Lightweight and Compostable Packaging for the Military

WP-201218

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US Army Combat Capabilities Development Command Soldier Center (CCDC SC)

Final Debrief

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ESTCP

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14. ABSTRACT

The project's goal was to demonstrate and validate environmentally friendly Meal, Ready-to-Eat (MRE) coated corrugated fiberboard ration containers to replace the current solid fiberboard used by the Army. The intent was to provide alternative high performing materials to reduce the amount of waste in the field. Materials and design of the containers were developed with a SERDP project and demonstrated and validated with this ESTCP project. The new containers were fabricated at a corrugator using a polymeric coated paper for water resistance and wet strength. The rations were then assembled at AmeriQual Packaging, one of the ration assemblers, producing pallet loads of MRE rations to test. Control containers of solid fiberboard were also fabricated and assembled at the same time, so they could be used as a comparison to the new container for demonstration/validation testing.

15. SUBJECT TERMS
Compostable Packaging, Military, fiberboard, shipping container, corrugate, polymeric coated paper, Meal, Ready-to-Eat

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Technical Objectives

- The overall objective is to demonstrate and validate lightweight coated corrugated fiberboard containers for the Meal, Ready to Eat (MRE) which will reduce the amount of solid waste for the military.

These environmentally friendly containers need to meet the operational and performance requirements of combat ration packaging.

Why Pursue a Lightweight, Corrugated MRE Shipping Case ?

- Need to work on new MRE fiberboard case originated from enormous amounts of packaging waste in the field

Facts	MRE
Fiberboard Waste/Pallet	190 lbs
Average Annual Production	3,300,000 cases (68,750 pallets)
Total Fiberboard Annual Waste	6,531 tons
Removal Cost at $50/Ton	$294,250

- Alternative cases for MREs were evaluated under SERDP research and development and then moved to ESTCP demonstration/validation programs
- Technical efforts have been documented in technical reports and publications.

Performance Objectives

Performance Objective	Metrics	Data Requirements	Success Criteria	Results
Quantitative Performance Objectives				
Reduce amount of solid waste generated from secondary packaging	Tons/day of solid, non-hazardous ration reduced waste sent to landfill	Disposal data for solid waste	Greater than 20% overall weight reduction of secondary packaging	FAIL (15% vs 20%)
Maintain compression strength of MRE fiberboard containers	Maintain functioning compression strength (lbf) of containers within representative environments	Compression data from finished containers after environmental testing	Maintain compression strength to support 4 unit loads (3950 lbs) during long term storage	PASS
Ensure repulpability to meet paper mill operating standards during recycling	Percent fiber-on-fiber yield	Fibre Box voluntary standard for repulpability	No more than 15% fiber reject	PASS
Ensure recyclability to meet recycling mill operations	Percent reject of recycled fiber	Fibre Box voluntary standard for recyclability	No more than 10 percent decrease in fiber strength properties	PASS
Ensure emissions from burning of containers contain no toxic chemicals	Identified emission gases from laboratory burn tests	U.S. EPA emissions protocol	Zero identified toxic emissions as a result of burn testing	PASS
Ensure fiberboard can undergo waste-to-energy trials	Convert fiberboard in waste-to-energy converter and measure BTUs	U.S. EPA emission guidelines	Create pellets from waste-to-energy trail	
Ensure biodegradability and compostability of fiberboard	Percent mineralization of chemical carbon in compost/soil	ASTM D6868 specification on biodegradable paper coatings	Meet the requirements of ASTM D6868 specification	PASS
Maintain resistance to insect infestation	Percentage of insect penetrations per 30 containers	Inspection of containers after insect exposure	Less than 20% penetration failure	PASS
Ensure MRE can withstand aerial delivery	Percentage of failures due to bursting of puncture	Percentage of defects on dropped MREs	Less than 12% failure rate	PASS
Ensure MRE can withstand distribution / transportation study	Percentage of packaging defects	Inspection of MREs after distribution and transport cycle	Less than 10% failure rate	PASS
Qualitative Performance Objectives				
Soldier acceptance of container	Field test questionnaire	Survey evaluation from individual soldiers	Positive feedback that soldiers could use this container	PASS
Ensure manufacturability of corrugated ration container	Observation / inspection of converted material	Manufacturing specifications ASTM D4727 & D5118	Complies with industry standards set by Fibre Board Association	PASS
Ensure ease of packing during assembly process pf the MRE rations	Observations during the assembly and packing processes	Feedback and inspection from the converter on the packaging of MRE rations	End item inspection at copackers with certificate of conformance and production report	PASS

Site Description

- Paper Coating – Spectrakote Gettysburg, PA
- Corrugator – York Containers, York PA
- Assembler – AmeriQual Packaging, Evansville, Indiana
- Case and Unit Load Performance Testing - Army Sustainment Command (ASC) Packaging, Storage, and Containerization Center (PSCC), Tobyhanna, PA
- Emission Testing – Environmental Protection Agency, NC
- BiodegradationCompostablilityTesting - Advanced Materials Center, Indiana
- Repulpability/Recyclability - Western Michigan University, Michigan
- Waste to Energy Trial – Fort Benning, Georgia
- Field Study -Fort Carson, Colorado 166th Armor Unit
- Air Drop – YUMA, Arizona, Fort Devens, MA

Site Description

Transportation Study

Location #1: Marengo Warehouse and Distribution Center
Marengo, IN 47140

Location #2: J
Joint Base Elmendorf-Richardson
JBER, AK 99505

Location #3:
Joint Base Lewis-McChord
Yakima, WA 98901

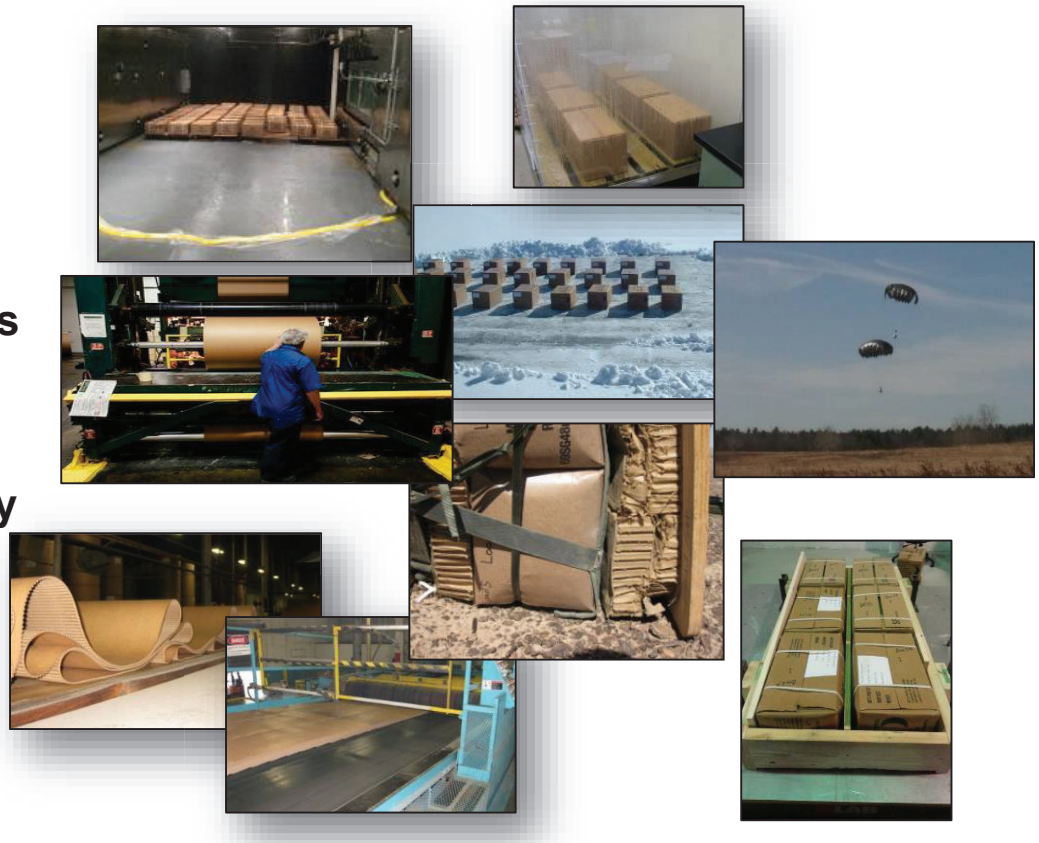
Location #4
Fort Bliss
Ft. Bliss, TX 79916

Location #5: Arrive
Fort Stewart
Ft. Stewart, GA 31314

Test Design

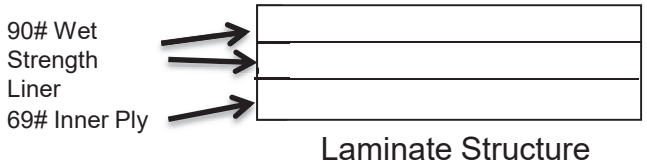
Demonstration/Validation Tests

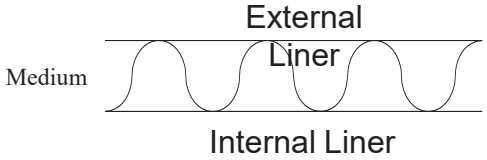
- Reduction of Solid Waste
- Environmental testing
  - ♦ ISTA and ASTM testing
    - ▪ Compression testing
    - ▪ Cobb Testing
- Repulpability/recycling analysis
- Emission testing
- Waste to Energy conversion
- Biodegradation/ Compostability
- Insect Infestation
- Airdrop trials
- Unit load transportation
- Field Study
- Manufacturability
- Assembly



Lightweight, Corrugated MRE Shipping Case

Current Case - Solid Fiberboard **New Case -** Corrugated Fiberboard





Solid

Corrugated

<u>Liner Grade</u>

90 # Paper

69# liner

30# Wax Alternative

medium C flute

<u>Container Design</u>

Regular Slotted Container (RSC) with Insert

Test Design
Fiberboard Performance at Tobyhanna

ASTM 4169 Standard Practice for Performance Testing of Shipping Containers and Systems

ASTM D5276 Standard Test Method for Drop Test of Loaded Containers by Free Fall

Test Design

Pallet Edge Drop Test

Cobb Test

Test Design

ESTCP Fiberboard MRE Box/Pallet Inspection Sheet

Inspector:_____ **Location:**_____ **Date:**_____

Check one : **Arrival**____ **Departure**____

Defects:

Individual Box		*Pallet Overall*
A. Adhesive Failure	E. Excessive Gap Width	I. Superficial Damage
1. No paper ripping observed.	F. Flaps Pushed Out	1. Ink Fade/Run/Smudg
2. Flap is loose.	G. Puncture Damage	2. Rip/Tear/Abrasion
B. Bottom Crush	H. MRE(s) Damaged.	J. Stretch Wrap Loose/Rippe
C. Corner/Edge Crush	1. Check "MRE damage" box.	L. Load Shift While Palletize
D. Delamination of Paper Layers	2. Indicate component(s).	O. Other

*Mark defect codes in box marked "***Defects:***" Describe defect in Observations.*

Pallet #	**SF/CF**	**Overall Pallet Defects:**	**Height:**	**Defomation**

Pallet Observations:

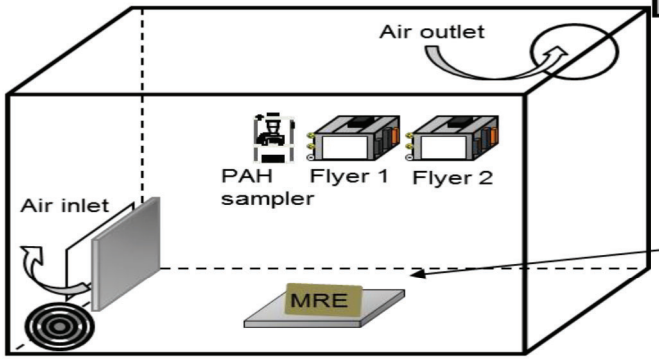
#	Layer	Box	Defects:	MRE Damage *(Check Y)*	Observations:
1	4	1			
2	4	2			
3	4	3			
4	4	4			
5	4	5			
6	4	6			
7	4	7			
8	4	8			
9	4	9			
10	4	10			
11	4	11			
12	4	12			
13	3	1			
14	3	2			
15	3	3			
16	3	4			
17	3	5			
18	3	6			
19	3	7			

Test Design

OBTF

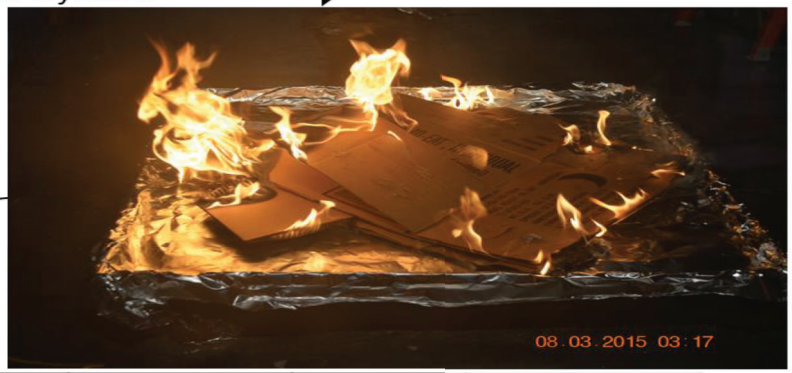
- 70 m^3 (2471 ft^3)
- High-volume blower and interior fan ensures complete mixing
- Paperboard/MRE's placed on a 0.93 m × 0.93 m (3 feet × 3 feet) foil covered and sand layer supported by a steel plate

Environmental Protection Agency's Open Burn Test Facility (OBTF)



Air Pollution Control System

High-volume blower



Fiberboard Type	Code	Test order	No. of Tests	Ash Samples
NA - Burn Hut Blank	BS	Pre-Test	1	NA
Current Fiberboard Container and Current Fiberboard Liner	CB/CL	3, 5, 7, 8	4	1 (composite)
New Polymer Coated Fiberboard Container and New Polymer Coated Fiberboard Liner	SB/SL	6, 9, 10, 11	4	1 (composite)
New Non-Polymer Fiberboard Container and New Non-Polymer Fiberboard Liner	NSB/NSL	4, 14, 15, 16	4	1 (composite)
Current Fiberboard, No Wet Strength	NWS	1, 2, 12, 13	4	1
NA - Burn Hut Blank	BS	Post-Test	1	NA

Test Design

Emission Sampling

- Dioxins
- PM2.5 (particulate matter 2.5 microns and below)
- PM10 (particulate matter 10 microns and below)
- Particulate matter – size distribution (PM1, PM2.5, PM4, PM10, Total PM) – continuous
- Metals
- Volatile Organic Compounds (VOCs), such as benzene
- CO, CO_2 - Continuous

Performance Assessment

- Reduction of solid waste
- Compression / case and pallet load testing
- Repulpability / Recyclability
- Emission Testing
- Waste to Energy Trial
- Biodegradability / Compostability
- Insect Infestation
- Aerial Delivery
- Distribution Testing / Transportation Study
- Soldier Acceptance
- Ensure Manufacturability of fiberboard
- Ensure Assembly – ease of packaging

Overall Performance Assessment

	Solid Fiberboard (Current Case)	Lightweight, Corrugated (New Case)
Rough Handling Survivability	High	High
Cobb Testing /Water Resistance	High	High
Air Drop – Survival of MRE	High	High
Transport - Survival	High	High
Insect Infestation - % Passed	High	High
Soldier Acceptance	High	High
Emissions	Similar results to Corrugated	Similar results to solid
Waste to Energy	Yes	Yes
Compostable	No	Partial
Manufacturability	Sole Source	Many Companies (coating is sole source*)

*But easily sourced and supplied

Overall Performance Acceptance

	Solid Fiberboard (Current Case)	Lightweight, Corrugated (New Case)
Overall Performance – MRE Survivability	High	High
Total Case Cost (case + liner)	$1.45	$1.42*
Weight	Heavy	Light
Weather Resistance	High	High
Compression Strength with Liner	High	High
Repulpability/Recyclability	NA	High (FBA*** Certified)
Burst Strength	High	Low**

**Compression strength more critical to performance
*Lowest Quote
***Fiberboard Association

Performance Assessment

- Reduction of solid waste
- Compression / case and pallet load testing
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- Ensure Assembly – ease of packaging

Performance Assessment Weight and Compression

Current Solid Fiberboard Case

- Outside Dimensions 15-7/8 x 9 x 10”
- Regular Slotted Solid Fiberboard Case with insert surrounding the rations to give stacking strength

Lightweight Corrugated Fiberboard Case

- Outside Dimensions 16 x 9-3/8 x 9-13/16”
- Regular Slotted Coated Corrugated Case with insert on outer rim of case
- Weight – 17% less
- Compression Strength 5% higher

Master’s Thesis “Assessment of Weights and Performance of MRE Packaging” S. Gedrich, Pennsylvania State University, Statistical Consulting Center Dept. of Statistics Eberly College of Science Dec.2016

Performance Assessment Transportation Study

Bottom Crush
Stress creasing on bottom face of box, creasing seen near the bottom edge.

Separation of Fiberboard Layers
De-lamination or Peeling. Inner layers are visible.

Performance Assessment
Recyclablity and Repulpability

Part 1 determines the repulpability of treated corrugated by determining fiber-on-fiber yield

Part 2 determines the recyclability of the treated corrugated by evaluating its effect on mill operations and finished products when it is added to untreated corrugated in the amounts specified
RESULT: Corrugated Coated Fiberboard is repulpable and recyclable and met FBA certification; Solid Fiberboard is not

Performance Assessment Ultimate Proximate Analysis for the Seven Fiberboard Materials.

	Current Fiberboard Solid Box	Current Fiberboard Liner	Corrugated Spectra-Kote Polymer Fiberboard Box	Corrugated Spectra-Kote Polymer Fiberboard Liner	No Spectra-Kote Box	No Spectra-Kote Liner	Current Fiberboard Box - No Wet Strength
Code	CB	CL	SB	SL	NSB	NSL	NWS
Heat of combustion (BTU*/lb)[1]	8121	7955	7537	7166	7598	7979	8145
Loss on drying (%)[2]	7.45	7.49	9.45	9.13	9.48	8.51	10.24
Carbon (%)[3]	46.3	46.19	44.99	45.44	45.36	45.85	46.56
Chlorine (ppm)[4]	188	185	297	251	97	57	139
Hydrogen (%)[5]	6.08	6.16	6.13	6.02	6.29	6.20	6.03
Nitrogen (%)[6]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulfur (%)[7]	0.234	0.243	0.162	0.155	0.149	0.140	0.236

*British thermal unit(s). Galbraith procedures: [1]S-231; [2]S-200; [3]ME-14; [4]ME-4A; [5]ME-14; [6]ME-14; [7]E16-2.

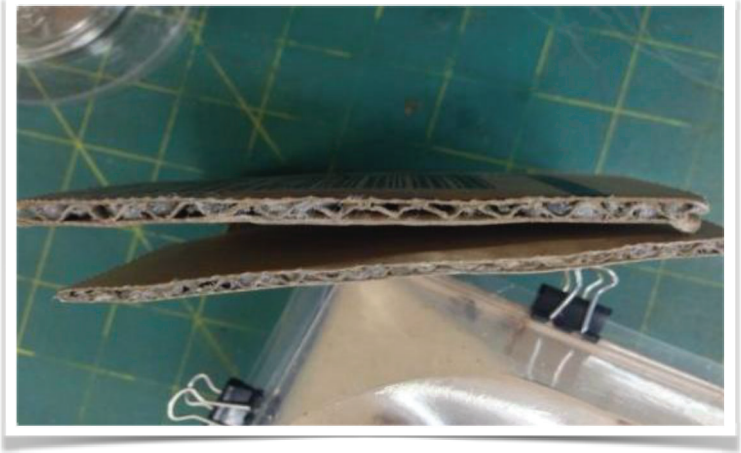
Performance Assessment

Waste to Energy Trial

Battalion Waste to Energy Converter (BWEC) Program

Pellet Properties
Solid Waste Discharge
Producer gas quality
Ambient air quality impact

Performance Assessment
Insect Infestation



Moth pupae found in the fluting

Performance Assessment Insect Infestation

Study 1 Infestation Data Using Indian Meal Moth Eggs - 4 x 4 Smooth Cut-Outs

Rep	1L Control Liner	2L New Liner York	ESTCP Coated Corrugate Box York	Control Fiber Board
1	Pass	Pass	Pass	Pass
2	Pass	Pass	Pass	Pass
3	Pass	Pass	Pass	Pass
4	Pass	Pass	Pass	Pass
5	Pass	Pass	Pass	Pass
6	Pass	Pass	Pass	Pass
7	Pass	Pass	Pass	Pass
8	Pass	Pass	Pass	Pass
9	Pass	Pass	Pass	Pass
10	Pass	Pass	Pass	Pass
11	Pass	Pass	Pass	Pass
12	Pass	Pass	Pass	Pass
13	Pass	Pass	Pass	Pass
14	Pass	Pass	Pass	Pass
15	Pass	Pass	Pass	Pass
16	Pass	Pass	Pass	Pass
17	Pass	Pass	Pass	Pass
18	Pass	Pass	Pass	Pass
19	Pass	Pass	Pass	Pass
20	Pass	Pass	Pass	Pass

Pass/Fail Evaluation

Pass = No Chew Holes

Fail = Chew Holes

Performance Assessment Infest Infestation

Study 1 Infestation Data Using Indian Meal Moth Eggs - 4 x 4 Roughed Cut-Outs

Rep	1L Control Liner	2L New Liner York	ESTCP Coated Corrugate Box York	Control Fiber Board
1	Pass	Pass	Pass	Pass
2	**Fail**	Pass	Pass	Pass
3	Pass	Pass	Pass	Pass
4	Pass	Pass	Pass	Pass
5	**Fail**	Pass	Pass	Pass
6	Pass	**Fail**	Pass	Pass
7	Pass	Pass	Pass	Pass
8	Pass	Pass	Pass	Pass
9	Pass	Pass	Pass	Pass
10	Pass	Pass	Pass	Pass

Pass/Fail Evaluation

Pass = No Chew Holes

Fail = Chew Holes

Performance Assessment
Insect Infestation

Study 2 - Infestation Data Using Cigarette Beetle Adults; Smooth Circle Cut-Outs

Rep	Control Liner	2L New Liner York	ESTCP Coated Corrugate Box York	Solid Fiberboard
1	Pass	Pass	Pass	Pass
2	Pass	Pass	Pass	Pass
3	Pass	Pass	**Fail**	Pass
4	**Fail**	Pass	Pass	Pass
5	**Fail**	Pass	Pass	Pass
6	Pass	Pass	Pass	Pass
7	Pass	Pass	Pass	Pass
8	Pass	Pass	Pass	Pass
9	Pass	Pass	Pass	Pass

Pass/Fail Evaluation

Pass = No Chew Holes

Fail = Chew Holes

Performance Assessment

Biodegradation Compostability

Sample	Biodegradation Carbon Dioxide Conversion (%)	Disintegration Testing (90 days) Weight Loss (%)
Cellulose	97	100
Solid Fiber Board	40	62
ESTCP Corrugated	52	63
Liner Coated	49	52
Liner Current	90	93

Performance Assessment
Air Drop

High Altitude

Rigged corrugated and solid fiberboard dropped at YUMA

100% inspection of all food components and containers each MRE on 2 pallet controls and 2 pallets of corrugated containers

Performance Assessment
Air Drop Data

Total Incidents of Case Damage by Location on Case by Layer

	Top	Corrugated			Bottom	Top		Solid		Bottom	Corrigated	Solid	Corrigated	Solid
Layer	5	4	3	2	1	5	4	3	2	1	Total	Total	%	%
Location														
bottom	7	5	5	10	15	2	3	10	18	11	42	44	14.4%	21.2%
corner	12	5	4	5	4	14	3	2	1	5	30	25	10.3%	12.0%
edge	14	17	16	19	29	15	8	5	8	12	95	48	32.6%	23.1%
end	0	0	0	1	1	0	2	0	2	1	2	5	0.7%	2.4%
flap	11	0	0	0	1	0	1	0	0	0	12	1	4.1%	0.5%
manufacturer's joint	0	1	4	5	13	0	0	1	0	0	23	1	7.9%	0.5%
N/A	0	0	4	0	0	2	2	5	0	0	4	9	1.4%	4.3%
not specific	0	2	2	4	2	0	2	1	7	4	10	14	3.4%	6.7%
side	3	3	8	18	26	5	1	0	0	2	58	8	19.9%	3.8%
top	1	6	2	1	5	1	5	13	14	20	15	53	5.2%	25.5%

Performance Assessment

Low altitude, low velocity drop at Fort Devens

100% inspection – minimal defects in both types of containers

Performance Assessment
Ensure Assembly

MRE Prototype Container on packing line.

Ration assembly of 96 (2 pallet loads) cases using prototype containers.

Performance Assessment
Ensure Assembly

Ration assembly of 96 cases using prototype containers.

MRE prototype containers on packing line.

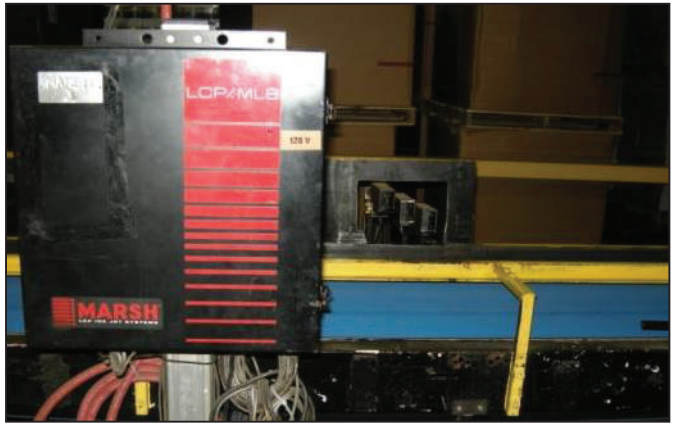
Case sealing (top) equipment.

Case sealing (top) of MRE rations.

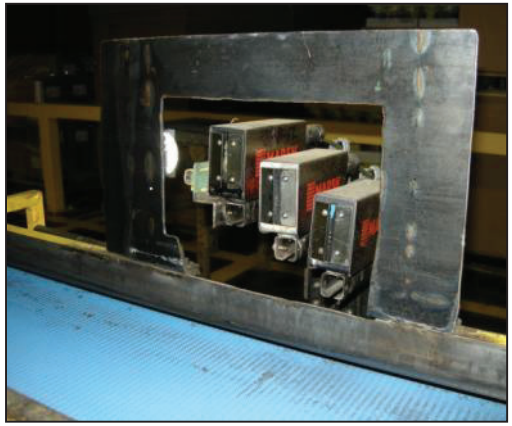
Performance Assessment Ensure Assembly

MRE Case Packing Equipment

Case sealing equipment (Klippenstein SK500 HM)



Inkjet Printer – Marsh LCP Ink Jet Systems



Inkjet printer heads to print date of pack

Strapping equipment (Dynaric ST-1)

Performance Assessment Ensure Assembly

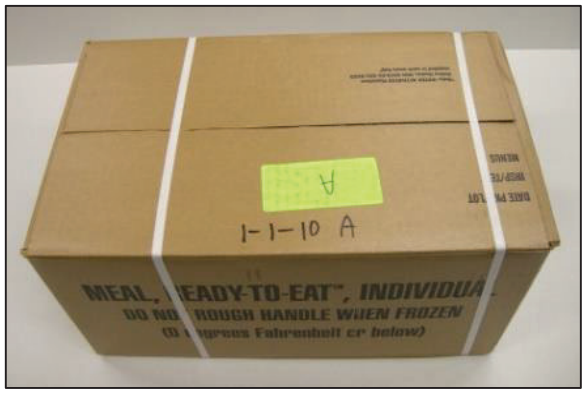
Full Scale Assembly Trial at AmeriQual

Thirty pallets of MREs at the AmeriQual packaging center

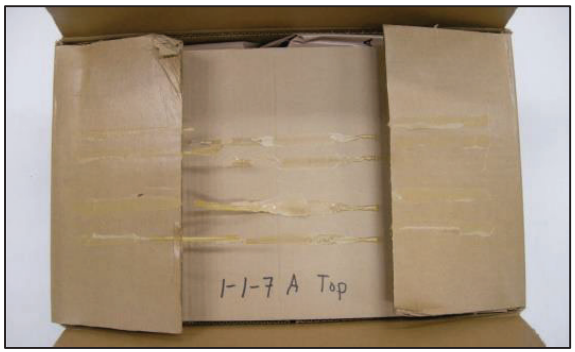
Performance Assessment Ensure Assembly

Some Issues Noted From Demonstration Which Can be Fixed by Altering Assembly Line

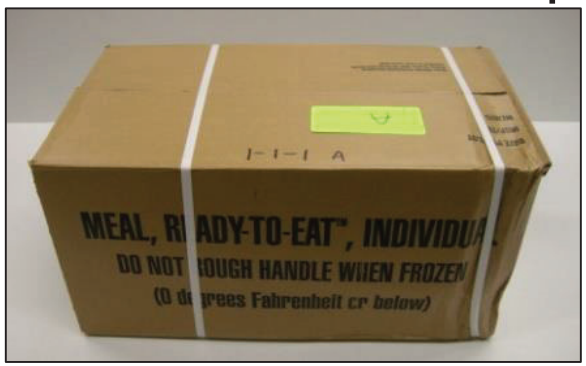
Misaligned Straps



Push out of minor flaps



Adhesive Failure



Container Crushing

Performance Assessment Distribution Study

- ***Marengo Caves Deflection Studies***

Stacks of MRE cases at Marengo Caves (left) and the deflection measurement system (right)

Performance Assessment
Soldier Acceptance

Focus Group:

BICI/STO-D

Soldiers from the 82nd Airborne preferred the corrugated boxes due to their lighter weight

- Soldiers from the 542nd did not have a preference for either of the MRE cases

Likes: Corrugated box is more lightweight and has better structural integrity

Dislikes: New box harder to open because it is thicker, has more glue, and Soldiers can't get their fingers underneath the box's flaps

Suggestions for Improvement:

- Make corrugated box easier to open (less glue*)

When asked which boxes they prefer, none of the Soldiers had a preference because "as long as we're eating, we don't care." They were also not concerned about ease of opening because "everyone has a knife."

*New glue validated by Tobyhanna for performance and ease of opening

Performance Assessment
Soldier Acceptance

Field Study Fort Carson, CO; 166th Armor Unit

Activity with the Cases

- Sitting: two sat on them the tall way and another the short way. The straps were still on all. The cases were adequate for sitting
- Threw cases around
  - Threw the cases straight up into the air and let hit the ground
- Carried by straps and tugged at the straps so the weight of the case pulled at individual straps

Comments

- Fiberboard insert is a better size for reuse than the current longer pieces
- Easier to open; Doesn't affect our mission to have easier/harder to open cases
- Dislike the long insert in the current cases
- Would like a range card printed on the insert
- Better for the environment
- "Lighter is better" when transported on the back of a vehicle
- May be bad if the boxes can't handle being sat on
- It would affect their mission if the boxes burst open in transit

Cost Assessment

Solid Fiberboard	Corrugated Fiberboard
Solid Case price = $1.151	**Corrugated Case $1.099**
Liner = $.295	**Liner = $.330**
Total: $1.446 = $1.45	**Total = $1.419 = $1.42**

Quotes: Requested 1,200,000 cases and inserts with shipping to Indiana

Solid fiberboard - price includes: lamination of paper, glue, wet strength additive (International Paper is only supplier)

Corrugated container - price includes: coated paper with spectrakote, glue, WAM (wax alternative medium), fluted fiberboard (York Containers, Interstate Containers, New England Wooden Ware Corporation are suppliers)

Here is a list of corrugated-treatment vendors certified to supply coatings to meet the recyclable wax-alternative standard:

Spectra-kote	Cascades Socono
Group Inc. (IGI)	Sustainable Fiber Solutions
Michelman Inc.	International Archroma U.S. Inc.

Scale-up

- Discuss what can be expected when moving from demonstration-scale to full-scale implementation.
  - All assemblers need to find a corrugator who can easily fabricate container for the right price
- Discuss any scale-up constraints in terms of engineering limitations or equipment availability.
  - Military specification for MREs has been updated to include this container
  - New glue machines needed for the assembler
  - New printing ink for corrugated containers
  - Assembly speeds need to be equal or better than current system
- Discuss any cost issues that will depend on the size of the future implementation.
  - The price fluctuation of paper (solid fiberboard uses more paper, but corrugated has “coating the paper” step
  - Choose corrugator near assembler to save on shipping costs .

Next Steps

- Publish technical report this month – All approved by ESTCP and CCDC SC technical reviewers
- Tobyhanna needed to send MIPRed funds back to CCDC SC and then return to ESTCP
- Keep in contact with assemblers and DLA for the transition of containers
- Survey others government agencies to see if any use for corrugated materials for containers besides rations

Technology Transfer

- Target audience/Stakeholders – Warfighter, DLA Troop Support, AmeriQual Packaging, Wornick, Sopacko, CCDC SC, CFD, All Services
- Passed Joint Service Operational Ration Forum (JSORF) decision brief in February 2018 and verified fit on aircraft (height of pallets)
- Regulatory issues associated with transfer of the technology, resulted in a modified military specification to include solid fiberboard and corrugated fiberboard.
- Try to transfer this to other military packaging uses besides rations

Technology Transfer Examples

- Presentations at key conferences – Sustainable packaging conference in June 2020 and TAPPI
- Web-based tools - Social media to show the container performance and structure
- Guidance documents – military specification and AERTA
- Technology fact sheets – created for ESTCP project but can make one with CCDC SC Strategic Communication office geared to other military applications
- “How to” Videos – Video of the container and its features
- Community open houses – Have had at CCCDC SC with Institute of Packaging Professionals New England Chapter
- Webinar to educate others about project promote the corrugated containers with industrial partners

Key Points

Transport

- Improve cube utilization of trailer loads by adding 1 pallet load to trailer shipments
- Decrease weight by 21 lbs per unit load

Disposal

- Eliminating 17 percent of packaging waste
- Create new alternatives for recycling of fiberboard materials
- Reduce backhaul operations from contingency basing locations

Other Potential Applications

- Meal, Cold Weather and First Strike Ration
- Other packaging containers for all military services

Key Points

Sourcing
- Competitive purchase with corrugators nationwide who can fabricate the case
- Simplify sourcing with corrugator companies

Manufacturing
- Can produce this fiberboard at corrugators located near assemblers

Packaging
- Reduce packaging related waste
- Reduce weight of unit load
- Add recyclability and repulpability

Location	# Corrugators
Evansville, Indiana	9
Cincinnati, Ohio	17
Mullins, South Carolina	9

Status

- Achieved approval of the coated corrugated lightweight container for the outyears of the procurement of MREs for FY20/FY21, but recently found out this ison hold to deal with assembly issues/changes (DLA decision with assemblers)

- Worked with Combat Rations Engineering and Support Team (CREST) team to modify the assembly specification

- Worked with the MRE assemblers and corrugator companies on glue and printing issues and fiberboard

- Provided additional data/reports to JSORF as needed

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Mr. Zach Eckbert, Mr. Charles Propst. Terry Moore

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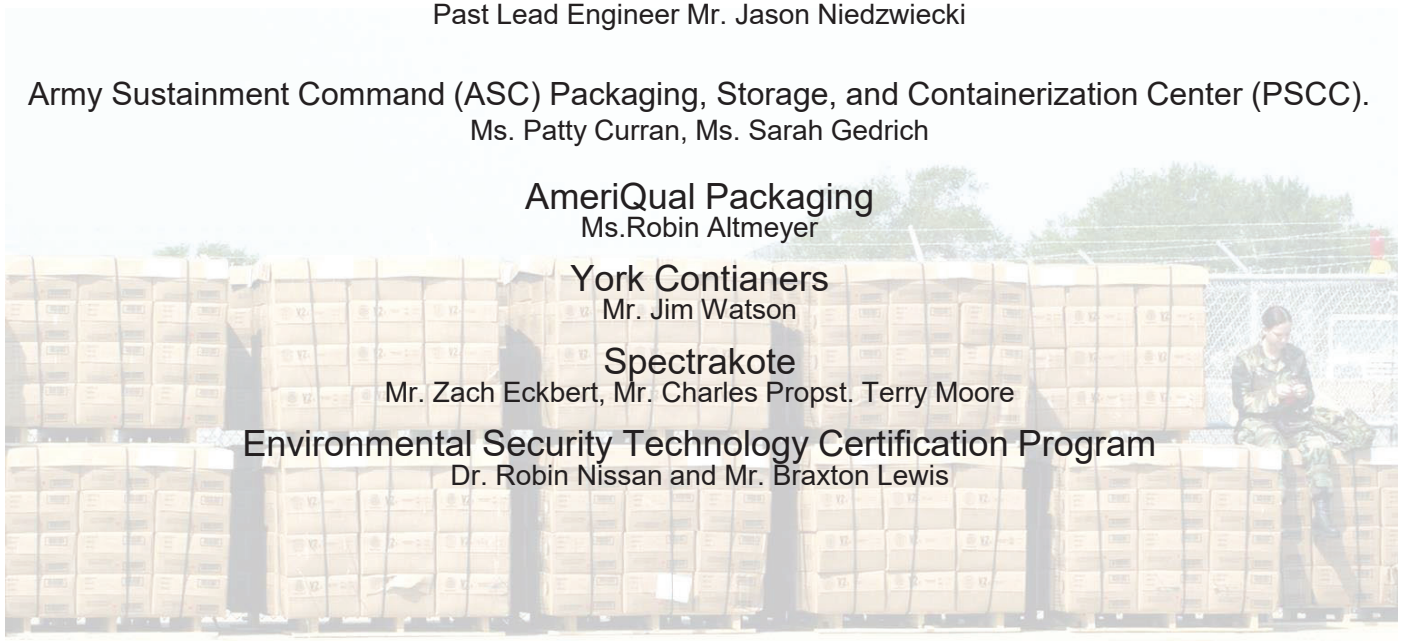

BACKUP SLIDES

Additional Information Slides

Publications

- Final Report – Technical Report “Lightweight and Compostable Packaging for the military” April, 2020
- Joint Service Operational Ration Forum (JSORF), 2013 ,2014, 2018 (Decision Brief)
- SERDP/ESTCP Poster Symposium November, 2017
- Master’s Thesis “Assessment of Weights and Performance of MRE Packaging” S. Gedrich, Pennsylvania State University, Statistical Consultin Center Department of Statistics Eberly College of Science Dec.2016
- Journal Article “Characterizing emissions from open burning of military foo waste and ration packaging compositions T. J. of Material Cycles Waste Management, Dominguez, J. Aurell, B. Gullett,· R. Eninger, D.Yamamoto, July 2017.
- Packing Bulletin Articles This is a U.S. Army publication that is published quarterly and originated by the Army Packaging Policy Working Group.
- Combat Feeding Research Engineering Program – Yearly posters/presentations
- Award – DoD Packaging Achievement Award 2018

WP-201218: Lightweight and Compostable Packaging for the Military

Performers: CCDC SC Spectrakote, York Container, AmeriQual, Western Michigan University, Advanced Materials Center, EPA, Moses Biologic, Marengo Caves, Army Sustainment Command (ASC) Packaging, Storage, and Containerization Center (PSCC), Infoscitex, Pira International, YUMA Proving Ground

Technology Focus

- *Environmentally friendly polymeric coated corrugated containers are developed to replace solid fiberboard containers for Meal, Ready-to-Eat military rations.*

Demonstration Site

- *Variety of Army demonstration sites are used for each demonstration test.*

Demonstration Objectives

- *Performance objectives include the reduction of solid waste for the military with comparable performance to the current container and keeps the ration food components safe*

Project Progress and Results

- *Fabricated the containers and assembled the containers into pallet loads with rations; executed the demonstration/validation plan and transitioned it to Defense Logistics Agency (DLA) to implement.*

Implementation Outlook

- *Implementation from DLA to assemblers has been pushed out. Assemblers need to to check assembly times with new containers and switch the glue and ink .*

Assembly of Meal, Ready-to-Eat in corrugated fiberboard

Lightweight, Corrugated MRE Shipping – Backup Slides

Corrugators close to Evansville, Indiana

Company Name	Plant Name	Street	City	St	Zip	Miles	Phone
Sisco Corporation		1231 E. Michigan	Evansville	IN	47720	8	812-422-2090
Hood Container	Packaging Purposes LLC	2588 Grimes Avenue	Owensboro	KY	42303	35	502-664-2197
Servants, Incorporated		3145 Lottes Drive	Jasper	IN	47546	52	812-634-2201
Packaging Corporation of America		408 E. St. Clair Street	Vincennes	IN	47591	53	847-262-8943
Sun Container, Incorporated		515 South First Street	Mt. Vernon	IL	62864	71	618-244-7244
Rusken Packaging	Cougar Packaging	2722 Union Hill Road	Clarksville	TN	37040	95	256-734-0092
International Paper		5150 Nashville Road	Bowling Green	KY	42101	95	901-419-7000
KapStone Container Corporation		225 Mitch McConnell Way	Bowling Green	KY	42102	97	847-239-8800
Sisco Corporation		1520 S. Mill Street	Nashville	IL	62263	97	618-327-3066

Lightweight, Corrugated MRE Shipping – Backup Slides

Corrugators close to Cincinnati, Ohio

Company Name	Plant Name	Street	City	St	Zip	Miles	Phone
Hood Container	Packaging Unlimited	2251 Augustine Avenue	Covington	KY	41014	3	859-431-6194
Oak Hills Carton Company		6310 Este Avenue	Cincinnati	OH	45232	6	513-922-2050
Angleboard		3253 Diehl Road	Cincinnati	OH	45211	7	513-248-2990
WestRock		9960 Alliance Road	Cincinnati	OH	45242	12	513-745-2400
Honeymoon Paper Products, Inc.		7100 Dixie Highway	Fairfield	OH	45015	15	513-755-7200
WestRock		9266 Meridian Way	West Chester	OH	45246	16	513-860-4700
Ohio Box Company		1228 Castle Dr.	Mason	OH	45040	18	513-398-5858
JIT Packaging		1550 Kingsview Drive	Lebanon	OH	45036	24	877-563-6048
Akers Packaging Service Group		2820 Lefferson Road	Middletown	OH	45042	28	513-422-6312
N-Stock Box Inc.		1500 S University	Middletown	OH	45042	28	513-423-0319
Packaging Corporation of America		1824 Baltimore Street	Middletown	OH	45044	28	513-424-3541
Green Bay Packaging Inc.		760 Kingsview Drive	Lebanon	OH	45036	29	513- 489-8700
International Paper		912 Nelbar Street	Middletown	OH	45042	30	513-425-0830
Burrows Paper Corporation		2000 Commerence Center Drive	Franklin	OH	45005	32	937-746-1933
International Paper		900 State Route 35 West	Eaton	OH	45320	45	937-456-4131
Welch Packaging Group	Imperial Packaging	321 Hopeland Street	Dayton	OH	45408	47	937-223-3958
Dayton Corrugated Pkg., Corp.		1300 Wayne Ave.	Dayton	OH	45410	48	513-254-8422

Lightweight, Corrugated MRE Shipping – Backup Slides

Corrugators close to Mullins, SC

Company Name	Plant Name	Street	City	St	Zip	Miles	Phone
Palmetto Packaging Corporation		1131 Edward Street	Florence	SC	29501	30	843-662-5800
International Paper		820 Caton Road	Lumberton	NC	28360	32	910-738-6214
Southern Packaging Corporation		526 Beauty Spot Road SE	Bennettsville	SC	29512	38	803-479-7154
Carolina Container Co., Inc.	Scotland Container	Hwy. 401 Bypass	Laurinburg	NC	28352	41	910-277-0400
International Paper		1480 International Drive	Georgetown	SC	29440	47	843-546-0427
Sonoco		1 North Second Street	Hartsville	SC	29550	48	510-785-0220
Sumter Packaging Corporation		2341 Corporate Way	Sumter	SC	29154	69	803-481-2003
Hood Container	Wilmington Box Company	101 Industrial Drive	Burgaw	NC	28425	79	910-259-1682
Far Packaging Co., Inc.		2800 Air Park Rd.	Fuquay Varina	NC	27526	100	919-552-2422