

Armament Development and Test Center
Eglin AFB, FL 32542
(SDC, SES, SDMT)

Air Force Logistics Command
Wright-Patterson AFB, OH 45433
(LOTP, CST, AFPEA)

Air Force Inspection and Safety Center
Norton AFB, CA 92409
(AFISC.SEV)

HQ, USAF
Washington, DC 20330
(LGTN)

Air Force Systems Command
Andrews, AFB, MD 20334
(CCU, LGT)

4950th Test Wing
Wright-Patterson AFB, OH 45433
(LGT)

Defense Logistics Agency
Cameron Station
Alexandria, VA 22314
(DLA-OWO, DLA-2S, DLA-HT)

Naval Weapons Station Earle (5)
Colts Neck, NJ 07722
(Code 80)

Pacific Missile Test Center
Pt. Mugu, CA 93042
(Code 2205)

Commandant Marine Corps
Washington, DC 20380
(Code LMG)

Naval Weapons Center
China Lake, CA 93555
(Mr. Guil Gerblick)

Naval Surface Weapons Center
White Oak Laboratory
Silver Spring, MD 20920
(Code WE 214)

Naval Supply Systems Command
Washington, DC 20376
(SUP-03221)

Naval Facilities Engineering Command
Alexandria, VA 22332
(FAC-045)

Chief of Naval Material
Washington, DC 20360
(MAT-09E, MAT-043)

USMC Development and Education Command
Quantico, VA 22134
(Plans & Studies Division, Development Center)

Naval Ship Engineering Center
Washington, DC 20362
(SEC-6101E02, SEC-6161, SEC-6162)

Naval Electronics Systems Command
Washington, DC 20362
(Code 404)

Naval Aviation Supply Office
700 Robbins Avenue
Philadelphia, PA 19111
(TEP-A)

Defense Documentation Center (25)
Cameron Station
Alexandria, VA 22314

Defense Logistics Studies Information Exchange (5)
US Army Logistics Management Center
Fort Lee, VA 23801

JOINT CONVENTIONAL AMMUNITION PROGRAM
COORDINATING GROUP

Office of the Executive Director
Rock Island Arsenal, IL. 61201

JCAP-EX

23 September 1977

SUBJECT: JCAP Packaging and Preservation Task Group Report on Standardization of Ammunition Packaging, 29 June 1977

SEE DISTRIBUTION

This report on Standardization of Ammunition Packaging is authorized for transmittal to the Joint Technical Coordinating Group for Packaging subject to the stipulations jointly reached between the JCAP Operating Group and the JTCG-Packaging on 13 June 1977, and the further stipulation that recommendation No. 7 is subject to decisions of the JCAP Coordinating Group at its meeting on 23 September 1977.

EDWARD J. JORDA
Executive Director



JOINT AGREEMENT

ON

PROGRESS IN STANDARDIZATION OF AMMUNITION PACKAGING

The JCAP Packaging and Preservation Task Group Report on progress in standardizing ammunition packaging has been reviewed and is approved subject to further agreements reached between the Chairman for the Joint Technical Coordinating Group on Packaging (JTCG/PKG) and the JCAP Operating Group at NSWC, White Oak, 13 July 1977.

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Ogden Air Logistics Center

JOINT CONVENTIONAL AMMUNITION PROGRAM
COORDINATING GROUP

Rock Island Arsenal, IL. 61201

SUBJ: Progress in Standardizing Ammunition Packaging

1. The JCAP Packaging and Preservation Task Group submits herewith its report on progress in standardizing ammunition packaging in response to a request for this information from the Joint Technical Coordinating Group on Packaging (JTCG/PKG).

2. We recommend that the JCAP Coordinating Group approve our recommendations and forward them to JTCG/PKG as the considered views of JCAP/CG.

3. We certify the accuracy and timeliness of the information contained herein.

Atch
Report

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29 June 1977