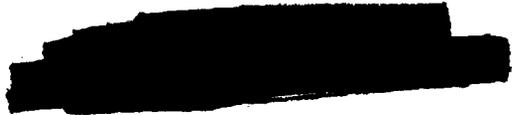
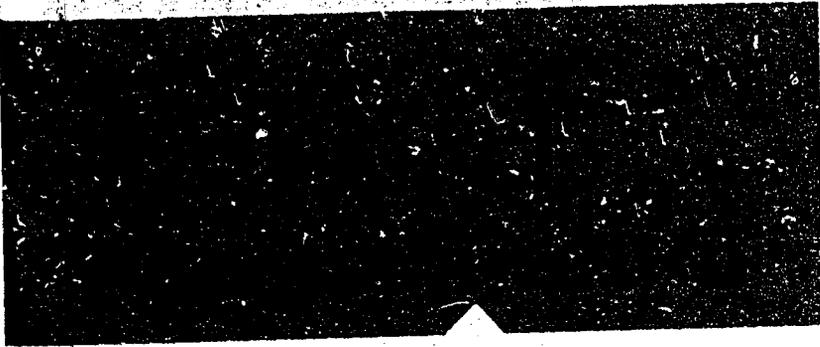


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OPERATIONAL FACTORS AFFECTING DESIGN CONCEPT FOR PACKAGING OF FUZES, BOMBS AND WARHEADS

R. E. Williams - 1284

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ABSTRACT

This is a report of a survey which was made to determine (1) if the present method of packaging warheads and bombs should be continued, or whether a metal cover should be used to replace the canvas security covers presently being used; and (2) if fuzes should be packaged in temporary wooden crates rather than reusable metal containers now being used.

This report recommends that the present method of packaging bombs and warheads be continued and that each fuze be considered as an individual problem.



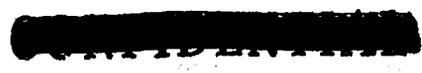
Work performed under AEC Contract AT-(29-1)-789.

Case No. 433.00

May 13, 1958

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OPERATIONAL FACTORS AFFECTING DESIGN CONCEPTS FOR
PACKAGING OF FUZES, BOMBS AND WARHEADS

Introduction

This study is an investigation of the present design concepts to determine if these concepts are still desirable or whether changes should be initiated. The report is based on comments made by persons inside and outside Sandia Corporation who have either had experience with using Sandia-designed containers in the field or who are associated with organizations which use these containers. The people whose comments were included in making up this paper represented the following organizations:

AFSWP	2552
AL00	7131
SWC	7132
1215	5523
1224	5521
7111	7310

Bombs and Warheads

Bombs and warheads were at one time packaged in sealed containers; but with the advent of sealed bombs and warheads, the sealed containers were no longer necessary and packaging, which consisted of a dolly with a cloth security cover supported by a metal framework, was adopted. It has been questioned whether or not the canvas covers are sufficient to protect the contents from physical damage caused by movement of these containers with forklifts and from any objects which might penetrate the canvas cover and damage the weapon.

The following table was compiled from the study and shows both the merits and demerits of the dollies as presently designed and the merits and demerits of the same type of dolly with a metal security cover.

Sheet-metal covers

1. Difficult to store.
2. Difficult to remove especially under aircraft. (To circumvent this problem, security covers have been provided to be used after metal lid is removed.)

Cloth covers

1. Easily stored.
2. Easily removed.

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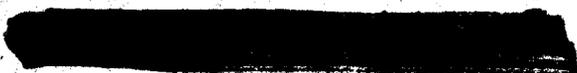
(continued)

Sheet-metal coversCloth covers

- | | |
|--|--|
| 3. Difficult to expand to enclose an expanded version of WH or bomb. | 3. May be expanded by addition of another section. |
| 4. Prevent some physical damage to contents. | 4. Offer physical protection to contents only in vicinity of framework. |
| 5. Require more space around weapon. | 5. Require minimum space around weapon. |
| 6. Require removal of access doors to obtain access to weapon. | 6. Provide easy access to weapon for test and inspection. |
| 7. Are rigid enough to prevent wind damage. | 7. Cause abrasion to weapons during wind conditions if cover is allowed to touch weapon. |
| 8. More expensive, but require less replacement. | 8. Moderate in cost but require some replacement. |
| 9. Cover can be secured with car seals to indicate a breach in security. | 9. Security sealing of cover is impractical. |
| 10. Difficult to handle under high wind or extreme temperature conditions. | 10. Relatively easy to handle in adverse weather. |

It is concluded from this table that the present method of packaging these items (i.e., with cloth covers) is the more satisfactory. The main reasons for this conclusion are: (1) The metal cover causes considerable difficulty in removal; this difficulty is particularly apparent for internally carried weapons where an internal fabric cover would have to be provided for removal in the vicinity of the bomb bay. (2) The metal covers are difficult to store and would be easily damaged when not in use. (3) It has not been definitely established that these covers would provide certain physical protection to the contents. The various advantages of the metal covers are considered to be minor in comparison to these.

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The following list of improvements to the present containers should be considered in future packaging designs:

1. Shear pins on some of the dollies are difficult to mate with the weapons. Spring-loaded pins will alleviate some of the difficulties as would lugs on the sides of the weapons.
2. Tie-down bands should be capable of being easily disconnected. A flexible band has been suggested as a means which would provide easy removal of these bands during aircraft loading.
3. Where a frame surrounding the entire weapon is provided, security covers should be designed in such a manner that wind conditions will not cause them to touch cables and bomb surfaces. In some instances these security covers have actually worn off the edges of metal parts which were exposed to this chafing action.
4. Consideration should be given to use of lighter colors on lids and security covers in order to reduce the temperatures of the various items.
5. Drain holes should always be provided for any portion of the dolly which may collect water.
6. The bulk of dollies and projections from dollies should be kept to a minimum.

Fuze Containers

The present concept of fuze containers, which consists of metal cans with either mechanical mounts or resilient material inside the can, has been questioned as being an expensive method of providing this package. It has been proposed that these fuzes be packaged in wooden boxes which may be destroyed. If repackaging is required, new boxes can be fabricated. This proposed method eliminates the need for storing empty fuze containers.

Under present concepts, fuzes will not be spared as complete units. However, there are numerous exceptions to this concept. The TX-28 fuze is to be spared as an entire unit because the individual components of this fuze are difficult to replace. No spare fuzes are planned for the TX-27. However, a fuze container is required as a part of the bomb-to-warhead conversion kit. So, although the present concept is that there will be no spare fuzes, for one reason or another we find that we still have fuze containers. The fuze packaging problem is further complicated by the fact that fuzes are quite dissimilar in construction. Some fuzes require considerable vibration and shock protection and others require a high degree of protection from moisture or sand and dust.

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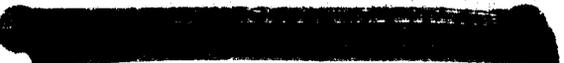


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Comparison of qualities of wooden containers and metal containers for fuze shipment are as follows:

- | <u>Wooden containers</u> | <u>Metal containers</u> |
|--|---|
| 1. Cheap initial pack. | 1. Higher initial package cost. |
| 2. Limited reusability. | 2. Reusable. |
| 3. Container can be salvaged and unit can be repackaged later from easily obtainable materials. | 3. Container must be stored for reuse. |
| 4. Repackaging requires considerable time by cleared personnel. | 4. Provide easy means of repackaging. |
| 5. Provide good physical protection and may include shock, vibration and/or other environmental protection. However, these items all increase the cost. | 5. Provide best physical shock and vibration protection and other environmental protection. |
| 6. As wood is combustible it may not be shipped with weapons in AEC's optimized weapon cars. | 6. Allows fuze containers to be shipped with weapons if desired. |
| 7. Deteriorate rapidly in open storage and therefore, will have high maintenance cost. | 7. Will remain relatively unaffected by open storage. |
| 8. Not normally usable as work stand. | 8. May serve as work stand. |
| 9. Not satisfactory for items requiring frequent inspection. | 9. Inspections may be made conveniently and with no damage to container. |
| 10. Facilities for repacking are unavailable at some sites. (Sites forward of OSS sites do not have packing facilities. AMC sites have inadequate packing facilities.) | 10. Require no special facilities for packaging. |
| 11. Frequent modifications to fuze will cause deterioration. | 11. Frequent modifications to fuze will not affect container. |

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Packaging these fuzes in wooden boxes does not seem practical if costly shock mitigation, either in the form of mechanical shock mounts or shock-absorbing insulating material, is required. The insulating material or shock mounts would have to be packaged to prevent their deterioration and stored in locations where the fuzes are to be repackaged. Also, there will be many instances where the organizations which are required to repack these fuzes either do not have the packaging facilities available or do not have cleared personnel in these packaging facilities who would be allowed to repack fuzes.

It appears that the present concept for packaging fuzes in reusable metal containers, or combination wood and metal containers, should be continued. However, with the wide variety of fuzes which have been designed, it is believed that each fuze should be considered as a special packaging problem and that no hard and fast rules should be set up for design of these packages.

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