Design of a Family of Munitions Containers (FMC)  
Overall Project Management  
of  
FMC #1 (CNU 532/E),  
FMC #2 (CNU 533/E),  
&  
FMC #3 (CNU 534/E, CNU 335 B/E, CNU 336 B/E, & CNU 505/E)
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APFEA PROJECT NO. 89-P-146
TITLE: Design of a Family of Munitions Containers, the Overall Project Management of FMC #1, FMC #2, and FMC #3

ABSTRACT

An OO-ALC/KMW (presently OO-ALC/LIWDT) Process Action Team (PAT) came up with the idea to have a Family of Munitions Containers (FMC) of three to six containers to replace most of the Air Force's 200 munitions containers. OO-ALC realizing the potential of this idea initiated Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01. The development of the Family of Munitions Containers was initially centered around five containers with internal volumes of 0.014 M³ (0.5 ft³), 0.078 M³ (2.75 ft³), 1.005 M³ (35.5 ft³), 1.657 M³ (58.5 ft³), and 3.051 M³ (107.75 ft³). APFEA was to design the three smallest containers, and they have been designated FMC #1, FMC #2, and FMC #3, from smallest to largest. The remaining two largest containers will either use current aluminum containers or be designed at a later date.

The three containers are designed to meet a tailored version of MIL-C-5584. The requirements in this tailored version meet as many of the users needs as possible. The tailored specification is titled "Design Criteria for a Family of Munitions Containers," and sets down the requirements for each of the containers. FMC #1 (CNU 532/E) is designed to a maximum gross weight of 19.1 Kg (42.0 Lb.), FMC #2 (CNU 533/E) is designed to a container gross weight of 68.2 Kg (150.0 Lb.). These two containers were designed to weight criteria because no specific item was chosen to be packaged. However, FMC #3 (CNU 534/E, as the empty configuration) was designed to hold specific items. It was designed for either 12 BSU/49's (CNU 335B/E), or 2 BSU/50's (CNU 336B/E), or 6 MU/5050s with supporting materials (CNU 505/E). The only requirement is that you package each set of bomb fins with a different set of cushioning/dunnage, thus the different CNU numbers.

MAN-HOURS: 1800

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</tr>
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</table>
INTRODUCTION:

REFERENCES:
Any of the referenced reports, listed below, may be obtained from the Air Force Packaging Evaluation Activity (AFPEA), AFMC LSO-LOP/LGTP (formerly HQ AFMC/LGTP), 5215 Thurlow Street, Wright-Patterson AFB, Ohio 45433-5540 DSN 787-3362 or Commercial (513) 257-3362.

1. Family of Munitions Container #1 (FMC #1) Final Report
   AFPEA Report No. 94-R-08
   AFPEA Project No. 90-P-125

2. Family of Munitions Container #2 (FMC #2) Final Report
   AFPEA Report No. 94-R-01
   AFPEA Project No. 91-P-101

3. Family of Munitions Container #3 (FMC #3) Final Report
   AFPEA Report No. 94-R-10
   AFPEA Project No. 90-P-122

BACKGROUND:
An OO-ALC/MMW (presently OO-ALC/LIWDT) Process Action Team (PAT) came up with the idea to have a Family of Munitions Containers (FMC's) of three to six containers to replace most of the Air Force's 200 munitions containers. OO-ALC realizing the potential of this idea initiated Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01. The development of the Family of Munitions Containers was initially centered around five contains with internal volumes of 0.014 M³ (0.5 ft³), 0.078 M³ (2.75 ft³), 1.005 M³ (35.5 ft³), 1.657 M³ (58.5 ft³), and 3.051 M³ (107.75 ft³). AFPEA was to design the three smallest containers, and they have been designated FMC #1, FMC #2, and FMC #3, from smallest to largest. The remaining two largest containers will either use current aluminum containers or be designed at a later date.

The three containers are designed to meet a tailored version of MIL-C-5584, Containers, Shipping & Storage, Metal, Reusable. The requirements in this tailored version meet as many of the users needs as possible. The tailored specification is titled "Design Criteria for a Family of Munitions Containers" (Appendix 1). This document sets down the requirements for each of the containers. FMC #1 (CNU 532/E) is designed to a maximum item weight of 19.1 Kg (42.0 Lb.), FMC #2 (CNU 533/E) is designed to a container gross weight of 68.2 Kg (150.0 Lb.). These two containers were designed to weight criteria because no specific item was chosen to be packaged. However, FMC #3 (CNU 534/E as the empty configuration) was designed to hold three specific items. It was designed for either 12 BSU/49's (CNU 335B/E), or 2 BSU/50's (CNU 336B/E), or 6 MXU/650's with supporting materials (CNU 5050/E). The only change to FMC #3 is that you package each set of bomb fins with a different set of
cushioning/dunnage. The external container configuration is the same (CNU 534/E).

These requirements were determined by AFPEA and OO-ALC/LIWDT. The requirements were arrived at after significant research which included meeting with the users at the base level (OO-ALC and HQ AFCOMAC/LGW, the Munitions School). These base level meetings included personnel that ranged in rank from Airman to Chief Master Sergeant, officers, and civilians all who worked with or in support of the types of munitions that will be packaged in the Family of Munitions Containers. Other meetings that helped to shape the requirements documentation for this project were Preliminary and critical Design Reviews and a full design presentation at the World Wide Munitions Conference to over 100 munitions personnel.

Some of the examples of design items that were added to requirements list or changed on the containers follow. First FMC #1 had a pressure relief valve add so that the containers would not have to be opened before air shipment and closed after shipment, thus reducing manpower significantly. A second example is that the ends of the extrusions for FMC #2 were opened up to alleviate the users concerns over troubles with decontamination, clean out of pests or other debris after a quarantined shipment scenario. These are just two examples of the types of items that the users commented on in order to improve the requirements document for the FMC project.

REQUIREMENTS:
AFPEA in union with OO-ALC/LIWDT developed a Statement of Work (SOW) for the design of the FMC's. This SOW was developed by tailoring MIL-C-5584, Military Specification, Containers, Shipping and Storage, Metal, Reusable. The SOW, titled The Design Criteria for Family Group of Munitions Containers is attached in Appendix 1 and defines all of the criteria and requirements for the container designs.

DESIGN:

CONFIGURATION:
The Family of Munitions Containers are aluminum shipping and storage containers. The containers are all fabricated from aluminum extrusions and contain many of the same or similar features. Some of these similar features are; cam-over-center latches, a pressure relief valve, air filling valve, and a silicone rubber gasket, integral stacking features, personnel handles for either lifting the lid or the entire container. All three of the containers are designed using bare unpainted aluminum with no extra finish. This cuts costs in painting and maintaining the container and reduces any adverse environmental impact caused by painting. This removal of paint from the surface of aluminum containers is one of several by products of
the Family of Munitions Containers project. The specific design configurations of each container can be found in their respective final project reports.

TESTING:

TEST SPECIMENS:
AFPEA fabricated two prototype containers of each configuration in house for testing. The prototype containers were fabricated IAW all the requirements and tolerances of the container drawing package(s). The same drawing package(s) that will be released to OO-ALC/LIWD for the manufacture of production quantities of the container(s). The specific drawing/data packages are the FMC #1 (CNU 532/E), FMC #2 (CNU 533/E), and FMC #3 (CNU 534/E, CNU 335B/E, CNU 336B/E, and CNU 505/E).

TEST PLANS:
The test plan(s) was designed, (IAW the Design Criteria for Family Group of Munitions Containers, MIL-C-5584, MIL-STD-648 and FED-STD-101), to qualify each of the container configuration for transportation and storage in a world-wide environment. The only deviation from the original design criteria, Appendix 1, has been for the pressure or leak tests for the small container, FMC #1. This deviation was approved by OO-ALC/LIWD and has been incorporated into the test plan for FMC #1. The approval for the new leak rate applies only to FMC #1 and is specifically due to the small volume of the container. The justification for the use of this deviation from the original design criteria is contained in the AFPEA Report # 94-R-08, Development of the Family of Munitions Container #1. The test plans include all test procedures, test equipment, and pass/fail performance criteria for conducting complete qualification testing. To see the specific test plans, reference the final project report for the specific configuration of interest.

RESULTS:
The specific results of all testing can be found in the final report of the configuration of interest. In summary, the testing of FMC #2 and FMC #3 was completely successful. They passed the test plan and are fully qualified shipping and storage container. FMC #1 did not completely pass the original test plan. There were two anomalies that occurred during the testing of FMC #1. First, the leak rate was changed due to the small size of the container, see the appendix 2 of the FMC #1 final report, AFPEA Report # 94-R-08. Secondly, the repeatability and reliability of the gasket seal came into question. Several items were changed/modified which improved the overall reliability of the seal. However, this improvement was not complete and therefore the reliability of the seal on FMC #1 is not 100%, see the final report for FMC #1. Therefore FMC #1 was not qualified as a sealed container. The factors that influenced this are its small
size, the gasket/lid/base interface. AFPEA is currently working on a Defense Ammunition Packaging Council (DAPC) Project on aluminum and aluminum extrusion technology. This project includes the improvement of the design of small munitions containers. AFPEA has taken many of the lessons learned from FMC #1 and started to incorporate them into the DAPC small munitions container. AFPEA is working on a new small container of the same size, when this DAPC project is completed the information will be forwarded to OO-ALC/LIWDT so they have the highest quality and completely qualified small munitions container possible.

CONCLUSION:

With the completion of the FMC project, AFPEA has provided OO-ALC/LIWDT with all the necessary information to procure and enter into the Air Force inventory all three of the smaller Family of Munitions Containers. This information includes providing the complete data package to both OO-ALC/LIWDT and the data repository at OO-ALC. This information is all that is necessary for complete procurement of any one of the six FMC configurations developed by AFPEA during Family of Munitions Containers PRAM project. However, this should be only the start of the Family of Munitions Container project. Because with out the support of the using groups like the Item Managers and the Procurement Officials these new containers can not entered into the inventory in large enough numbers to make an impact. It is imperative that those in a position to procure these types of items be convinced of the merits of the Family of Munitions containers and that as many of the new munitions purchased be placed in the newly designed containers. Then and only then does this project have a chance to be fully successful.
APPENDIX 1

DESIGN CRITERIA
FOR
FAMILY OF MUNITIONS CONTAINERS
DESIGN CRITERIA
FOR
A FAMILY OF MUNITIONS CONTAINERS

1. The Air Force Packaging and Evaluation Agency (AFPEA) will design three specific containers following the applicable military standards for container design requirements as well as user and program manager in puts. The below listed sizes have been determined by the program manager along with specific design specifications as listed in the following paragraphs.

<table>
<thead>
<tr>
<th>SIZE</th>
<th>LENGTH</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>MAX WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>8</td>
<td>9</td>
<td>25 lb.</td>
</tr>
<tr>
<td>2</td>
<td>20.5</td>
<td>16.5</td>
<td>14</td>
<td>150 lb. CNTR GROSS WT.</td>
</tr>
<tr>
<td>3</td>
<td>49</td>
<td>38</td>
<td>33</td>
<td>675 lb.</td>
</tr>
<tr>
<td>*4</td>
<td>100</td>
<td>39</td>
<td>26</td>
<td>2,000 lb.</td>
</tr>
<tr>
<td>**5</td>
<td>180</td>
<td>45</td>
<td>23</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

* Use CNU-411/E for this container.
** Use the new AUR missile container.

2. These containers will be designed for the maximum load weight and/or items in each container as indicated:

<table>
<thead>
<tr>
<th>SIZE</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design to maximum content weight.</td>
</tr>
<tr>
<td>2</td>
<td>Design to maximum content weight.</td>
</tr>
<tr>
<td>3</td>
<td>BSU 49/50 and MXU 650 Airfoil Group.</td>
</tr>
<tr>
<td>4</td>
<td>Use CNU-411 container for CBU 87/89, SUU 30-type, Mk 20, and similar type/size CBU munitions.</td>
</tr>
<tr>
<td>5</td>
<td>Use CNU 407 type container for all present and or future air to air missiles or other air munitions.</td>
</tr>
</tbody>
</table>

3. The Family of Munitions Containers shall be designed in accordance with MIL-C-5584D and options in MIL-C-5584.
   A. Par. 1.2; Classification.

Sizes 1, 2, 4, and 5 Type II – Horizontal Mount
Size 3 Type I - Vertical Mount

B. Par. 3.2; First article. One container of each size (1, 2, and 3) shall be provided for first article testing, for each container design. A second container of each design shall be provided after completion of first article testing.

C. Par. 3.4; Design and construction. These containers shall be designed in metric units in accordance with Public Law 94-168, as amended by Public Law 100-418.

D. Par. 3.4.2.2; Cure date on shock isolation system. This applies to rubber products only.

E. Par. 3.4.3.1; Desiccant receptacle. Container sizes 2 and 3 shall have desiccant receptacles. Container 1 would not have a desiccant receptacle because of its small size. If required, desiccant can be placed inside container 1 by removing the cover then resealing.

F. Par. 3.4.3.2; Humidity indicator. A humidity indicator shall be provided on sizes 2 and 3. Note: A humidity indicator card may always be placed inside container size 1.

G. Par. 3.4.3.3; Pressure equalizing valve. All containers shall have a pressure relief/equalizing valve, with the following characteristics:

Cracking Pressure = 1.0 to 1.5 PSID
Full Open Pressure = 2.5 PSID
Reseal Pressure ≥ 0.5 PSID

Minimum Flow Rate (cubic feet/minute) = Vc * (0.12)
Vc = Volume of the Container (cubic feet)
Ref. MIL-V-27166, Par. 3.6.3

H. Par. 3.4.3.4; Visual inspection ports. N/A

I. Par. 3.4.3.5; Air filling valve. An air filling valve will be provided on containers 1, 2, and 3.

J. Par. 3.4.3.6; Record receptacle. N/A

K. Par. 3.4.3.7; Drain plug. N/A

L. Par. 3.4.3.8; Fuel leak detector. N/A

M. Par. 3.4.4; Handling provisions. Investigate the use of spring loaded handles on container 1.

N. Par. 3.6.1; Item testing/inspection. N/A

O. Par. 3.6.2; Item uploading. N/A
P. Par. 3.6.3; Installation time. N/A

Q. Par. 3.6.5; Shock transmission. Container 3, BSU 49, 50 and MXU 650 fins, require physical and mechanical protection only. The other container designs require testing to the maximum weight, therefore, shock transmission is not a concern.

R. Par. 3.6.5.1; UN drop test. Container sizes 1 and 2 shall be tested to category A, at the maximum weight, unless actual items are used.

S. Par. 3.6.8; Size and weight. The containers shall be designed to the internal sizes and for the weights specified in paragraphs 1 and 2 above.

T. Par. 3.9.1; Aluminum. The container shall be treated as defined in 1 below. An alternate method of finishing aluminum products shall be as specified in 2 below.

(1) The exterior of the container shall be bead blasted with plastic media. NOTE: this is pending MAJCOM's approval.

(2) The painting of aluminum shall be as follows:

Aluminum surfaces shall be cleaned, pretreated, primed and painted in accordance with MIL-STD-171E. Cleaning shall be in accordance with Finish 5.2, MIL-STD-171E. The container shall have an immersion cleaning in accordance with TT-C-490C(1); Method III, Type III, then rinsed, followed by a force drying. This shall be followed by a spray application of wash primer DOD-P-15328D(1). Priming and finish shall be in accordance with Finish 20.9, MIL-STD-171E, see Section 5.3 of MIL-STD-171E. The primer used shall meet the requirements of MIL-P-23377F, followed with two (2) coats of topcoat TT-E-515A(1).

U. Par. 3.12; Installation instructions. N/A

V. Par. 4.7.7.1 & 4.7.7.2; Vibration tests will not be conducted unless the actual/dummy load is being tested. When testing to a maximum weight per container vibration tests will not be required.

W. Para. 4.7.5.2; Latch strength for containers 1 and 2 shall be 500 lb.
APPENDIX 2

DISTRIBUTION LIST
DISTRIBUTION LIST

DTIC/FDAC
CAMERON STATION
ALEXANDRIA VA 22304-6145

HQ AFMC/LG
WRIGHT-PATTERSON AFB OH 45433-5006

AFMC-LSO/LGT
WRIGHT-PATTERSON AFB OH 45433-5006

AFMC-LSO/LGTP (LIBRARY)
WRIGHT-PATTERSON AFB OH 45433-5540

10

HQ USAF/LGTT
WASHINGTON DC 20330

654 ABG/LGT
7701 SECOND ST, STE 209
TINKER AFB OK 73145-9100

654 ABG/LGTP
7701 SECOND ST, STE 209
TINKER AFB OK 73145-9100

649 ABG/LGT BLDG 1135
7973 UTILITY DR
HILL AFB UT 84056-5713

649 ABG/LGTP
7530 11th ST
HILL AFB UT 84056-5707

651 ABG/LGT BLDG 1530
410 JACKSON RD
KELLY AFB TX 78241-5312

651 ABG/LGTP
401 WISON BLVD
KELLY AFB TX 78241-5340

652 ABG/LGT
1961 IDZOREK ST
MCCLELLAN AFB CA 95652-1620

652 ABG/LGTP
1961 IDZOREK ST
MCCLELLAN AFB CA 95652-1620

653 ABG/LGT BLDG 376
455 BYRON ST
ROBINS AFB GA 31098-1860

1
DISTRIBUTION LIST (Cont'd)

1

653 ABG/LGTP BLDG 376
455 BYRON ST
ROBINS AFB GA 31098-1860

1

ASC/AWL
WRIGHT-PATTERSON AFB OH 45433

1

ASC/ALXS
WRIGHT-PATTERSON AFB OH 45433-7642

1

ASC/YJA
110 WACISSA RD
SUITE 15
EGLIN AFB FL 32542-5313

1

GSA OFFICE OF ENGINEERING MGT
PACKAGING DIVISION
WASHINGTON DC 20406

1

COMMANDER
ATTN: N KARL (SUP 045)
NAVAL SUPPLY SYSTEMS COMMAND
WASHINGTON DC 20376-5000

1

COMMANDER
ATTN: E PANIGOT (AIR 41212A)
NAVAL AIR SYSTEMS COMMAND
WASHINGTON DC 20361

1

COMMANDER
ATTN: T CORBE (CODE 8218)
SPACE AND NAVAL WARFARE SYSTEMS COMMAND
WASHINGTON DC 20360

1

ATTN: C MANWARRING (FAC 0644)
NAVAL FACILITIES ENGINEERING COMMAND
HOFFMAN BLDG 2 ROOM 12S21
ALEXANDRIA VA 22332

1

COMMANDING OFFICER
ATTN: K POLLOCK (CODE 15611K)
NAVAL CONSTRUCTION BATTALION CENTER
PORT HUENEME CA 93043

1

COMMANDER
NAVAL SEA SYSTEMS COMMAND
ATTN: G MUSTIN (SEA 66P)
WASHINGTON DC 20362
DISTRIBUTION LIST (Cont'd)

COMMANDER
ATTN: F BASFORD (SEA 05M3)
NAVAL SEA SYSTEMS COMMAND
WASHINGTON DC 20362

ATTN: E. H. BRIGGS (CODE 0512)
NAVAL AVIATION SUPPLY COMMAND
700 ROBBINS AVENUE
PHILADELPHIA PA 19111-5098

ATTN: F SECHRIST (CODE 0541)
NAVY SHIPS PARTS CONTROL CENTER
PO BOX 2020
MECHANICSBURG PA 17055-0788

COMMANDING OFFICER
ATTN: F MAGNIFICO (SES 0D CODE 9321)
NAVAL AIR ENGINEERING CENTER
LAKEHURST NJ 08733-5100

COMMANDING OFFICER
NAVAL WEAPONS STATION EARLE
NWHC/CODE 8023
COLTS NECK NJ 07722-5000

US AMC PACKAGING STORAGE AND
CONTAINERIZATION CENTER/SDSTO-TE-E
16 HAP ARNOLD BLVD
TOBYHANNA PA 18466-5097

DLSIE/AMXMC-D
US ARMY LOGISTICS MGT CTR
FT LEE VA 23801-6034

ATTN: Mike Ivankoe
US ARMY ARDEC/SMCAR-AEP
DOVER NJ 07801-5001

US ARMY NATICK LABS/STRNC-ES
NATICK MA 01760

HQ AFMC/LGSH
WRIGHT-PATTERSON AFB OH 45433

ATTN: DLA-MMNO
DEFENSE LOGISTICS AGENCY
CAMERON STATION
ALEXANDRIA VA 22304-6100
ATTN:  DLA-AT
DEFENSE CONTRACT MANAGEMENT COMMAND
CAMERON STATION
ALEXANDRIA VA 22304-6190

AGMC/DSP  
NEWARK AFS 43057-5000

AMARC/DST  
DAVIS MONTHAN AFB AZ 85707-5000

2750 TRANS/DMTT  
WRIGHT-PATTERSON AFB OH 45433-5001

HQ PACAF/LGTT  
HICKAM AFB HI 96853-5000

HQ USAFE/LGTT  
APO NEW YORK 09094-5000

HQ ACC/LGTT  
LANGLEY AFB VA 23665-5001

HQ AFSPACECOM/LKT  
PETERTSON AFB CO 80914-5000

HQ ANGSC/LGTT  
ANDREWS AFB MD 20331-6008

HQ ATC/LGTT  
RANDOLPH AFB TX 78150-5001

HQ AU/LGTT  
MAXWELL AFB AL 36112-5001

HQ AMC/XONC  
SCOTT AFB IL 62225-5001

SCHOOL OF MILITARY PACKAGING TECHNOLOGY  
ATSZ-MP  
ABERDEEN PROVING GROUND MD 21005-5001

HQ USMC (CPP-2)  
WASHINGTON DC 20380

ATTN:  DGSC/QED  
DEFENSE GENERAL SUPPLY CENTER  
8100 JEFFERSON DAVIS HIGHWAY  
RICHMOND VA 23297-5000
DISTRIBUTION LIST (Cont'd)

ATTN: DGSC/OMAD
DEFENSE GENERAL SUPPLY CENTER
8100 JEFFERSON DAVIS HIGHWAY
RICHMOND VA 23297-5000

ATTN: THEO COX
CO-ALC/LIWDT
633 ELM LN
HILL AFB UT 84056-5819

ATTN: MAJ GREG POWELL
ASC/SMT
WRIGHT-PATTERSON AFB OH 45433

HQ AFCOMAC/LGW
SIERRA ARMY DEPOT CA 96113
Design of a Family of Munitions Containers (FMC) Overall Project Management of FMC #1, FMC #2 and FMC #3.

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PACKAGING BRANCH
5215 Thurlow Street BLDG 70
Wright-Patterson AFB OH 45433-5540

94-R-09

DISTRIBUTION UNLIMITED

An OOC-ALC/MMW (presently OOC-ALC/LLIWTI) Process Action Team (PAT) came up with the idea to have a Family of Munitions Containers (FMC) of three to six containers to replace most of the Air Force's 200 munitions containers. OOC-ALC initiated a PRAM project 21989-01 to develop this family of containers. The five containers to be developed had internal volumes from 0.5 cubic feet to 110.0 cubic feet. AFPEA developed the three smallest containers. The remaining two largest would use pre-existing containers or be developed at a later date. The three containers that were developed are the FMC #1 at 0.5 cubic feet, FMC #2 at 2.75 cubic feet and the FMC #3 at 35.5 cubic feet.