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Military Subsistence Requirements Reflect Circumstances of Use[a]

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Five thousand miles is an incredible distance to travel on horseback—particularly during the rigors of a Russian winter. Yet, some 700 years ago, the tough, seasoned troops of Genghis Khan rode through summer heat and winter blizzards—from the Yellow Sea to Kiev—to the gates of Europe. This primitive army, as it plundered and pillaged its way westward, "lived off the land" in the most absolute meaning of that expression. Sometimes, however, crop failures or a "scorched earth policy" on the part of the defenders rendered the land bare. The Mongol warrior, confronted by what we have come to call a "survival situation," solved his problem by direct action. He killed his horse and drank its blood—through a straw which he carried for just such an emergency. A crude expedient, certainly, but one which reveals the fact that the feeding problems of armed forces—even the problem of survival when normal supply sources fail—are not new.

Today, survival feeding as well as other military feeding problems are not so easy to solve as were those of 700 years ago. Technological advances have revolutionized modern life, and accompanying social, economic, and cultural changes have given us attitudes much different from those of an earlier time.

Thus, today, we Americans, it must be admitted, are a comfort-loving people. We have become—as compared to yesterday—sophisticated in our attitude toward food. As a consequence, it is difficult to imagine an American Army living off the forage and booty of a conquered land. It is virtually impossible to picture an American soldier downing the blood of a horse, regardless of circumstances. It is true, of course, that the American serviceman in a surprisingly short time learns to endure many hardships that are second nature to those inured to war from birth—attack by the enemy, heat, cold, lack of sleep. But through it all he likes to be assured that there is available to him good food and plenty of it. He is willing to live for a time on Spartan fare, but not for long. Food habits and preferences built up in civilian life are too strong for him as was demonstrated in World War II *(4)*. It is not the policy[c] of the Armed Forces to ignore these preferences and habits. In fact, much time and effort has been expended to find out precisely what they are and to take steps to reflect them in the menus.

The over-all problem. Technological advances, as mentioned, have increasingly complicated life—and perhaps nowhere more than in the feeding of modern armies. To paraphrase General Sherman's famous remark, "modern war is hell on wheels." With units as large as divisions and army corps moving with great speed, the business of keeping huge bodies of troops supplied with the proper rations is no longer the fairly simple matter it was during the Civil War, nor even during the trench-warfare days of 1917 and 1918.

THE BASIC REQUIREMENTS

It should be evident to everyone that since our overseas forces cannot and do not live off occupied territory in any real sense—as a matter of fact, it is usually just the other way around—they must be provided with packaged subsistence from this country. Furthermore, due to stringent military requirements, the food provided must be easy to issue, must withstand rough handling, and remain stable under the long storage normal to military supply channels. Add to these requirements the fact that nutritional values and acceptability must be retained during this period, and you have the elements of the problem. The hard fact is that very few civilian food items and very little civilian packaging are precisely adapted to meeting such requirements and therefore must be modified—in some instances extensively modified. This sometimes frustrating job of adapting existing foods and containers to Armed Forces use, of suggesting new methods of processing, and of designing new items for specific situations in the field is the function of the Quartermaster Food and Container Institute. The end results of the Institute's work, insofar as they apply to food, are embodied in the specifications for the various operational rations and their components. Many of you have had first-hand experience with our specifications and have had an opportunity to comment on their efficacy. On occasion you may have doubted the need for the stringency of their requirements.

In developing rations, however, the Institute must keep in mind the military "facts of life" just outlined. Based on these, five guideposts have been established which point to the desired goal—military effectiveness. They are: (a) utility throughout transportation, handling, storage, issue, and consumption in varied operating situations; (b) nutritional adequacy even after prolonged and sometimes extremely adverse storage; (c) stability, particularly of items of critical concern because of certain vulnerabilities inherent in their constituents; (d) acceptability, with special reference to processed foods which tend to lose their appeal for the serviceman since their flavor and texture are not that of the fresh products; and (e) manufacturing feasibility.

To make clear what is involved in each of these basic objectives, a brief amplification of their meaning in terms of military situations is in order. Functional design, or the *utility* feature of rations (Figure 1, A), includes considerations both as to the food components and the packaging and packing of the ration. Foods, it will be noted, must be capable of easy and rapid preparation in the field and be usable in both routine and unexpected operational situations. For many operational situations con-

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[c] It should be made clear that this and other references to policy are not to be taken as official statements of the Department of Defense. Any final statement of policy would have to include such considerations as the fact that operational situations vary. In some instances, where it is necessary to train troops for the rigorous conditions of combat, it is equally necessary to accustom the trainees to the use of rations whose components are not in a form familiar to them in garrison or civilian life.

nected with combat-patrol duty, for example, they should be edible either hot or cold. Since heating facilities at or near the line of resistance are rarely if ever permitted due to the danger of exposing a position to the enemy, edibility in the cold state is a basic requirement. Hamburgers with Gravy, for example, a favored C-ration item, is excellent when heated, but not so acceptable when it is necessary to eat it in the cold state, largely because of the rather high fat content of the gravy. This example emphasizes a definitely limiting factor in developing products for individual combat use; namely, the somewhat narrow range of selection we have when it comes to products that can be eaten in the cold state. Not many have the taste or appeal that they have when heated.

Containers also must be easy to handle, store, and issue. In the case of individual ration containers, they should be of a size and shape to make for easy and safe carrying on the person. Obviously, they should be easy to open. Other utility factors that must be considered include those of space and weight. There is never an excess of shipping or storage space in military operations. Odd sized containers are particularly unpopular since they waste space and are difficult to stack.

The ultimate object of all rations is, of course, to provide the fighting man with the best attainable nutrition *(3)*. Foods must be sufficiently rich in nutrients to sustain him during heavy and prolonged activity, be relatively easy to digest—owing to conditions of military life that may sometimes be disturbing to bodily processes—and should contribute essential nutrients in the proportions optimum for health. Difficulties in the way of achieving these objectives are shown in Figure 1, B. They include the ever-present limitations of space and weight—a problem, important in the design of almost all rations but a particularly mean one to solve in the case of the survival ration, where considerable food value must be concentrated in a small package. The highly limited stowage space normally available on planes and lifeboats, the impossibility of predicting the number of days the ration will be needed, and the fact that water is likely to be in limited supply (even in lands of snow and ice) makes the design of a survival ration that will fulfill many purposes a problem of algebraic complexity. There are still many unknowns.

In Figure 1, B, under the heading—"Best Attainable Acceptability to Assure Adequate Intake," some of our acceptability problems may be visualized. Foods must not only *be good* for the serviceman, but must *taste good* to his critical palate, and *look good* to his critical eye. For only if the ration is consumed will its nutritional value be realized. This whole problem is one that has many ramifications—most of which lead sooner or later into the requirements written into specifications. Among factors of concern are color, odor, texture, and flavor. Can these be defined for use in specifications? We are trying to do so.

Whether or not ration foods are of the type and variety preferred by most Americans of military age is yet another aspect of the problem. *Acceptability*, that is, the palatability of rations, is of paramount importance in military situations where the basic foods are processed foods. Another problem is the preparation and cooking techniques used. Two of the greatest enemies of good acceptability are the deterioration to which rations are subject through faulty handling procedures and faulty cooking by kitchen personnel. Rations such as the "A" and "B," designed for large-group feeding, are the chief victims. Anyone who has served in the Armed Forces is well aware that the messes of certain units enjoy a reputation for the quality of their food; this can only be attributed to the ingenuity and skill of their cooks. It is advisable, of course, that all messes should have a reputation for good food. To achieve this, rations that are nearly proof against unskilled cookery as it is possible to make them must be provided. One successful step in this direction is the precooked frozen meal, now in limited use by the Air Force *(1)*. Another is the increasing use of prepared mixes by the Navy and Air Force. As an interesting aside on prepared mixes, I might mention that the limiting factor insofar as the Army is concerned is in getting prepared mixes into use "up forward." The fact is that field range ovens are not and probably cannot be designed with temperature regulators. Hence, owing to the necessity for oven control the prepared mixes have not yet gotten very close to the front lines.

DESIRED CHARACTERISTICS OF RATIONS AND COMPONENTS

A. OBJECTIVES AS TO FUNCTIONAL DESIGN

Foods	*Containers*
Ease and rapidity of preparation	Readiness of issue
Edibility—either hot or cold	Ease of handling and storing
Versatility of use in field	Ease of carrying on person (individual rations)

SOME OBSTACLES TO OVERCOME

Limitations of space and weight imposed by shortage of shipping and/or storage facilities
Limitations due to food characteristics and manufacturing facilities

B. NUTRITION AND ACCEPTABILITY

Adequate Nutritive and Caloric Properties	*Best Attainable Acceptability To Assure Adequate Intake*
Sufficient amounts of vitamins and other nutrilites	Optimum color, odor, texture, flavor
Best attainment of body reserves	Adaptation of rations to food preferences of Americans of military age
Attainment of best composition of rations to optimum metabolism	Sufficient variety to prevent monotony of diet and resulting waste

SOME OBSTACLES TO OVERCOME

Difficulty of reconciling opposing needs, e. g. adequate nutritive properties and limited size of food packet as in survival feeding	Limited stability of nutrilites
Limitations of space and weight	Adversities of military supply lines and storage, resulting in food deterioration
	Inadequate and faulty preparation for consumption

C. STABILITY

Prolonged Shelf Life: Extended Stability

Foods	*Containers*
Canned, dehydrated, frozen, cured, and otherwise processed foods that retain their acceptability and nutritive properties through extended storage	Adequate packaging and packing design to protect against handling and storing hazards
	Barrier materials resistant to damage by heat, air moisture, flavor transfer and other spoilage factors

SOME OBSTACLES TO OVERCOME

Natural instability of foods and food constituents under processing and storage conditions	Extreme climatic conditions encountered in supplying and storing rations for use in remote areas of the world
	Handling hazards of military supply lines

Figure 1. Primary problems of food and container research and development with respect to: A, design; B, nutrition and acceptability; C, shelf life.

Prolonged shelf life or *stability* (Figure 1, C), another of the characteristics desired in rations and ration components, presents two formidable obstacles to the Armed Forces ration planners; namely, the long periods of storage at supply points or in stockpiles and the extreme temperatures that prevail there. The storage may be of a "formal" type—as shown in Figure 2, or it may be "informal" storage under a tarpaulin or completely out in the open and exposed to the elements as is pictured in Figure 3. In extreme cases length of storage may be for as long

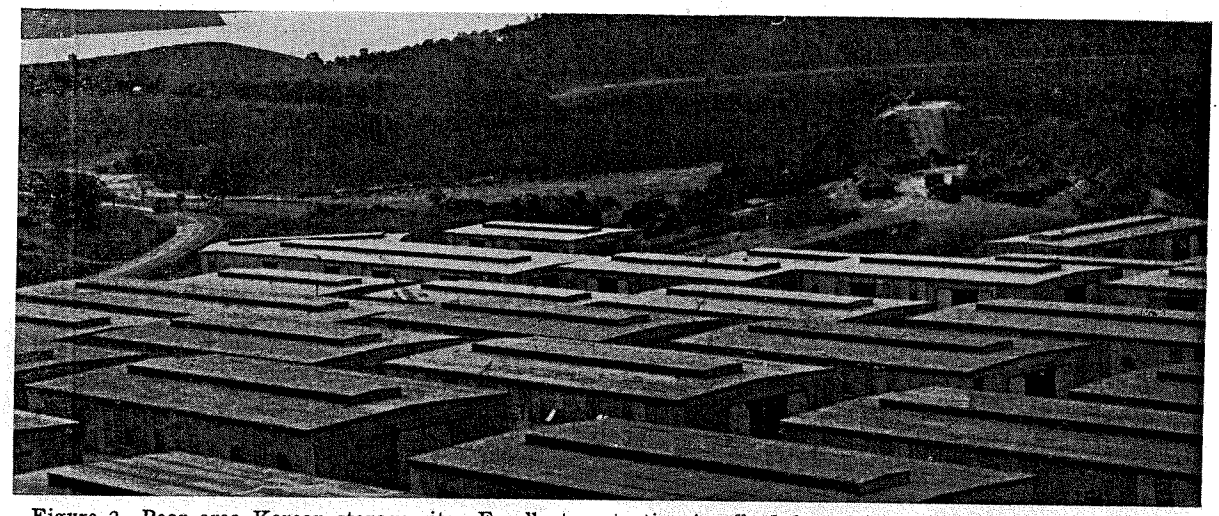

Figure 2. Rear area Korean storage site. Excellent protection is afforded supplies in storages such as these.

as two years. In addition, a given ration might have to withstand cold as low as —80° F. and hot temperatures up to 160° F. as well as great variations in humidity. In some cases, rations may have to endure both these temperature extremes before reaching destination, as when a shipload of subsistence items originally destined for an arctic region may—in an emergency—have to be re-routed to the tropics. In the tropics, always hot and often humid, too, the natural or climatic heat may be greatly increased by radiation—on the decks of ships, for example, during transit. Supplies stored under tarpaulins are also subject to elevated temperatures. This intensified heat is hard on keeping quality.

Canned foods are perhaps the least affected by these hazards and are used extensively in overseas rations. Much of the keeping quality of a ration, of course, depends upon the effectiveness of the packaging and packing used in protecting the contents against handling and storage hazards *(2)*. Items packaged in containers other than metal or glass have been given much attention by Institute personnel. Damage from heat, air, moisture, microorganisms, and the transfer of flavors or odors is more likely to be sustained in foods so packaged, but the advantage of lighter materials is such that work to effect adequate packaging if this type is distinctly needed. One dream of the future is a plastic package that will withstand processing temperatures.

Manufacturing considerations. The final "fact of life" that must be considered in developing suitable operational rations is largely a civilian responsibility—namely, determining the feasibility of manufacturing a new or improved item rapidly and in volume. This can be a real problem. A newly developed item may have all the desirable qualities mentioned previously, but a scarcity of one of its ingredients, a new mode of processing that may be required, even a new shape may nullify the prime military requirement—that the product be available for use rapidly and in huge volume. Our careful study of the feasibility of manufacturing canned bread, an ideal product for military use, could be used as Exhibit A in this regard.

MILITARY REQUIREMENTS IN TERMS OF RATION TYPES

To recapitulate our requirements in terms of the various principal types of Armed Forces rations, we might begin with Ration Operational, B which is shown in use in Figure 4. Three key characteristics of the B-ration are: (a) the utmost concentration of nutritional value in the most stable and palatable form attainable; (b) the greatest possible reduction of labor in preparation and cooking—a good example of success in this regard is 4-way boneless beef; (c) the greatest possible manufacturing potential in terms of available raw materials, existing food and packaging plant facilities, and, of course, cost. All three characteristics are exemplified in dehydrated products; and it is here, of course, that the ultimate in space and weight saving is effected. The Institute has an extensive program under way on dehydrated foods—a program in which many groups from

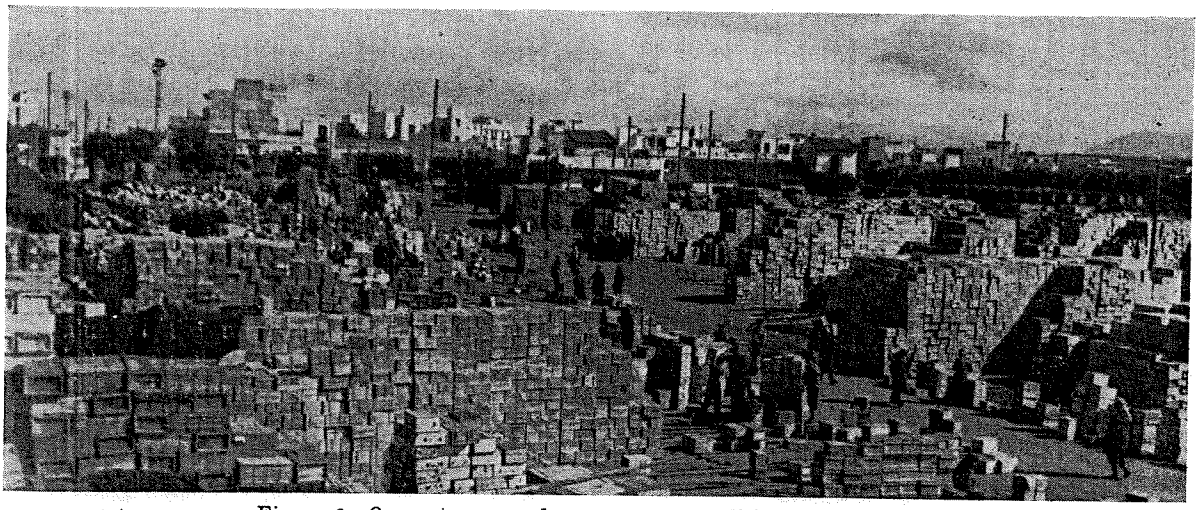

Figure 3. Open storage under emergency conditions—Italy, 1944.

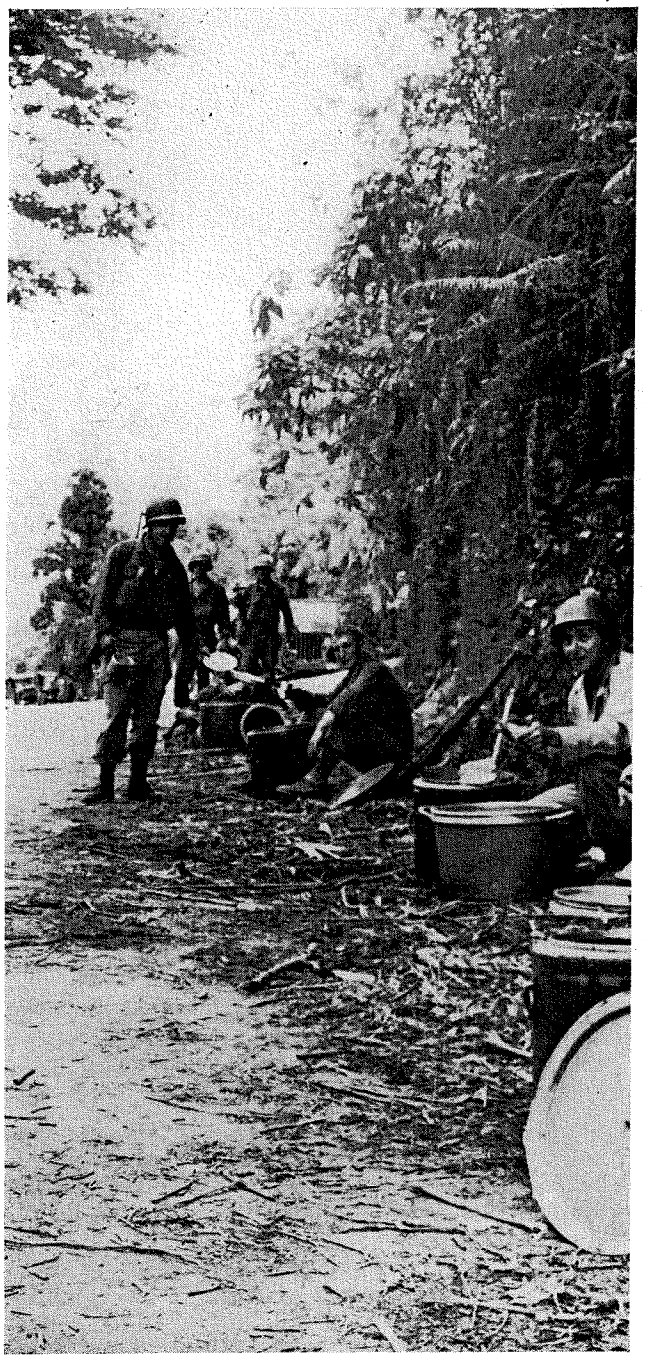

Figure 4. In front areas the B-ration, served hot, approaches stateside meal standards.

Government and industrial laboratories cooperate. Dehydrated products are used, it should be stated, for other rations than the "B."

For a small group (Figure 5) a typical ration is Ration, Small Detachment, Five-in-One. There are 4 important requirements for rations used by small groups: (a) the greatest possible efficiency of issue, particularly, the optimum arrangement and number of components to assure proper distribution at the time the meals are to be eaten; (b) prolonged shelf life and, particularly, freedom from flavor or odor transfer within the carton; (c) sufficient variety of menu to prevent monotony; (d) high retention of essential nutrients to assure health while subsisting on packaged rations. Past

Figure 5. Rations for small detachments must contain "much in little." The Five-in-One, food for five men for one day, can be used by radar, weather station, patrol and numerous other groups on detached assignments.

experience has shown this last item to be a very important consideration.

For individual rations, the basic requirements are very similar to the ones just described for the Five-in-One, the most important difference, perhaps, being the fact that the basic needs change somewhat from situation to situation. Probably the most conspicuous example of a ration constructed to meet a single purpose is to be found in Ration, Individual, Trail, Frigid. A characteristic of vital importance in this ration is density of calories within a relatively small package. It is also necessary that it have immediate taste appeal. Also required is a ration that can be readily eaten despite the encumbrances of arctic gear (see Figure 6). Of perhaps even prior importance, is the necessity for a food so low in moisture content that when eaten cold, subzero temperatures cannot solidify the product into a rock-like texture and render it inedible.

Having taken note of the characteristics required of the 3 broad types of rations, the A and B, the Five-in-One, the Trail ration, it would perhaps be in order at this point to examine—more closely than has heretofore been possible—a ration, or rather food packet, designed for a highly specific purpose. A packet that meets this description is the Food Packet, Individual, Assault, also known as the Assault Packet, which consists of pre-

Figure 6. Hot gruel for cold soldiers is possible from the resources of Ration, Trail, Frigid.

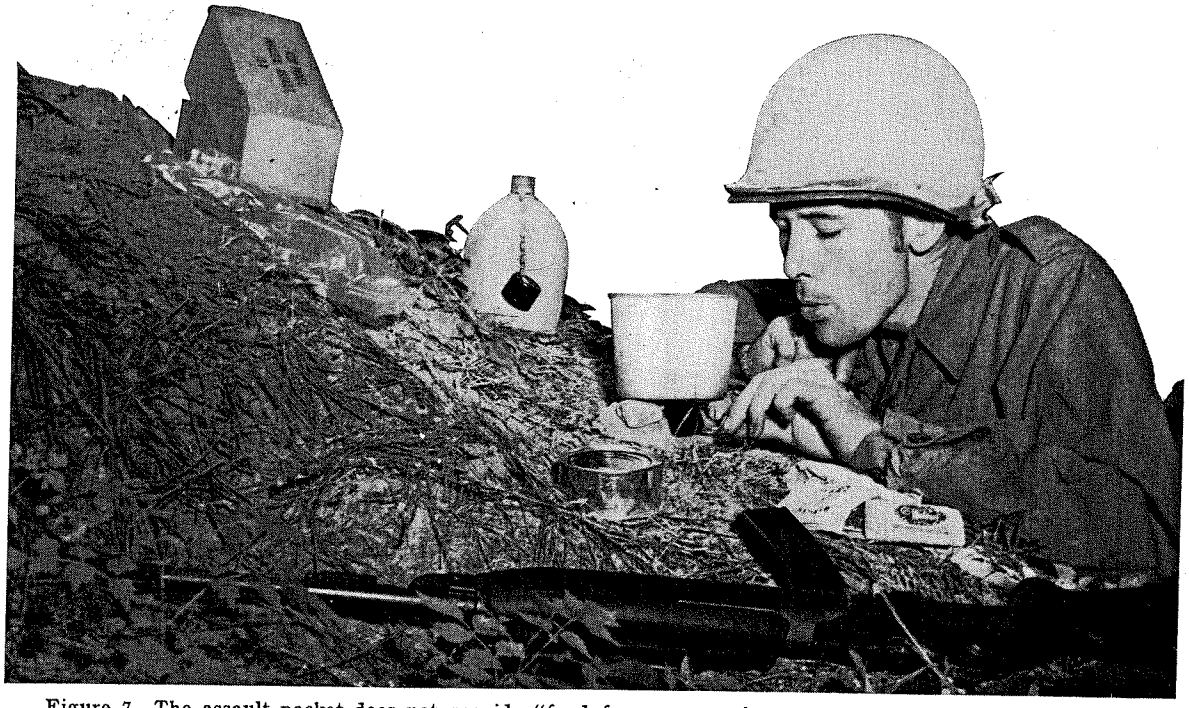

Figure 7. The assault packet does not provide "food for one man for one day"—the official definition of a ration—but for an initial period of combat action less than thirty hours in duration, the Food Packet, Individual, Assault, serves its purpose admirably.

cooked, ready-to-eat foods so packaged as to allow easy carrying during the early stages of an assault operation or beachhead landing. At such times, even if regular rations were available (which is often not the case) it would not be desirable to issue them. For one reason, the soldier or marine is keyed up prior to such an operation and has little desire for food. For another, he simply will not allow himself to be weighed down with bulky cans of food; not only will they slow him up, they can actually cause injury when he "hits the ground" under fire. Furthermore, ammunition always comes first with the man in combat. In a choice between an extra grenade and a can of food, the can of food is likely to lose. Still, since his regular rations may not catch up with him for a day or more, a man in combat must be given something to sustain him. The Assault Packet, pictured in use in Figure 7, contains canned meat of one of 8 varieties, candy, soluble coffee, cigarettes, gum, matches, water purification tablets, and toilet paper. It seems to be a good answer to the feeding problem in situations such as that shown (Figure 7). The packet, approximately one-and-one-half pounds in weight, is of a size and shape that fits readily into a pocket. This packet is an excellent example of what can be accomplished when precise field-use requirements are established for a ration and the research and development efforts are keyed to meet these requirements.

CONCLUSION

Thus far discussion has been confined to the characteristics of rations in terms of current concepts. However, there is always the urge in military planning to attempt to pierce the veil of the future. The subsistence situation in Korea, for example, is in general good. It is true that there are a few factors—the difficulty of adjusting the Five-in-One Ration to *all* small detachment situations, for example—which have presented problems, but on the whole the situation is in hand. In other words, if our problems in the future could be relied upon to be those of Korea or similar areas that sometimes ominous term "the future" would cause no great anxiety. But who knows what the future holds? A dramatic turn in world events could well involve feeding situations different from those of Korea. It is for this reason that we need to have a flexible ration program and scientific, military, and industrial personnel alert to new problems and experienced in the techniques used in solving the older problems. In other words, and to make this last thought more concrete, if world events should inspire military action in a theater remote in space and character from Korea, the requirements for a small group type of ration might well be again a key problem.

In closing let me stress the significance of the role industry is playing in the Armed Forces research and development program on foods and containers. While it is true that the Food and Container Institute is, in the very nature of things, the center of this work—in fact, it is the *only* organization in the Department of Defense with a clear-cut obligation to design foods for changing military tactics and supply line requirements, we have never lost sight of the teamwork that must exist and continue to exist, both within the Department of Defense and outside, if future emergencies are to be met. Actually, industry, in opening the doors to its laboratories and its plants enables us to reconcile the exacting requirements of foods for military use with the realities — or let us say the necessities — of modern volume production. Many concrete results, that is to say, end items, have come from the cooperation that

has long prevailed between industry and the Institute. Four-way Boneless Beef, Prefabricated Poultry, Canned Bread, and numerous dehydrated products are but a few of the items on the long list. In the future as in the past industry's assistance will prove invaluable when new and even spectacular techniques of processing are introduced. Processing by means of irradiation may bring us new and better meat items and improved dehydrated fruits and vegetables. Dehydrated whole milk comparable to fresh whole milk, prepared cake mixes of high stability, a thermo-stable margarine—these are some random examples of problems that are moving toward solution with the aid of industry.

When it is considered that in World War I the cost of Quartermaster subsistence purchases amounted to $727,000,000, whereas in World War II it came to the astronomical total of $11,048,032,000, it can be appreciated that the Armed Forces and industry are joined together in a cooperative enterprise that is worthy of the best efforts and talents of its food and container research and development personnel.

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