Quartermaster Association Convention
October 1958

FOOD DEVELOPMENT MAINTAINS PACE WITH CHANGING COMBAT CONCEPTS

Dr. F. P. Mehrlich
Scientific Director
Quartermaster Food & Container Institute
for the Armed Forces
Quartermaster Research & Engineering Command

Having become Scientific Director of the Quartermaster Food and Container Institute for the Armed Forces since your last national convention, I am a newcomer to many of you. I hope during this meeting, and certainly before your next meeting, I will have an opportunity to get to know most of you personally and that we who have a common interest in the Quartermaster Corps and the Armed Forces will have even more in common -- a common, yet greater, pride in having helped resolve the problems of the Military. It is a pleasure for me to talk to you, the members of the Quartermaster Association, who share our burden in this effort.

The feeling of pride in accomplishment is justified only when the pride is based on solid accomplishment. At the Food and Container Institute, we feel we have achieved much in the past year.

Simply stated, our task is to develop operational foods for the Armed Forces. The past year reflects significant basic contributions to the operational effectiveness of the Air Force and the Navy, as well as the Army. Further, satisfying the unique subsistence requirements of the Military is a definite challenge.

With so much to say and seemingly not nearly enough time in which to say it, I feel my first statement should begin, "In summary" for I will try to summarize the Institute program as briefly, yet as completely as possible. Knowing you are the people who can help us achieve our technical and logistical goals, it is

important to us that you know our program.

"Foods suitable for military use must satisfy certain exacting requirements. They must be palatable enough to assure that they will be eaten. They must be chemically, physically, and microbiologically stable enough to resist deterioration when stored under adverse conditions for extended periods. They must be nutritious enough to protect against dietary deficiencies. And, finally, they must have utility and adaptability features that ease the logistics burden. Foods for the Military must strike a balance between the best tasting and most nutritious on the one side and the most easily used, least space- and labor-consuming on the other -- a difficult balance to achieve. The fighting man must be provided not only with what he wants but also with what he needs."

Military performance under stress depends largely on the food -- or fuel -- the fighting man receives. Data is being gathered on which to base the amounts of food and water required daily to maintain fighting effectiveness. As part of the same study, determinations are being made of the rate of deterioration in performance capacity as body reserves are depleted. Preliminary studies of the effect of chronic water restriction showed that a daily water intake of four pints will sustain performance indefinitely. These are the things we must know.

Without overlooking the very substantial contribution Industry has made to our program, I think the Armed Forces have pioneered in six areas; namely, 1) the design of sensory testing methods for obtaining valid food preference data -- 2) increasing the stability of processed foods -- 3) the attainment of nutritional adequacy of packaged foods -- 4) methods of dehydration -- 5) the design of protective food packaging -- and, 6) radiation preservation of food. Understandably, several of these areas are of prime concern to the Military. Though not all new areas, these are still the areas with which we are mainly concerned.

Food preference and food acceptance are vital phases of food research. The reasons for our concern are many. The cost of food for the Armed Forces approaches a billion dollar a year. Preventing waste by discard or rejection of even a small percentage of this food can mean very substantial savings. Data gathered relating food preference to rejection rates identifies the foods of low appeal, and by limiting quantities of these foods, much food waste is prevented. More important than preventing the waste of food is the effect of poor food on a man's fighting efficiency and morale. However good a food may be nutritionally, it can do a man no good if he does not eat it.

The compatibility of foods has been the subject of another study. It has been found that the preference for combinations of foods cannot be predicted by attitudes toward single foods. A man's preference rating for beans is not an indication of how he may rate chili and beans. As preference, although a major determinant of acceptance, is not the only controlling factor in food behavior, studies are continuing to establish and correlate other criteria. Acceptance and preference ratings are sensory reactions, and being subjective evaluations, are difficult to assess. Nevertheless, they provide guidelines we need and must heed.

Stability is another problem of vital concern to the Military. Supplying military forces capable of policing the peace, or, if necessary retaliating against an aggressor, has created a need for ration storage virtually everywhere at any time. Everywhere covers a wide range of extreme climatic conditions; any time can be a long time. Knowing the useful life expectancy of a ration requires extensive storage study and an awareness of the multiple handling and transport as well as storage abuses that may be encountered. At the Institute we are concerned with the chemical and enzymatic changes occurring in food before, during, and after

processing that bear on its stability in storage. Storage stability studies have revealed that packaged rations have a safe storage life of five years in cold storage, two to three years in temperate storage, and one year under tropical conditions. Methods of accelerating food spoilage, designed to permit accurate stability predictions, are under study. A means of determining product stability without time-consuming stability studies will expedite the food development process and permit estimates of the storage life of rations at the time of procurement. A test has been devised to measure the effects of oxidation on dehydrated foods. Similar tests for other products are in the offing. Foods requiring a minimum of protection are a must. Packaging to provide the required protection is as important as the food itself.

If I may, I'd like to mention a few of the many nutritional problems that have excited our interest. Based on pathological findings in Korea, rations now in use are being re-evaluated to determine whether their constituents produce harmful effects. The high incidence of fatty deposits in the blood vessels of soldiers killed in Korea has cast a suspect eye on saturated fats. Research indicates a relationship between saturated fats consumed and atherosclerosis. As saturated fats are more resistant to rancidity and contribute to the prolonged storage requirements of military rations, they have been widely used. Research is under way to identify causative dietary imbalances and gain the understanding required to formulate rations that will not contribute to degeneration of the health and fitness of military personnel.

Vitamin studies are another continuing concern. The loss of vitamins in the processing of dehydrated and irradiated foods has increased our emphasis on vitamin carriers that will assure an adequate vitamin supply for military personnel. Vitamin carriers must possess three features: acceptability, utility, and

stability. Studies to correct existing vitamin deficiencies and diversify vitamin supply are progressing. Vitamin deficiencies not actually apparent could cause loss of mental alertness and impairment of judgment.

The Institute deals with food and container problems revealed by actual military operations, studies them, and furnishes research-founded solutions to the best of its abilities and resources. Let me cite such a problem for each of our military arms and the approach taken.

The problems of the ground forces are many. Tactical concepts formulated by military planners since World War II call for relatively small, highly mobile combat units with tremendous fire power. Attack teams will use hit-and-run tactics; that is, move in fast, strike hard, and move on. Logistical facets of the subsistence problem -- stress on minimal weight and bulk, maximal durability and utility -- have assumed even greater importance. Considerable progress has been made toward the development of a simplified feeding system compatible with the newer concepts. The feeding system consists of quick-serve meals based largely on precooked dehydrated foods. The fully cooked components, stabilized against deterioration by atmospheric or freeze dehydration, can be prepared for serving in a matter of minutes -- approximately twenty minutes -- by men trained for combat duty -- not food service personnel. By just adding hot water, such tasty entrees as chili, ground beef and spaghetti, chicken and rice, and beef and noodles can be prepared. Disposable accessories such as trays and eating utensils are packaged with the foods in quantities for 6- and 25-man groups. Emphasis on these quick-serve meals has brought about the development of a variety of precooked dehydrated fruits and vegetables, including a precooked dehydrated white potato dice for use in combination dishes.

Have we accomplished our logistical objectives? Yes, to a considerable degree

we have. The dehydrated foods are lighter -- a weight reduction of about 40 percent -- and they require less space. In addition, they eliminate the need for heavy, bulky field kitchen equipment, plus releasing personnel previously needed for food service for operational missions. Again, this is a project in progress. While we are pleased with the progress, we cannot be satisfied until our objective -- providing the fighting man with the ultimate in foods -- has been achieved. Packaging of precooked dehydrated foods presents something of a problem. Experimentally, they are now being packaged under vacuum in hermetically sealed flexible containers made of laminated materials with low moisture-vapor transmission rates. With ever-increasing pressure to attain the ultimate in space-weight savings, in protection against the hazards of the military environment, and in utilitarian features, the direction that food packaging is taking is toward packaging in films and other flexible materials.

Renewed emphasis has been placed on experimental 25-man uncooked dehydrated meals. Bridging the gap between the present and future feeding systems is an individual meal-type ration with canned components designed so that meals can be issued singly or for a full day.

Turning to the Air Force, the development of highly acceptable, nutritionally adequate, utilitarian foods for in-flight feeding is progressing. As you are aware, high performance aircraft -- that is, supersonic, ultra-high-altitude aircraft -- have flight durations beyond a man's ability to do without food without loss of efficiency. Though he must eat, the man flying the aircraft clad in a full pressure suit cannot remove his helmet face-piece and put food into his mouth nor can he have his attention or hands diverted from his task -- flying. Semi-solid chicken, ham, and beef packaged in toothpaste-like tubes with long snouts that can be inserted into the mouth through an aperture in the face-piece

may provide the answer. Preliminary studies in test chambers under simulated flight conditions have been encouraging. Other foods being considered for in-flight tube-pack feeding include juices, milk drinks, applesauce, and cheese mixtures. The problem is not nearly so great in large, pressurized aircraft, as precooked frozen meals or box lunches can be used. While flight feeding problems are not solved; as a result of joint Aero-Medical Laboratory -- Institute efforts we can say the in-flight food development effort is "off the ground."

A parallel exists between the Air Force problem and the Navy's most challenging subsistence problem -- both are concerned with the need to re-fuel the man, and in each case the problem arises because the operational range of the vehicle before refueling exceeds the range of the man. The Navy's difficulty is lack of storage space aboard small surface craft; more so in submarines. The almost indefinite operational range of nuclear-powered submarines has heightened the problem. Concurrent with the need for more food for longer missions is the need for more space for more everything. The Navy needs ration-dense foods so that more food can be stored in the same or less space. Technically, these foods must be nutritionally adequate, stable, easily prepared, and highly acceptable. A tough problem, but some answers have been found.

Aboard the NAUTILUS when she first ventured under the Arctic ice last fall were a variety of ration-dense items -- Institute-developed items including dehydrated beef steaks, pork chops, chili and beans, compressed flour, and sterile-packed cheese spreads. This problem has not been solved. Current efforts of the Navy Supply Research and Development Facility and the Institute may provide the answers. It can be said, however, that our "heads are above water" in the quest for foods that will be useful both below and above water.

The project exciting the most interest is radiation preservation of food.

The objective is to extend the storage life of a food while keeping its quality comparable with the fresh food, avoiding the loss of nutritive value or changes in color, odor, flavor, or texture, or the production of toxicity of any kind. As you are probably aware, troop acceptance testing of irradiated foods has been under way at the Field Evaluation Agency since spring. The tests are designed to determine the reactions of soldiers to the taste, texture, and other sensory characteristics of irradiated meats, fruits and vegetables. Preliminary results are encouraging. Much has been accomplished; more remains to be done. The outlook for radiation preservation of foods remains reasonably promising.

It is possible by varying the dose of radiation to produce four phenomena of usefulness in expanding the food distribution system. First, with very low levels of radiation, the order of 7,500 r.a.d., one can inhibit sprouting in vegetables in which this is undesirable. Second, at doses on the order of 25 - 50,000 r.a.d., it is possible to achieve insect disinfestation. Third, at levels of radiation on the order of 500,000 r.a.d., excellent pasteurization can be obtained and finally at doses of millions of r.a.d., sterilization is possible.

The use of radiation for pasteurizing foods offers great promise since shelf life can be extended several fold. The immediate application of this technique to food processing offers relatively few problems since the doses required are below those at which flavor, texture, and color changes occur. It is difficult to see how a process that will extend shelf life in the refrigerator by so much as a factor of 5 can long go unemployed. For the Military, irradiation of foods may provide a way of giving the man at the action end of the supply line fresh-like, highly acceptable foods without burdening the supply line with refrigeration equipment. Promising foods include pork, bacon, chicken, shrimp, tuna, flour, and potatoes. In addition to providing a means of better retention of the

desirable characteristics of fresh foods, the successful development of radiation preservation may provide a partial solution to certain logistical problems. Packaging in flexible film containers fabricated from non-critical materials that are cheaper, lighter in weight, and less bulky is an approach promising logistical advantages. A wide-scale program on irradiated subsistence packaging in progress is devoted to both flexible and rigid packaging materials, including not only the materials themselves but the geometrics. When the product is irradiated with an electron accelerator, use of conventional metal cans will limit radiation penetration. The can is suitable, however, for gamma irradiation.

The final step in the Quartermaster Corps and Department of the Army mission in bringing irradiated food into the military ration system and into commercial reality is the establishment of the U. S. Army Ionizing Radiation Center. The USAIRC will include a food processing plant with both gamma and electron radiation facilities. It will be constructed during 1960 at the Sharpe General Depot, Lathrop, California.

The development of an instant bread mix is also noteworthy. The standard multi-ton, heavily manned field bakery may be a logistic casualty. Fresh bread in the field -- all foods, for that matter -- are morale determinants. The need will continue to exist. A chemically leavened bread mix has been developed which promises to reduce baking time from more than four hours to less than hour. The acceptability rating of the instant mix bread is almost equal to that of standard Army bread.

There are, of course, many other facets to our program, but the areas I have mentioned are the stress areas. Now that you know some of our problems, perhaps you know some of the answers. In this technological era, problems arise faster than problems are solved. Your assistance will be most welcome.

Thank you.