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MILITARY PACKAGING

What's Needed . . . What's Perplexing . . . What's Being Done

Food for the armed forces must be put up by available machines in convenient packages that provide suitable protection. Cited are major accomplishments of laboratories in meeting container specifications and getting desired materials

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Containers for foods put up for the armed forces must be sturdy enough to withstand rough handling and to safeguard the packaged goods inside under extreme conditions. Here, subsistence supplies are being covered with tarpaulin for protection in an open storage area at Pusan Quartermaster Base Depot in Korea. (U. S. Army photo)

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There are difficulties encountered in the packaging of foods for the armed forces that are, perhaps, not fully realized by the food industry, whose main experience has been in the manufacture and distribution of foods for the civilian domestic market.

To indicate the perspective, therefore, this article is offered for the purpose of showing—

- **Chief properties required in containers to meet supply-line conditions**
- **Representative accomplishments of the container laboratories in fulfilling the requirements, and**
- **Desired, but not yet attainable, materials for solving persistent container problems, such as resistance to temperature extremes and inadequate storage controls in overseas stations**

Food packaging for the armed forces has three prime objectives—(1) utility, (2) manufacturing practicability, and (3) preservation of contents. These may be defined, in turn, as follows:

1—Utility

In its military sense, this involves consideration of the convenience with which the package may be transported and stored, and of the ease with which it may be carried and eventually opened by the fighting man. Consequently, the package must be relatively light in weight, rugged, and compact, yet afford maximum capacity. As for the ease of access to contents, it must permit ready opening with equipment

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TABLE I—CONTAINER REQUIREMENTS Listed in Terms

Type of Foods	Ration, Where Used	Present Packaging	Handling & Storage Hazards to Consider	Qualities Required to Protect Contents
1. Dehydrated Soup Mix Pea & Bean (Purchase Desc. 10 Aug., 1950)	Frigid Trail	Flexible packaging (aluminum foil coated with or laminated to vinyl or heat-sealable coating.) Holds 1½ oz.	Storage at extreme low temperatures which cause embrittlement of plastics, and exposure to rough handling after issuance of complete ration.	Flexibility of materials at extreme low temperatures and ability to withstand rough handling
2. Dehydrated Soup Mix Bouillon (Mil-B-1112A 17 May, 1950)	Individual Survival Packet	Flexible package (acetate laminated to aluminum foil, and coated with odorless and flexible heat-sealing compound on foil side.)	Same as (1). Packet designed for air force personnel in Arctic.	Same as (1).
3. Cream of Tomato Soup, Condensed (JJJ-S-581 28 April, 1931 with Change No. 1 28 Dec., 1950)	Special Item Supplement Pack for Hospital Use	Round cans. Body hot-dip tinplate and enamel-coated ends either of same material or electrolytic tinplate.	Conditions are slightly intensified over those in civilian handling. High humidity creates possible corrosion. Military handling results in impact damage more frequently than commercial practice.	Ability to withstand rough handling and high humidity.
4. Canned Ham Chunks (Mil-H-1021A 16 May, 1950) (Amend. 1 17 Jan., 1951)	5-in-1	30 oz. of product packaged in round cans with body and ends of commercial tinplate. Ends enameled inside. Outside coated with corrosion-resistant lacquer or enamel.	Same as (3)	Same as (3).
5. Frankfurters (Mil-S-3069 26 Oct., 1949) (Amend. 1 2 June, 1950)	5-in-1	Same as (4).	Same as (3).	Same as (3).
6. Meatballs & Spaghetti (Jan-M-682 30 Sept., 1948)	5-in-1	Same as (4).	Same as (3).	Same as (3).
7. Luncheon Meat (Mil-L-1080A 21 June, 1950)	5-in-1	Rectangular key-opening cans. Made of hot-dip tinplate.	Same as (3).	Same as (3).
8. Dehydrated Meat Food Bars (Mil-M-3421 19 Feb., 1951)	Frigid Trail	Flexible packaging (pouch-type bag of aluminum foil laminated to cellophane—this sheet laminated to rubber hydrochloride base.) Bag heat-sealed on 3 sides before filling. After filling, vacuum-sealed on 4th side and seams folded flat against bar.	Same as (1).	Same as (1).
9. Canned Ham & Eggs (Mil-H-1038A 31 Mar., 1950) (Amend. 1 12 Jan., 1951)	5-in-1 Individual Assault Packet	Round can. Inside enameled and sprayed with a shortening material or gelatin solution. Or enameled and lined with special lard-vegetable parchment. Small size (300 x 200) for individual serving.	Same as (3).	Same as (3) plus resistance to additional rough handling can receives when carried by soldier in combat.
10. Solid-Pack Canned Chicken (Mil-C-1058A 13 April, 1950)	Individual In-Flight Combat Packet	Hermetically-sealed open-top round cans. Hot-dip tinplate. Small size (300 x 200) for individual serving. Enamel-coated overall inside, and with soldered size seams and compound-lined, double-seamed ends.	Same as (3).	Same as (3).
11. Solid-Pack Canned Hamburger (Mil-H-1048A 30 June, 1950)	Individual In-Flight Combat Packet	Hermetically-sealed open-top style round can of commercial tinplate—with soldered side seams and compound-lined double-seamed ends. Small size (300 x 200) for individual serving.	Same as (3).	Same as (3).
12. Green Beans (Wax beans also included in B-Ration components) (JJJ-B-151b 3 Nov., 1948)	5-in-1 B-Ration*	Round cans of tinplate with soldered side seams and compound-lined double-seamed ends. Body of hot-dipped tinplate. Ends of electrolytic tinplate coated on inside.	Same as (3).	Same as (3).
13. Dehydrated Onions (Mil-O-3028 8 August 1949) ("Ration, Individual, Trail, Frigid" New military specification now available.)	Frigid Trail	½ oz. packaged in a foil envelope approximately 5 in. long x 3½ in. wide, with a ¾ in. wide heat seal. Made from dead soft aluminum foil coated on one side with odorless and permanently plastic heat-sealing compound that provides moisture-resistant closures.	Same as (1).	Same as (1). Package must prevent onion odors from permeating other rations.
14. Fruit Jam (Z-J-96a 25 April, 1950)	Individual Combat	(a) Seamless 1½ oz. can made of hot-dip tinplate and with inside enamel coated. Lid provided with sealing gasket and closed with annular aluminum band, with tear tab crimped over curled top, band gold-lacquered inside. (b) Seamless 1½ oz. can made of hot-dip tinplate, and with inside enamel coated. Double-seamed, hermetically-sealed style top. Top scored to facilitate puncture-opening. Both cans small size (300 x 200) for individual serving.	Same as (3)	Same as (3).

# of Types of Food and Military Supply Line Conditions

Type of Foods	Ration, Where Used	Present Packaging	Handling & Storage Hazards to Consider	Qualities Required to Protect Contents
15. Canned Apricots (Z-A-631a 20 June, 1941) (Mil-C-1501 Canned Subsistence Items, Packaging & Packing 28 Oct., 1949) (Amend. 1 30 June, 1950)	Individual Combat Individual In-Flight Combat Packet	Round, hermetically-sealed open-top metal can with soldered side seam and compound-lined double-seamed ends. When specified, can shall have slipcover reclosure of electrolytic tinplate with skirt about ¼ in. deep, and with such diameter as to fit snugly over double seam at one end. Small size cans for individual serving.	Same as (3).	Same as (3).
16. Dried Pears (Z-P-206a 2 July, 1946) (QM Pow. No. 1 Dried Fruits Thermoplastic Packaging)	B-Ration*	Packaged in a "two-pound shell" or a "raisin container." (a) 2-lb shell—shall conform to standard commercial shell used for prunes, and may be used either with or without conventional waxed paper or glassine inner bag. If liner used, shell is made of kraft-lined or news-lined chipboard. If liner is not used, shell is made of single manila-lined chipboard. In either case, lined side of chipboard shall constitute inner surface of shell. (b) Raisin container shall be made of single manila-lined chipboard, No. 2 finish. Manila-lined side shall form inner surfaces of container.	Rough military handling and high stacking result in greater-than-usual impact and pressure damage.	Ability to withstand stacking pressures and be resistant to rough handling.
17. Cereal Bar "Cereal, Compressed, Premixed" a. Block (Mil-C-1045A)	Frigid Trail Individual Survival Packet	Tightly wrapped in sheet of dry finish aluminum foil. Closure effected by pressing end folds against ends of bar.	Storage at extremely low temperatures which cause embrittlement of wrapping.	Same as (1).
18. Soluble Tea (Purchase Desc. 16 Aug., 1950)	Frigid Trail Individual In-Flight Combat Packet Individual Survival Packet Special Item Supplement Pack for Aid Station Special Item Supplement Pack for Hospital Use Survival Packet	Envelope of cellulose acetate laminated to aluminum foil with suitable odorless and permanently plastic compound other than wax. Laminated sheet coated on foil side with film of odorless and permanently plastic heat-sealing compound to provide tight, moisture-resistant closures. Contains 1.6 g. Can hermetically-sealed and open-top style with electrolytic tinplate and soldered side seam and compound-lined double-seamed ends. Contains 5 oz.	Storage at extremely low temperatures which cause embrittlement of plastics, and storage at extremely high humidity.	Flexibility of materials at extremely low temperatures and ability to withstand high humidity.
19. Soluble Coffee "Pure" and "Product" (Mil-C-1019B 30 Jan., 1951)	All of the above plus 5-in-1 Individual Combat	(a) Envelope same as (18), but holds 2.5 or 5 g. (b) Can, same as (18), but holds 2 or 4 oz.	(a) Envelope, same as (18). (b) Can, same as (3).	(a) Envelope, same as (18). (b) Can, ability to withstand rough handling and humidity.
20. Sweet Chocolate Bars "Candy & Chocolate Confections" (Mil-C-10928 (QMC) 12 Feb., 1951)	5-in-1 Ration Supplement Sundries Pack Food Packet Individual Assault	Flexible package (cellophane, glassine or greaseproof paper) with continuous seal along seam and end closures. Wrap shall conform to shape of bar.	Danger of fat seepage at high temperature.	Fat-resisting material.
21. Powdered Whole Milk (Mil-M-1495 28 Oct., 1949)	Ration Supplement, Special Item Pack, Hospital B-Rations*	1-lb. open-top, key-opening reclosure style metal can and 5-lb. open-top metal can (key-opening reclosure style if specified). Both size cans to be hermetically sealed with vacuum displaced by inert gas previous to sealing. Soldered side seams and double-seamed compound-lined ends.	Same as (3).	Same as (3).
22. Cocoa Beverage Powder (Mil-C-3031 30 Aug., 1949) (Purchase Desc. "Ration, Individual, Trail, Frigid" New military specification now available.	Frigid Trail Individual Combat	Packaged in 2-oz. compressed discs and 1½ oz. envelope. Disc—wrapped and heat-sealed in cellophane. Wrap shall be siftproof and conform closely to contour of disc. Envelope—Flat duplex type, made of kraft paper coated with plastic film on inside. Top and bottom heat-sealed. Lengthwise seal of plastic film shall be a heat-sealed lap seam, and lengthwise seal of paper shall be lap seam made with good low temperature adhesive. Size 5 in. long x 3½ in. wide inside.	Same as (1).	Same as (1).
23. Lemon Juice Powder (Synthetic) (Mil-L-1066A 14 Oct., 1949) (Amend. 1 29 May, 1950)	Ration Supplement, Spice Pack, Kitchen	Hermetically-sealed open-top style round can of electrolytic tinplate, or with body of electrolytic tinplate and ends of bonderized blackplate. Soldered side seams and compound-lined, double-seamed ends. Bonderized ends must be enamel-coated on inside. Contains 12 oz.	Same as (3).	Same as (3).

* B-Ration items packaged in bulk for mass feeding. Items are described in specifications for individual commodity.

normally at the disposal of the soldier, sailor, or airman.

2—Manufacturing Practicability

This entails such considerations as the availability in quantity of specific packaging materials, their cost and adaptability to fabrication on such machines as are generally available.

3—Preservation of Contents

Most important by far is the preservative function of armed forces' packaging. Attainment of success here is complicated by two factors—the great variety of foods procured by the military and the frequent extremes in rough handling and adverse conditions imposed on packages by the "supply line."

There is no need to dwell here on the quite obvious fact that the unique properties of each food call for individual packaging considerations. However, the rigors of the military supply line are sufficiently unusual to warrant additional explanation.

Briefly, from the moment the package of food comes off the supply line until it is finally opened and used on the firing line, it must be prepared to "take it." It may be exposed to excessive cold and burning heat, tropical humidity, immersion in water, rough handling during repeated loadings and unloadings, jolting in cargo holds and in freight cars, bouncing in the backs of trucks, and rough manual portage.

If these tribulations are not sufficient, there is the ever-present danger of attack by insects and rodents, and, in tropical climates, the ravages of mold contaminations. Vulnerability to pilferage is still another problem.

Table I illustrates, by means of representative foods, the specific conditions that existing packaging must meet. It is, of course, understood that any or all of these presently satisfactory packaging materials might eventually be superseded when, and if, a superior material is developed.

There is also, of course, the possibility of hindering material shortages.

This table is designed to provide an overall picture of the range of armed forces' problems with reference to the specific rations involved. Specification number and date are included for each product. However, since the reader may also wish to consult the specification of the particular ration involved in any given case, a complete ration listing may be obtained from the QM Food & Container Institute.

Packaging Improvements

After reviewing the Table I presentation of the overall packaging program, it will be interesting to consider some special packaging problems that the QM Food & Container Institute has met and at least tentatively solved. These solutions are the best answers to specific problems that are attainable at present. They represent the improvements suggested by intensive laboratory and field tests.

Tables I and II are representative of the great number and variety of packaging problems tentatively solved.

TABLE II—REPRESENTATIVE PROBLEMS Investigated by QM Food & Container Institute and Progress on Their Solutions

Item	Original Packaging Difficulty	Tentative Solution Provided
1. Canned Bread (Mil-B-1070A 7 Dec., 1950)	To manufacture a sterile product under baking limitations. Product must be baked in can with cover loosely attached, and sealed after baking. Contamination must be avoided. Corrosion of inner can walls after prolonged storage noted.	Manufacturing difficulty overcome by adapting handling and baking technics to limitations described. Corrosion problem may be solved through changes in the dough formula and use of an inside enamel or liners.
2. Container for Jam (Z-J-96A 25 April, 1950)	Each of two types of cans currently acceptable is deficient. "Tear-tab" can often fails due to breaking of tab. Sharp instrument needed to open can. One company produces this can at present. "Scored-top" can has a scored line for opening with sharp instrument or folding can-opener. In field, utility of this type opening is unsatisfactory.	Ribbed slip-cover can is now being investigated. Slipcover is held down snugly over a gasket by pull of vacuum inside can. Rib allows a fulcrum for easy opening with coin or sharp instrument.
3. Vacuumized Foil Package for Dehydrated Meat Bar (Mil-M-3421 19 Feb., 1951.)	Originally, problem was to reduce high percentage of leakers (as high as 60–70%) which caused packages to lose vacuum. Present problem concerns adhesives which impart unpleasant flavors and odors.	A change in packaging technic followed by another in packaging that together reduced leakers to about 2 percent. Adhesives problem is under investigation.
4. Packing Glass Containers (Specifications included under commodities packaged in glass.)	Principal problem is breakage due to insufficient protection from packing materials. Currently acceptable methods of packaging that overcome this are not entirely satisfactory because of high cost, excessive bulk or weight. Present methods include all weatherproof boxes (V and W board) construction, domestic containers cushioned with excelsior and overpacked in nailed wood boxes, and nailed wood boxes with excelsior or sawdust between glass containers.	New method of packing has been proposed and is currently undergoing tests. It requires shipping each bottle into a prefabricated cellulose-wadding pocket sleeve ¼ in. thick. Sleeve is folded over top and sealed. Each cushioned bottle is placed in compartment formed by cell spacers. Container and inner packing are of water-resistant material. Pack gives promise of providing adequate protection without undue bulk and weight.
5. Packaged Fresh Bread (Experimental)	To accomplish manufacture of packaged bread that will remain fresh for 6 mo. without mold development.	Encouraging results with saran wrappers. Investigating use of regenerated cellulose, coated to reduce moisture-vapor transmission.

TABLE III—PACKAGING and Packing Problems Requiring Attention

Problem	Chief Present Deficiency	Desired Solution
Package for powdered vinegar.	No package yet developed.	Package other than glass that will withstand corrosive action of contents (a very damp powder containing glacial acetic acid).
Packaging for molasses and chocolate syrup.	Lack of information for optimum packaging of dense products of this nature.	Development of new packaging materials or processes through stimulated interest among food processors.
Packaging for shredded wheat.	Commercial package not adapted to overseas use (contents vulnerable to oxidation).	Material needed to prevent rancidity. Possibly a "breather" type of material that will permit escape of gases and prevent entry of external fumes or deleterious odors and oxygen.
Siftproof carton or bag.	No adequate test method or standards available.	An adequate test method and standards for defining siftproofness.
Flexible containers for processed foods.	No adequate substitutes for metals, which may be in short supply in event of emergency.	Need for metal substitute that will withstand processing temperature and handling to same degree required of metal.
Information on sizes, packing materials, and products.	No precise information on limitations for packaging equipment.	Necessary surveys to furnish information on what can and cannot be accomplished with available machines.
Shelf life of packaged foods under military storage.	No correlation between accelerated and actual storage conditions.	Coordination of all data on long term storage under adverse conditions, particularly on extreme temperatures and humidities in respect to what actually happens during storage and shipment—*i.e.*, temperature and humidity fluctuations (day to night, daily variations, seasonal variations, during transportation from one geographic location to another, and air transport).

In some cases, a sizable gap remains between the ideal package and what is now practical. But the two have at least been brought together sufficiently to afford a working solution.

In a number of other instances, however, further work is indicated before the ideal is satisfactorily approximated. Results to date have been encouraging, but not conclusive. The search is still going on for readily available materials that furnish good protection, present no unusual difficulties of manufacture, and can withstand the abuse that is so often an unavoidable characteristic of the military supply line.

Table III lists a number of current packaging and packing problems, the chief deficiency in each case, and the result desired.

Future Problems

Packaging and packing problems of the future are known in their general outlines on the basis of past military experience. However, it must be admitted that specific difficulties that may arise in future modes of warfare are unknown, and will have to be met and solved as they arise.

One of the most spectacular difficulties may well be how to package against radioactive contamination. Such a problem will involve basic research which, at present, has scarcely been initiated.

Despite such unpleasant prospects as are raised by the need for maintaining subsistence in good condition in areas contaminated by radioactivity, or even chemical or bacteriological agents, there is also a happier side. It can be said that, relative to ordinary circumstances, today's packaging and packing for the armed forces is, for the most part, reasonably close to being adequate.

As in the past, the challenge of better packaging for new military conditions will be met through cooperative effort between the QM Food & Container Institute, private institutions, and industry.

It is hoped that this article, by setting forth the general considerations pertinent to food packaging for the armed forces, and by defining some specific difficulties, will assist those interested in working with the Institute toward development of new and improved packaging that will meet the exacting requirements of the military.